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VOLUME V

The Book of Knowledge

The Children's Encyclopedia

THAT LEADS TO LOVE OF LEARNING

Editor-in-Chief

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Educational Consultant

LEONARD POWER, Ed.D.



With an Introduction by

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The Grolier Society Inc · New York

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The

BOOK OF KNOWLEDGE

The Children's Encyclopedia

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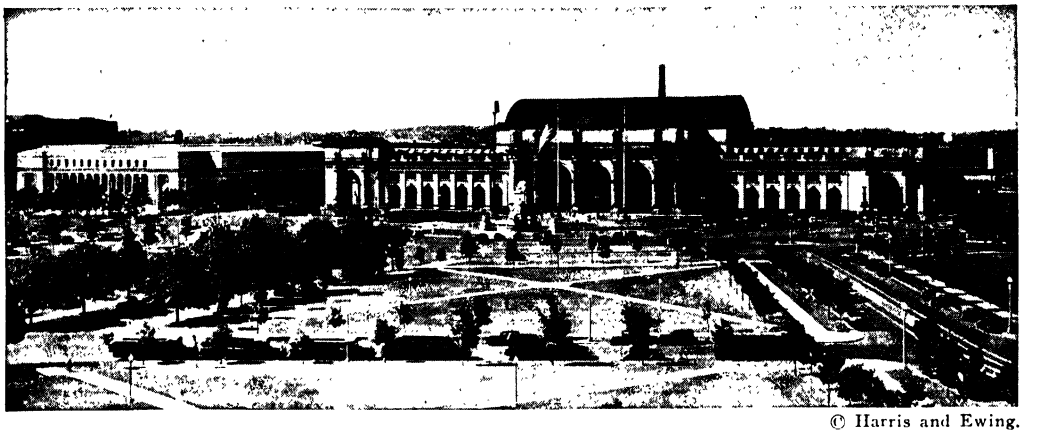
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© Harris and Ewing.

The plaza in front of the Union Station. The arch in the right wing is the President's entrance.

WASHINGTON, OUR CAPITAL CITY

THE honored name of our capital city turns our thoughts to the past, to the days when the nation just at its beginning was fortunate in having such a leader as George Washington, the first president, to think and plan what should be done. Like other truly great leaders, he knew how to choose the men who could meet the needs of the time in different posts, and serve not only their own generation but the future also.

When the Congress of the young country decided to build an entirely new city for a capital, there was at hand a French engineer who had come with Lafayette in 1777 to fight in the Revolutionary army and had afterward shown himself to be a skillful and gifted architect. When he heard of the project for a new capital he began to dream out a city of rare beauty, and he wrote to President Washington for a commission. As soon as permission was received, the architect, Major Pierre Charles L'Enfant, eagerly gave his mind to surveying and planning. His design was on such generous lines that people laughed at the broad open stretch, a mile long, between Capitol and White House; but his vision saw far into the future. What he saw we are realizing.

In 1825 L'Enfant died poor and disheartened because of difficulties and enmities that he could not conquer; but the city of his dream is still being expanded in accordance with the faded old plan which he left and which was brought to light again about 1900, when new efforts were being made to beautify Washington. L'Enfant's plan was found to be the best.

Let us suppose that we have just reached Washington for our first visit. Emerging from the fine Union Railway Station, we can already see the Capitol building as we stand in the plaza before the station. In a taxicab we drive through the tree-lined streets toward its great dome, which seems to hang high up against the sky.

We leave our taxi at the eastern front and climb the broad flight of steps that leads to the rotunda of the Capitol. On each side of us is a colossal group of marble figures. One is Persico's Columbus and an Indian girl, and the other represents a pioneer in desperate conflict with a savage. Before us are the beautiful bronze doors designed by Randolph Rogers, representing a series of scenes in the life of Christopher Columbus from his first voyage in search of the New World to his sad death at Valladolid, in 1506.

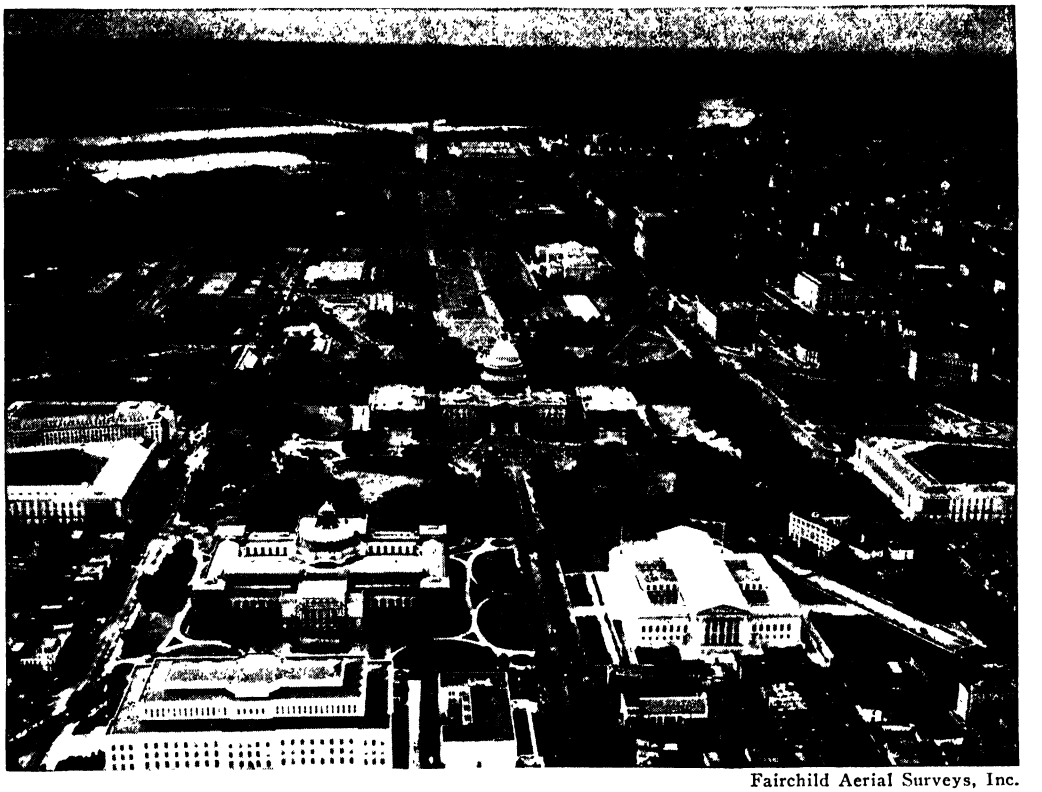
Through these massive doors we enter the rotunda, or interior of the dome. The Capitol possesses some interesting statuary and paintings, and as we pass through its halls, we may see them.

As we come into the great circular hall of the rotunda, we pause for a moment at the door to note the magnificent columned corridors spread out before us. The walls are decorated with a bewildering array of paintings, sculptures and frescoes. Over us

WHERE THE NATION DOES ITS BUSINESS



Here is a picture of the East Front of the Capitol at Washington seen over the tree-tops of the Capitol grounds. Note the majestic simplicity and beauty of the building, and the great white dome against the background of the sky. It is probably the most stately of all legislative palaces. Back of the Capitol, at the left, you can see the Washington Monument. The Senate wing to the right and the House wing to the left were constructed after the central portion. People generally see the other side first, as the city has grown toward the West instead of the East, as had been expected, and most of the hotels are West of the Capitol.



Fairchild Aerial Surveys, Inc.

An air view of the heart of the city, showing the plan. In the centre is the Capitol, with columned dome. The building in front, with the small, squat dome is the Library of Congress. Leading from the Capitol to the Washington Monument is the Mall. Avenues extend like the spokes of a wheel.

the vaulted canopy of the dome is aglow with color. As we stand breathlessly gazing about us and wondering where we shall begin our inspection of the pictures, a guide who has been viewing us from the distance hastens forward and takes us under his wing.

The canopy, he explains, is an allegorical fresco, painted by Burnside, representing George Washington surrounded by all the Arts, Sciences and Industries.

There are some paintings upon the rotunda walls that are worth noting—The Landing of Columbus, The Discovery of the Mississippi, The Baptism of Pocahontas, The Embarkation of the Pilgrims, and a series of impressive pictures by Trumbull showing scenes in the American Revolution. We wander along admiring these and the fresco by Brumidi and Castigini that encircles the wall.

We visit the National Statuary Hall, one of the most beautiful rooms in the Capitol. It was once the Hall of the House of Representatives, before the new wing was built. It is semicircular in shape and adorned with noble columns. The domed ceiling, decorated after the design of the Roman Pantheon, rises fifty-seven feet to the cupola that lights the room. Around the room on their marble bases stand statues of persons who have been famous in the history of the country. Each state has the right to select two persons who have been prominent in its history. Many of the statues are very badly done, and reflect more credit upon American patriotism than upon American art. Among these statues is one that arrests our attention—the figure of a woman—Frances Elizabeth Willard, the first woman to be given a place in Statuary Hall. The most interesting figure in the hall is the statue of Père Marquette, and there is in another place a fine head of President Lincoln, a copy of which is in the College of the City of New York.

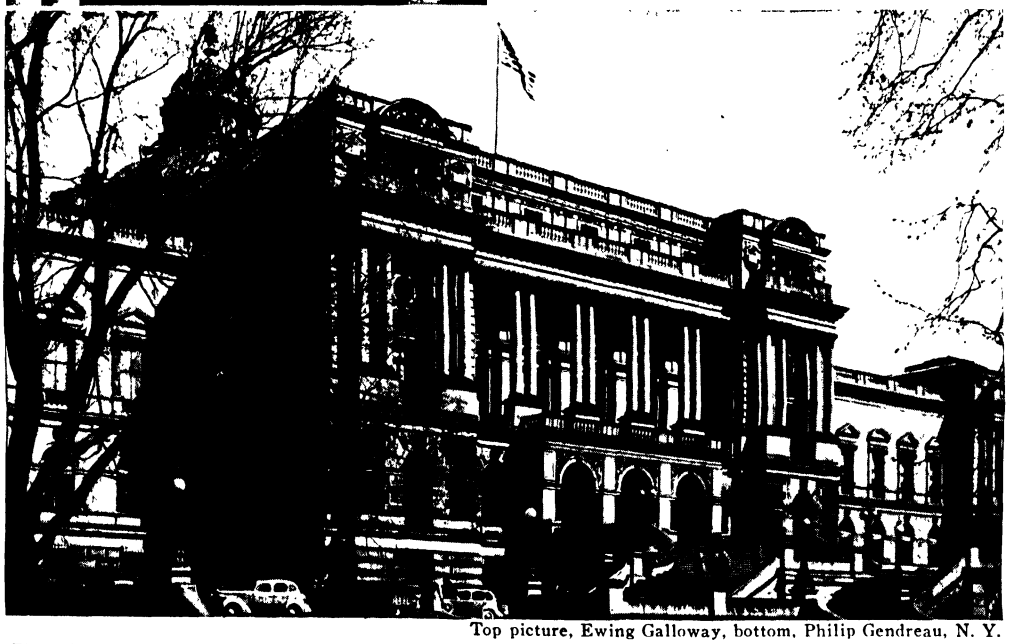
As we turn and look at the door through which we have just entered Statuary Hall from the rotunda, we pause to glance at the great clock above the door. Behind the clock is a winged car resting on a globe circled



by the zodiac. This car is meant to represent Time, the guide tells us. In the car is the marble figure of a woman called History. The clock was designed by Franzoni, a sculptor popular many years ago.

We look into the old Senate Chamber, later used by the Supreme Court, and see the Hall of Representatives and the Senate Chamber, are impressed by their simplicity. Then, as we pass through the corridor, our attention is arrested and held by a picture on the wall of the landing of the West Stairway. It is called Westward Ho, and has for its legend Bishop Berkeley's words, "Westward the Star of Empire takes its way." The picture represents an emigrant caravan stopping to rest in one of the defiles of the Rocky Mountains. The scene holds all the wild grandeur of the rough mountain pass, yet beyond is a glimpse in the distance—the Land of Promise—a land wonderfully fair to see.

We visit the President's Room, with its quiet richness of decoration; we see the Senators' Reception Room, known as the Marble Room because it is constructed wholly of that material, with stately Corinthian columns of Italian marble, paneled walls of Tennessee marble and a wonderful ceiling of marble from Vermont. We inspect



Top picture, Ewing Galloway, bottom, Philip Gendreau, N. Y.

The Library of Congress is the largest library in the world. It contains more than 8,000,000 books and pamphlets, nearly 9,000,000 manuscripts, 2,000,000 maps and views, over 100,000 microfilm reels and strips and motion-picture reels and 2,000,000 volumes on music, pieces of music and phonograph records.



Philip Gendreau, N. Y.

The graceful shaft of the Washington Monument.

the Public Reception Room, a richly furnished apartment glowing with brilliant colors and having a vaulted ceiling with allegorical frescoes depicting War, Peace, Liberty, Plenty, Power, Temperance, Prudence and Justice.

We leave the Capitol and walk a little way through its beautiful grounds to the Library of Congress—an impressive marble building, three stories high, surrounded by gardens with broad stretches of greensward and trees.

We enter the Central Stair Hall, a magnificent structure of polished marble. On each side of us rise lofty rounded columns with elaborate capitals of Corinthian design. The lofty arches rise above, exquisitely decorated with marble rosettes, palm leaves and foliated designs of wonderful delicacy. We climb the low, broad stairway slowly, pausing now and then to admire one or another of the carved figures in its alcoves. In the entrance pavilion above we see the wonderful series of paintings by H. O. Walker depicting Lyric Poetry and the Poets' Boys —Emerson's Uriel; Wordsworth's The Boy of Winander; Milton's Comus; Shakespeare's Adonis; Keats's Endymion; Tennyson's Ganymede.

In the South Curtain Corridor are The Greek Heroes, painted by Walter McEwen. These are nine pictures having for their themes the Greek myths of Paris, Jason, Bellerophon, Orpheus, Perseus, Prometheus, Theseus, Achilles and Hercules. In the Representatives' Reading Room we find two beautiful mantels showing Law—a woman enthroned, with Fraud, Discord and Violence on her left, and Truth, Peace and Industry on her right—and History, with Tradition and Mythology, one on either side.

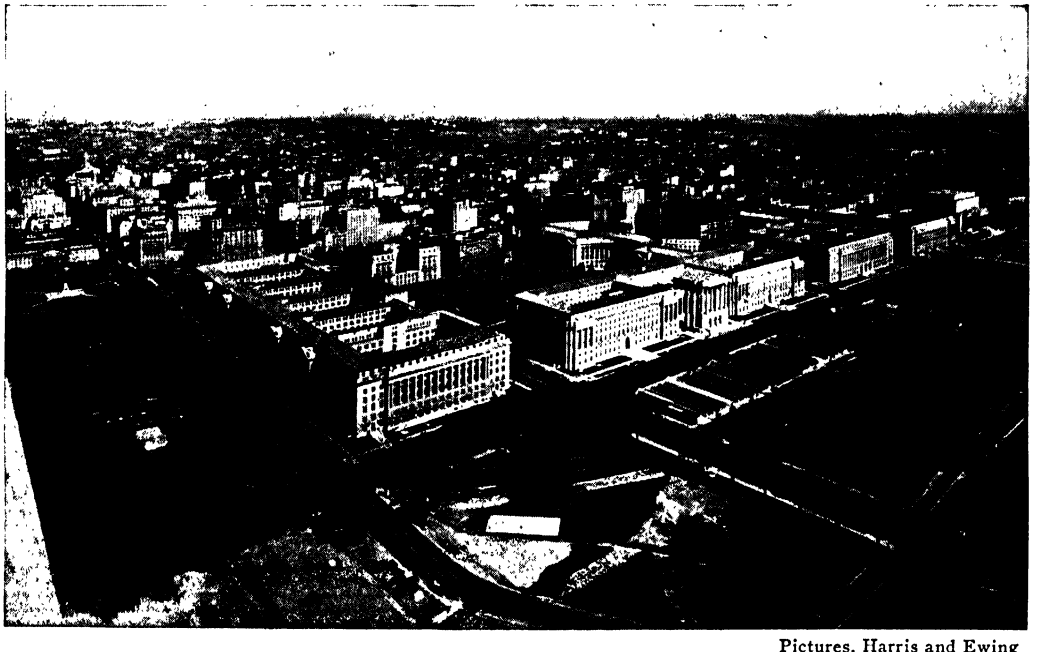
The results of good and bad administration are shown in a series of paintings we see in the Reading Room Lobby, while the Evolution of the Book is beautifully pictured in six panels, painted by John W. Alexander. The Family, Religion, Labor, Study, Recreation and Rest, painted by Charles Sprague Pearce decorate the North Hall. The ones called The Family and Religion are singularly beautiful. The latter shows two worshippers, a man and a woman, kneeling before a rude stone altar from which ascends the smoke of their sacrifice, and before the rude altar, and clustering close about it, are some wild growing flowers of the iris plant.

And so we wander on, now inspecting the panels, now some dancing figures of the

LAFAYETTE SQUARE AND FEDERAL TRIANGLE



In Lafayette Square, facing the White House, stands a statue of General (later President) Andrew Jackson.

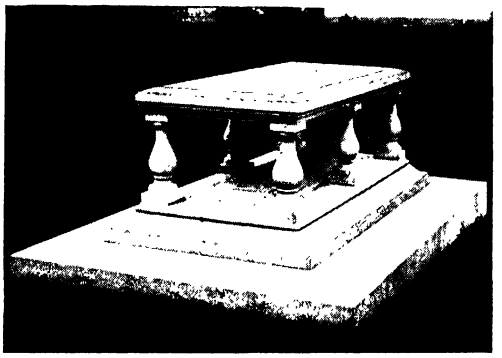


Pictures, Harris and Ewing

The Federal Triangle, a group of new public buildings, seen from the Washington Monument. The Department of Commerce Building is nearest to us. Further along Constitution Avenue are the Department of Labor, the Government Auditorium (with pillars), and the Post Office and Interstate Commerce Commission buildings.

Muses, now the Graces, now the Sciences and Arts. Two visions of The Seasons are seen in the panels by F. W. Benson and the sculpture reliefs by Bela L. Pratt. Which is the more beautiful of these we hardly know. Both win us by the flowing beauty of their lines.

As we come out of the Library we see, across a terraced plaza, the magnificent new Supreme Court Building, pictured on page 1792. We cannot help contrasting its gleaming, austere beauty with the weathered appearance of the Library which we have just left. It is not unlike an ancient classical temple in style. We cross the plaza, to the tall portico where twin rows of Corinthian columns support a sculptured pediment, beneath which is the line "Equal Justice Under the Law." Inside this noble building the highest court in our land solemnly meets to decide what is allowed under the Constitution when an act of government has been questioned.



Wide World Photos.

Here, in the Arlington National Cemetery, lies Major Pierre Charles L'Enfant, who planned the city.

We leave the building, and, driving around the Capitol grounds, come out on Pennsylvania Avenue. We are going to the White House. We lean forward in our seats that we may get a better view of the streets through which we are passing. Washington was once called in mockery the "City of Magnificent Distances," and such it truly seems to us as we bowl slowly along the mile of the avenue which is so broad that there is no feeling of being crowded. The street cars in the middle seem to take up scarcely any room. Up the side streets we see trees, trees, trees, and where streets and avenues cross there are so many beautiful little spots of green. "On every side of us there is a picture"—a picture of unruffled tranquillity, of beauty and of prosperity—rare combinations in the national capital of a large country. We think of the changes that have taken place since President Washington first chose this spot upon the banks of the Potomac for the seat of government in 1790. Then it was an untrod wilderness, and as late as 1800, when the Capitol itself had been built, a belle of the times described it as a "town of streets without houses."

Oliver Wolcott, in an interesting letter to his wife, says there was at that time "one good Tavern about forty yards from the Capitol, and several other houses and buildings, but I do not perceive how the members of Congress can possibly secure lodgings unless they will consent to live like scholars in a college or monks in a monastery, crowded ten or twenty in one house and utterly secluded from society. The only resource for such as wish to live comfortably will be found in Georgetown, three miles distant over as bad a road in winter as the clay grounds near Hartford."

Gouverneur Morris wrote humorously: "We want nothing here but houses, cellars, kitchens, well-informed men, amiable women and other trifles to make our city perfect . . . In short it is the very best city in the world for future residence."

At last we reach and pass the Treasury Building and see, set in a noble park, the home of the presidents, known to everyone as the White House. Washington himself selected the place for the White House, and laid the cornerstone in 1792, and lived to see the building completed, though he never occupied it. That honor was reserved for the second president, John Adams, and his wife Abigail, who occupied it in 1800. It was burned by British troops in 1814



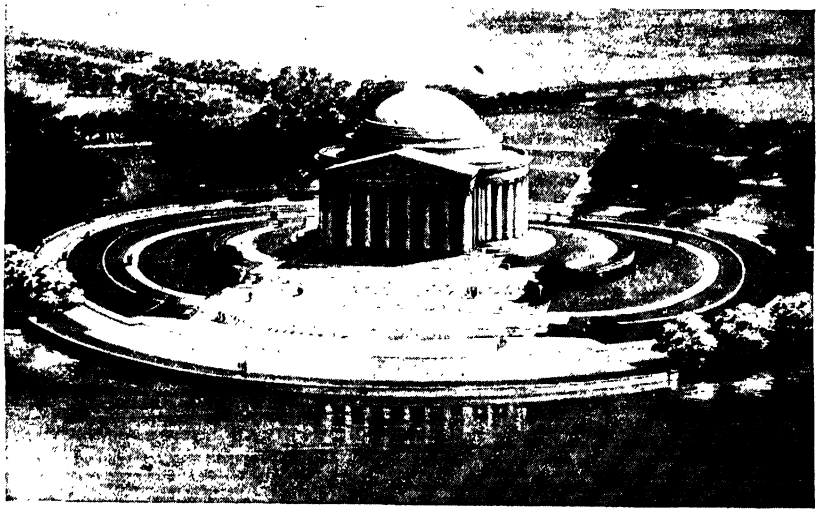
Courtesy, U. S. Department of the Interior.

Also in Arlington is the honored tomb of the Unknown Soldier of World War I.



TO HONOR TWO GREAT MEN

National Photo.
The noble memorial to President Abraham Lincoln is seen here across the tidal basin, framed in Japanese cherry blossoms.



Peter Juley & Son.
The memorial to Thomas Jefferson owes its inspiration to Monticello, the mansion which Jefferson himself designed. **See page 6839.**

during Madison's administration, which included the War of 1812. But it was soon rebuilt and, except for new coats of dazzling white paint, was little changed until 1902-03 and again in 1909, when additions were built on each side. Other changes were made in 1934.

The new wings do not rise very high and hardly show above the terraced lawn, but they afford room for the President's office and for entrances into the public rooms, which had been up to that time in the main building.

The designer of the White House was James Hoban. Although many of the public buildings in Washington are of gleaming marble, the White House, curiously enough, is built of gray Virginia sandstone, painted white. The mansion in its spacious green park has a dignified graceful beauty probably unsurpassed by any other residence in the world.

Let us enter the public rooms, which are sometimes open during certain hours of the day. We make our way through a long colonnade on the east and which leads to the basement corridor, where hang the portraits of many of the mistresses of the mansion. Along the walls are cases in which are bits of historic china or ornaments used in bygone days. Ascending the broad stairway, we reach the centre hall, from which we may enter the great East Room, where the formal receptions are held. This magnificent room is bare of furnishing, but the proportions are so beautiful and the colors so harmonious that we do not realize it. In this room is the portrait of Washington by Gilbert Stuart,



© Horydczak.

Latin America is represented in this building of the Pan American Union, one of the most beautiful buildings in the world. Within its court, or patio, is an Aztec fountain set amid the luxuriant foliage of South American plants. Here are held the conferences of the American nations.

the picture which was saved by Dolly Madison when the British burned the White House in 1814.

The other rooms are not usually open to the public, but if we have special permission, the guide may take us into the Blue Room, with its hangings of blue silk and the clock sent to Lafayette by the great Napoleon and presented to Washington by Lafayette. The Green Room has green velvet on the walls and contains portraits of many of the presidents, besides interesting things sent by foreign rulers. In the State Dining Room the formal dinners are given, and a hundred guests may sit down at the massive mahogany table. The private rooms of the president's family are not shown.

We leave the White House, and after a delightful little luncheon in a restaurant on Pennsylvania Avenue, we drive back through the Presidential Park, bound for the Washington Monument. Sight-seeing is rather tiresome, however enjoyable, and we gladly settle back among the cushions of our taxi to view comfortably the green, fresh beauty of the public grounds through which we are passing. "The trees! The wonderful quiet majesty and greenness of the trees!" we exclaim, with a little sigh of deep content.

On every side are the rolling lawns and great trees in a glory of summer greenery. A soft midday breeze stirs through the wide-spreading elms on one side and ruffles the leaves of sturdy oaks and sugar maples on another. "No such trees adorn a city anywhere else in America." Each avenue is planted with one variety only. The oaks that line one street are superb. The great horse-chestnuts that bloom on another offer an ever-growing enjoyment of vista of leaf and flower. The beauty of shrubs, the evergreens, the great magnolias of the South, the symmetrical lawn trees that are profusely used to adorn the circles and the small squares, fill us with a sense of peaceful satisfaction.

Since 1872 the city of Washington has been systematically planting and controlling the trees under governmental authority and it has spent hundreds of thousands of dollars on this good work.

Suddenly through the trees we catch our first glimpse of the Washington Monument. How purely it raises its straight shaft into the air, a majestic tapering obelisk of white against the sky. We descend from our taxi and enter the monument. The interior is lighted by electricity. The elevator carries us nearly to the top, a height of 555 feet. As we slowly rise up the elevator shaft we

catch glimpses through the cage of a series of stones—on the landings of the stairway—dedicated to the memory of Washington.

There are 170 of these stones—many of them notable for their beautiful and elaborate carving. When we have reached the height of 504 feet we leave the elevator and step out on a platform. Here the walls are pierced with eight port openings, or windows, two on each side. Through these we get an extensive bird's-eye view of the city. On one side of us stretches the great parkway with the Treasury, the State, War and Navy Departments, and the White House; on another side, through the intervening treetops, we catch a glimpse of the Smithsonian Institution, the National Museum and the white gleaming dome of the Capitol; to the south, beyond the beautiful Lincoln Memorial and the Jefferson Memorial, flow the waters of the Potomac between their green winding banks; while yonder to the west are the wooded slopes of peaceful Arlington, where lies the "Field of the Dead," containing the bodies of many who gave their lives for their country on the battlefield. The tomb of the Unknown Soldier is there. There, too, is the burial place of Major L'Enfant. For long years he lay in a humble grave, which friends had provided for him; but in 1909 he was carried with honor to be placed on a hillside there, overlooking his dream city. Let us pause for a moment to think of the two men to whom first of all we owe this capital beside the Potomac—Washington, who chose the site, and L'Enfant, who planned the arrangement.

From our high, far-seeing view of the great and singular city spread out at our feet, we realize for the first time how strikingly different Washington is from all other cities. Not only is it noted for its dignified public structures that house the government's business, for its extensive public parkways of the Mall, the Public Gardens, the Capitol Grounds and the President's Park; it is noted, too, for the fact that it is not a city laid out in checkerboard fashion as other cities are. The avenues radiate from the Capitol and the Executive Mansion, north and south and east and west, in straight broad lines like the spokes of a great wheel, and here and there, where they cross the streets, are dotted with circles or squares of little parks that break the monotony with spots of rich green.



Portico of the beautiful building that houses the National Archives, the Government records that are no longer needed in everyday business, including some documents drawn up before the Revolutionary War. The Treaty of Paris, which officially ended that war, is preserved in this building, also Lincoln's Emancipation Proclamation.

In a line with the Capitol and the Washington Monument is the noble memorial to Abraham Lincoln. Approaching it, we admire its fine classical proportions; then, passing between the simple Doric and Ionic columns, we stand reverently before the seated marble figure of Lincoln—the work of the sculptor, Daniel Chester French. The Memorial building, designed by Henry Bacon, was completed in 1922.



Wide World Photo.

The apse of the Cathedral of St. Peter and St. Paul, also known as Washington Cathedral. In it are the tombs of Woodrow Wilson and Admiral Dewey.

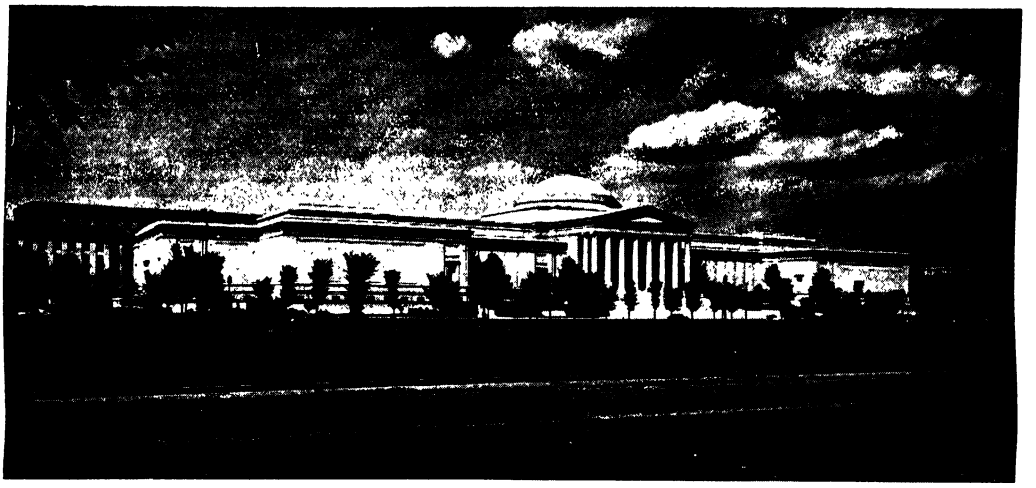
Returning past the monument, we drive through the Agricultural Grounds, where is the building of the Agricultural Department, and crossing the street, we enter the grounds of the great Smithsonian Institution. Through the green screen of the trees we catch glimpses of the red sandstone building of the Institution itself, and of the National and New National Museums, and of the Medical Museum.

Let us spend a short time in the New National Museum. We enter the building from the park, and turn to the right to reach the great collection of animals made by President Theodore Roosevelt. Here are many of the animals of which we read in this book—bears and lions, antelopes and deer of all sorts, tall giraffes, striped zebras, monkeys of all kinds, and many beautiful birds. There is not time for any of the other interesting things in the museum.

Three short blocks away in one of Washington's newest and loveliest public buildings, the National Gallery of Art. It is, like the National Museum, conducted under the direction of the great Smithsonian Institution. The building, of pink Tennessee marble, was given to the nation by Andrew W. Mellon. He also gave his collection of one hundred and twenty-six paintings and twenty-six sculptures to form, as he hoped, the beginning of a great national collection of art. Mr. Samuel H. Kress, of New York, in 1939 gave to the National Gallery a collection of three hundred and seventy-five paintings and eighteen sculptures, and loaned other works of art. We could spend a very long time examining all this beauty. Perhaps we shall return some day soon, for a longer visit.



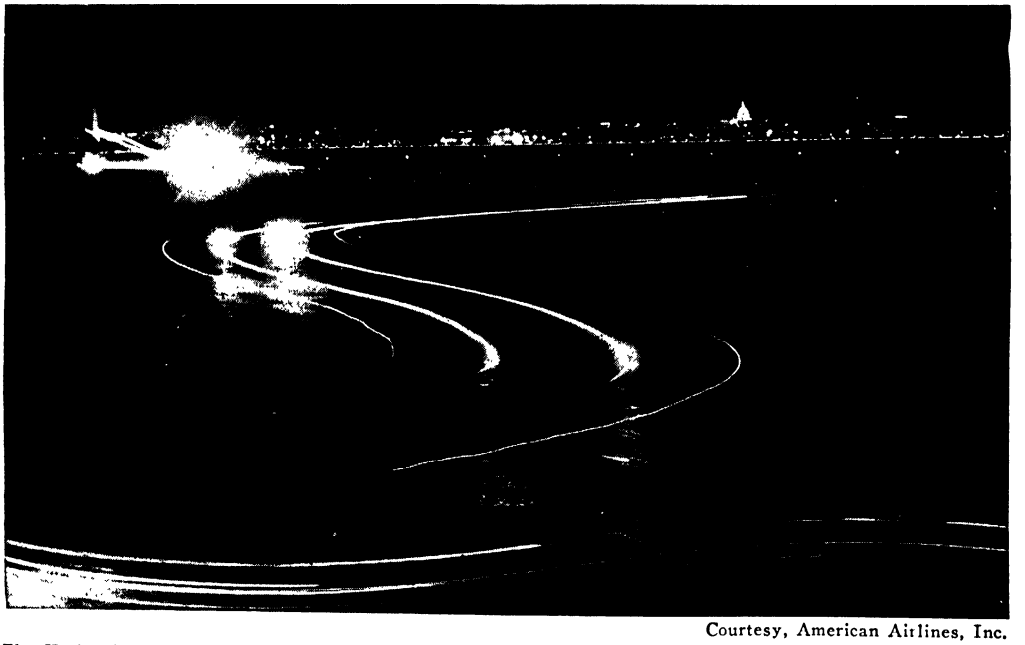
In 1829 an Englishman, James Smithson, died, leaving a large fortune to "the United States of America to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men." The Institution now is trustee for one of the greatest museums in the world, two art galleries, an observatory and other important charges. The Smithsonian Building is oldest of the group.



The National Gallery of Art was a gift to the nation from Andrew W. Mellon. It contains the Mellon collection of paintings and sculptures, also a large treasure of Italian art, presented by Samuel H. Kress.

We are leaving Washington, for we wish to see Mount Vernon, the home and burial-place of George Washington. On an eminence overlooking the Potomac River stands a simple home built of wood, and two stories high. A high piazza runs along the whole front of the house, which has six rooms of moderate size on the ground floor, containing many objects of historical interest. The plain brick tomb, to which Washington's remains were removed from the old family vault in 1831, stands a few hundred yards from the house, near a wooded ravine. Mount Vernon, which needed repairs badly, was bought in 1858 by the Ladies' Mount Vernon Association, which holds it in trust for the people.

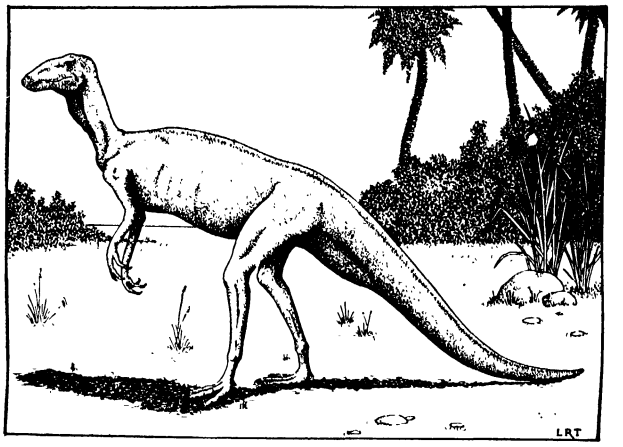
THE NEXT STORY OF THE UNITED STATES IS ON PAGE 1647.



Courtesy, American Airlines, Inc.

The National Airport, opened in 1941. You can see the Washington Monument and the Capitol dome on the skyline. The tracks of light are reflections from the lights of an incoming plane.

THE JURASSIC PERIOD



Camptosaurus, a plant-eating dinosaur, stood only four feet high.

THE Jurassic period, the second great division of the Mesozoic era, receives its name from the Jura Mountains lying between France and Switzerland, a locality rich in rock formations of the period. Jurassic rocks are widely distributed throughout much of Europe, extending from the extreme north of Scotland, across England and France, to the Alps and Apennines, to Spain and northern Germany, and to central and eastern Russia. They are also found in Tibet, Kashmir, Nepal and in South Africa, New Zealand, Australia and South America.

In North America there are few Jurassic rocks. During the period most of the land in America was high above the water. In the East there are no rocks which were formed during the period, but in parts of the West where the land sank we find Jurassic rocks.

Alaska was the first land to disappear beneath the waters, and then Vancouver Island and much of California and Oregon. Later an inland sea covered most of British Columbia and much of Alberta, and extended over Montana, Idaho, Nevada, Utah and Wyoming, and a part of Colorado. This has been named the Logan Sea. In Wyoming the rocks are 3,500 feet thick. The rocks of the Jurassic in America are sandstones, shales, limestones and marls.

Towards the close of the Jurassic period parts of the world which had been under the sea began to rise. Volcanic disturbances occurred in North and South America. In North America the Pacific Mountain system was formed. Mountain ranges rose from Alaska to Mexico, among them the Sierra Nevadas.

As far as animal and plant life are concerned, there was no great gap between the Triassic and Jurassic periods. In each the plants and animals were of the same general character, although in the Jurassic there were many more species of animals. The reptiles increased so much in size and numbers that the period is often called the Age of Reptiles.

The vegetation of the Jurassic period was probably luxuriant, but not greatly varied in character. It greatly resembled that of the Triassic. Cycads and cone-bearing trees, ferns and horsetails were the most common types. The Ginkgo, or maiden-hair tree, also flourished and was the first broad-leaved tree. It still exists to-day in China and Japan, having undergone no changes for more than a hundred million years.

The animal life of the period varied greatly and is full of interest. Both land and water forms abounded; many strange forms appeared. The ammonites were the most characteristic shell-fishes of the Jurassic, although they showed signs of dying out. The belemnites, ancestors of the squids, more than held their own. There is no lack of sponges among the fossils of this period, and the remains of starfishes and molluscs are plentiful. Crinoids were common, the largest form reaching a height of fifty feet with a crown a yard long. The ancestors of the modern crab and lobster appeared. Corals were particularly abundant, and during this period most of Europe seems to have been submerged under a sea full of coral islands and coral reefs. These reefs can be traced in parts of England and from Normandy in France to the Mediterranean. They are found, too, over the east of France along the

Jura Mountains and in parts of the Alps. A very different Europe it must have been, with coral reefs in England and on the mountains.

As many as a thousand species of Jurassic insects are known, including beetles, dragonflies, grasshoppers, crickets, earwigs, walking-sticks, cockroaches and termites. The social ants made their appearance in the early years of the Jurassic period. Fishes were also numerous, and sharks and rays were well represented in the seas. Most of the Paleozoic fishes about which we have already read had disappeared.

In the Triassic rocks the first mammals appeared, and in the Jurassic rocks a few more have been found. Mammals, however, were still an unimportant-seeming form of animal life. Both the European and American mammals of this early day were very much alike.

A COUNTRY GIRL DISCOVERS A THIRTY-FOOT MONSTER

The most interesting animals of the time were undoubtedly the great lizards. One of the most amazing of these was the ichthyosaurus, or fish-lizard, which originated in the Triassic and continued to develop during the Jurassic period. Certain localities in England and Germany have furnished great numbers of their remains. In a quarry at Lyme Regis, England, the first fossil ichthyosaurus was found by a country girl, Mary Anning, who made a living by collecting and selling fossils. She was hammering away at the rock one day when she noticed some big bones sticking out. When she had cleared away the rubbish and rubble round about, she found the skeleton of a huge animal and hired workmen to dig out the whole block of stone. It proved to be a monster thirty feet long, with six-foot jaws and huge eyes like saucers.

The plesiosaurus, another lizard having its origin in Triassic times, was still abundant in the Jurassic seas. However, the plesiosaurus of the Jurassic period did not reach as great a length as did his Triassic ancestor.

Crocodiles resembling the modern gavial of India swarmed in the seas and rivers. They probably spent less of their lives in the water than do their modern descendants.

PTERODACTYLS, REPTILES WITH THE POWER OF FLIGHT

Stranger in some ways, though not so monstrous, were the pterodactyls, or flying reptiles. Judging from their remains, they must have been quite common and of many different kinds. Some were as large as an albatross, and others grew no bigger than a sparrow. In appearance they were more or less bird-like. The head was usually fairly long and thin and had slender jaws equipped with curved teeth well suited for holding and tearing their prey. The bones of the forelegs, or arms, were very long and supported the leathery wing membrane. Upon the ground the pterodactyls walked about readily on their hind legs. In flight they either glided or flapped their wings just as do our modern birds.

THE FIRST TRUE BIRD MAKES ITS APPEARANCE

In the Jurassic rocks of Germany the first true bird was discovered—the Archaeopteryx. The name is Greek for "ancient wing." Archaeopteryx was rather smaller than a modern crow. He had no beak; his jaws were lined with small, sharp teeth. His tail was longer than the rest of his body and was set with feathers on either side, giving it a fern-like appearance. In modern birds the tail is merely a stump, and the feathers spread from it like a fan. The wings of Archaeopteryx were equipped with three wing fingers. These early birds were probably better at gliding than at true flying.

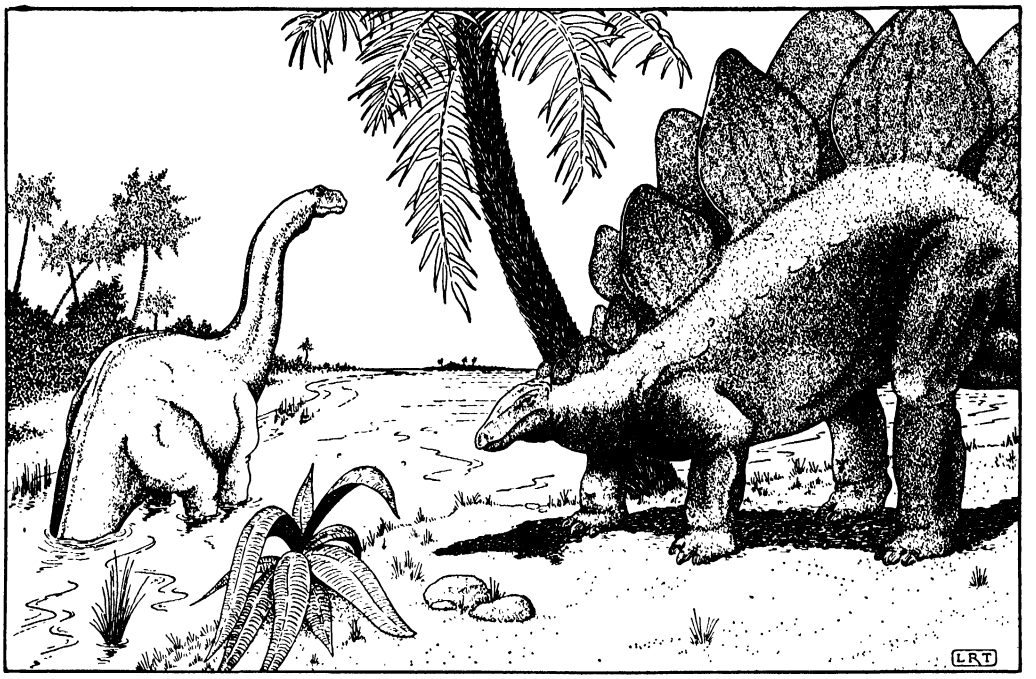
Big as were the Jurassic sea lizards, there were still larger reptiles on the land. The dinosaurs which appeared in the Triassic period now attained gigantic proportions. The brontosaurus was fully sixty-five feet long and weighed about thirty-seven tons. He had a barrel-like body, at one end of which was a long, snake-like neck and at the other a slender, tapering tail. Each of his foot-prints covered about a yard. The diplodocus was still larger, reaching a length of eighty feet. The gigantosaurus, the largest land animal known, was eighty feet long, thirty-six feet of which was neck. He weighed something like forty tons.

STEGOSAURUS, A DINOSAUR CLAD IN BONY ARMOR

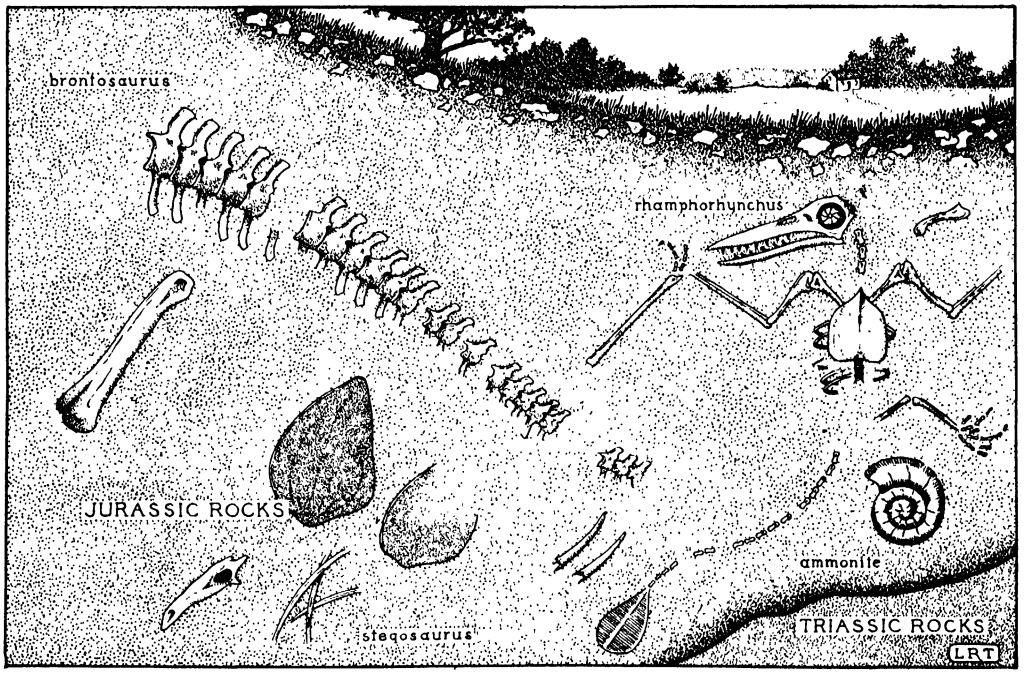
Not all Jurassic dinosaurs attained the tremendous proportions of the diplodocus and the gigantosaurus. Some of the most curious of them were the smaller armored reptiles which appeared quite late in the period. The strangest of these was stegosaurus. His name means "covered lizard." Along his back ran a double row of great bony plates, which reached a height of more than two feet over his hips. Near the tip of his tail were several long spines.

THE NEXT STORY OF THE EARTH IS ON PAGE 1659.

LIFE AND REMAINS OF THE JURASSIC PERIOD



This is an imaginary view of the world in the Jurassic period. In the foreground is stegosaurus, an armored dinosaur twenty-five feet long and protected by a series of bony plates extending along his back. Brontosaurus, a monster sixty-five feet long and weighing almost forty tons, stands in the shallow water.

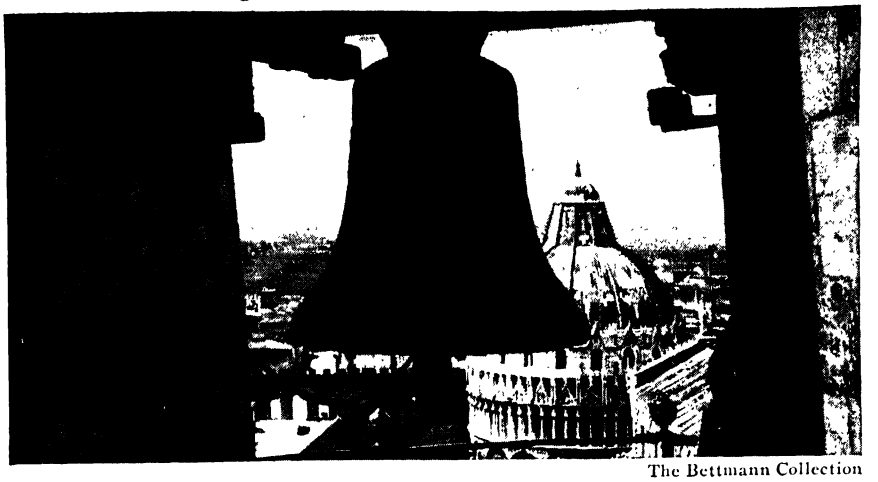


Here are a few of the fossil remains of creatures that walked the earth and flew through the air during the Jurassic period. Rhamphorhynchus was a pterodactyl, or flying lizard. At the tip of his long tail was a rudder which must have been used for steering his body when he was in flight.

A SCHOOLGIRL MEETS ICHTHYOSAURUS



At Lyme Regis took place one of the most astounding meetings in the history of geology. Mary Anning, aged 12, coming upon the first ichthyosaurus found in England.



The Bettmann Collection

An old bell in the famous leaning tower of Pisa, Italy.

THE STORY OF BELLS

THE word bell comes from an Anglo-Saxon word meaning to bellow, to make a noise, and making a noise has been an important function of bells throughout their history. In war and peace, fire and flood, they have been useful because their voices could be heard far and wide. But bells can make something beside noise. They can make music. When they are placed high in a tower, their clear notes float out and down so beautifully that poetry and song are full of praise for them, as in the line, "Think, when bells do chime, 'tis angels' music."

True bells are shaped like a cup and are made in such a way that they give one fundamental tone when struck. Gongs, cymbals and the like are not strictly bells, and as for little bells, such as sleigh bells or cow bells or doorbells, they are too familiar to need description.

Bells of some kind were known in China, 2,000 years before the Christian era, but it is quite certain that bells as we know them to-day were the product of the Christian Church. The earliest that have been found were not cast in one piece but made from plates riveted together. Such bells were rectangular in shape.

A very old bell is preserved in Belfast, Ireland. It is known from its inscription as "the bell of Saint Patrick's will." Tiny as bells go, it is only 6 inches high and 5 inches wide. It is decorated with gems and with gold and silver tracery. The dates on it are 1091 and 1105.

In the 13th century, bell founders, many of them in monasteries, began to make large bells and place them high above the ground in towers. Such bells were sounded by striking them with a rod or with a metal clapper hung within the bell and left free to swing back and forth with its motion. The year 1400 saw the casting in Paris of a successful bell that weighed more than 6 tons. It was thought enormous at the time, yet it does not cut much of a figure among the world's big bells.

The largest bell known is the Russian "Tsar Kolokol" of Moscow, weighing more than 32 times (about 200 tons) as much as the big bell of Paris just mentioned. Its history is disappointing, however, since it was never

rung, has a big piece weighing 11 tons broken out of it and is used as a public building instead of a bell. Resting on a special base, it forms a good-sized room, 19 feet high and 21 feet wide. Russia also possesses the biggest bell in actual use, a brazen monster of 110 tons. A pagoda in Upper Burma houses a bell of 87 tons, while in the city of Peking (Peiping) there is a great bell weighing 53 tons. Other bells of the world are perhaps better known (Big Ben in the Houses of Parliament, London, for example) but they are nowhere near these giants in size.

The most famous bell in America, the Liberty Bell, is a mere pigmy in comparison. It was originally cast (1751) in England by Thomas Lister, of London, and weighs about a ton. The Assembly of the Province of Pennsylvania directed that the following words be cast on the outside of the bell: "By order of the Assembly of the Province of Pennsylvania for the State House in the City of Philadelphia. Proclaim Liberty throughout all the land unto all the inhabitants thereof. Lev. xxv, 10."

The bell arrived at Philadelphia late in August, 1752, and was cracked in testing. It was melted down and recast by Pass and Stow of Philadelphia, who added 1½ ounces of American copper for each pound of the original metal in order to make it less brittle. In spite of this attempt, the bell cracked again on testing and was recast a second time by Pass and Stow. The second attempt was successful, and the bell was hung in the tower of the State House, June 7, 1753. On the new bell the quotation from Leviticus was placed above the other inscription instead of under it as in the original, and the name and date "Pass and Stow, Philadelphia, MDCCLIII" were added.



A simple, sturdy keyboard for playing a peal of bells. The heavy handles (keys) work the leathers and rods that may be seen above behind the music rack. The leathers reach up to levers like those at the bottom of the picture on the next page. Electric devices using regular organ keys are a modern substitute for this older method of ringing chimes. Photographs, courtesy Meneely Bell Co., Troy, N. Y.

The bell's most historic ringing was on the occasion of the formal proclamation of the Declaration of Independence, July 8, 1776. In later years the bell was rung on every festival and at the time of every important event until July 8, 1835, when it cracked as it tolled while the body of Chief Justice John Marshall was being taken from Philadelphia to Virginia for burial.

CASTING IN ANCIENT AND MODERN TIMES

Ancient bells, as we have said, were made in pieces and then riveted together, but the bells of modern times are cast in one piece from molten metal. This metal is known as bell metal and is a form of bronze. It consists of a mixture of copper and tin in the proportion of about 3 parts copper to 1 part tin. There is more tin in bells of high pitch. Bell metal not only gives a fine, full tone but also withstands hard usage and bad weather conditions indefinitely. It is commonly thought that the presence of gold or silver in a bell gives it added beauty of tone. This is not a fact. A solid gold bell, for instance, would sound about as well as one of solid lead.

In bell casting, two molds of baked clay are constructed, one solid, to form the open interior of the bell, the other hollow, following the curved shape of the outside surface. The bell metal, heated until it will flow, is poured between the two molds. After the metal has cooled enough to set, the molds are removed. A really big bell will need several weeks to cool completely.

When bell founders had mastered their art sufficiently, it became possible to make bells not only of good quality but of accurate pitch, and the custom developed of hanging groups of bells in the towers of churches and important public buildings. On these groups of bells simple tunes could be played and also a system of musical figures called changes.

THE NUMEROUS CHANGES POSSIBLE ON FEW BELLS

Changes are not so much tunes as musical patterns, one pattern differing so little from another that it is possible to ring many changes on a very few bells. Only 6 changes are possible on 3 bells, but on 5 bells, 120 changes can be rung; on 7 bells, 5,040 changes are available. A set of 12 tuned bells may not seem very large, but it is the maximum number used in change-ringing, and there is a good reason for this. The reason is that 479,001,600 changes can be rung on 12 bells, requiring 37 years, 355 days of continuous ringing. Of course this is merely a theoretical possibility and has never been tried. Nevertheless, in England, where change-ringing has been developed into a national specialty, expert ringers require many hours to run through an elaborate set of changes.



This peal of 10 bells is mounted and rigged for playing. Each of the chains shown below the bells works the clapper of an individual bell. The bell at the top can be swung, the others are fixed. Many melodies can be played on this set of tuned bells.

While the art of change-ringing by hand was spreading throughout England, the chiming of tuned bells by mechanical means grew popular on the Continent, particularly in Belgium and the Netherlands. Tower clocks were furnished with bells to chime the quarter hours in a very pretty style and at the hour quite a tune was played by automatic machinery. This machinery consisted usually of a revolving cylinder or drum, timed so that it worked a series of wires, that were attached to small hammers which struck the bells in proper sequences to give both rhythm and melody.

Bells rung by hand actually swing as they sound, but when chimes are rung by a machine the bells are stationary. The idea of adding to the number of these fixed bells grew until there were enough notes to sound the full chromatic scale through several octaves. Grouped in this way and playable

POURING THE MOLTEN ALLOY FROM THE LADLE INTO THE MOULD

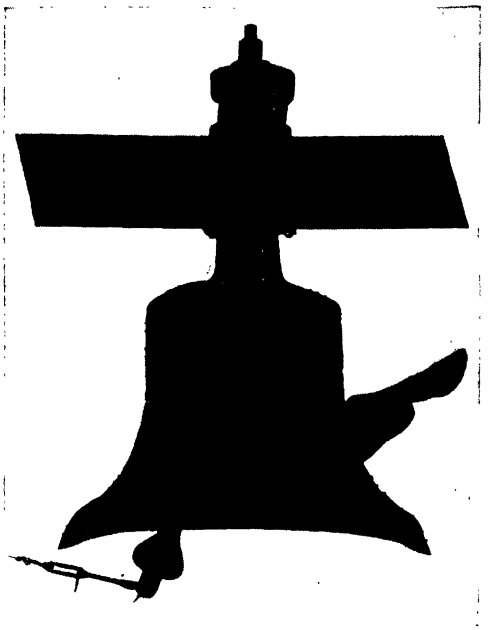


This picture shows the pouring of a bell. While the man holding the wheel regulates the flow, the one at the far left is steadying the ladle. A third holds his "skimmer" ready to catch any small pieces of slag that might slip through and spoil the casting.

by hand from a special keyboard, the bells form a carillon (French word for chimes). To-day there are many carillons in the world, concentrated chiefly in Belgium, the Netherlands and the United States.

FAMOUS CARILLONS IN EUROPE AND IN THE UNITED STATES

One of the most famous carillons in the world is that of Mechlin, Belgium, famous not so much for its size as for its beautiful tone and the fine tuning of its bells. It has 45 chromatic tones, giving a compass of slightly less than 4 octaves. Other noted Belgian carillons include Antwerp (47 bells),



Half this bell has been cut away so that we can see its varying thickness and the adjustable mechanism by which it is rung. The speed with which the spring returns the clapper to playing position after each stroke can be regulated to a fraction of a second.

Bruges (47 bells) and Ghent (52 bells). A leading Dutch carillon is at Amsterdam (37 bells). The United States has about 35 carillons, averaging 42 bells each. The Bok Singing Tower at Mountain Lake Bird Sanctuary in Florida has 61 bells, of which the largest, a low E flat, weighs 12 tons, the smallest 16 pounds. In the high Gothic tower of the Riverside Church, Riverside Drive, New York, is a set of 72 bells, including the largest tuned bell in the world, a mighty low C with a weight of more than 20 tons. This great carillon has a range of no less than six chromatic octaves.

The carillon player, called a carilloneur, uses a set of keys and pedals arranged much like those of an organ. He strikes the keys with a closed hand (not a fist) and wears a guard on each little finger to protect it from injury. A good carilloneur can produce marvelous effects, from the softest, most delicate tinklings to the almost unbearable thunders of the great bells. Some carillons, in spite of fine equipment and expert playing, are more or less spoiled by their location, either in the midst of constant noise or at points on high ground where prevailing winds carry their music away much of the time. A fine summer evening, still and dim, is the ideal. Then the bells can float their notes from on high as lightly as soap bubbles or rain them down like golden hail. The wise carilloneur avoids music not suited to bells. Good bell music is played slowly, and harmonies should remain simple since the best of bells are not really in tune.

WHAT THE GREAT POETS HAVE SAID ABOUT BELLS

Poets have had much to say about bells, finding them varied enough in character to fit into many different poetic situations. The great Italian poet, Dante, writes of the bell rung for vesper services.

> The vesper bell from far
> That seems to mourn for expiring day.

In Shakespeare's Hamlet, Ophelia describes Hamlet's ravings at a time when she thinks he has lost his mind as "sweet bells jangled, out of tune and harsh." Tennyson mentions bells frequently in his great poem, In Memoriam, including the now famous lines

> Ring out the old, ring in the new
> Ring, happy bells, across the snow.

and

> Ring out, wild bells, to the wild sky,
> The flying cloud, the frosty light.

One of the greatest of American poets, Edgar Allan Poe, wrote an entire poem about bells. Here is a characteristic portion of a stanza from it

> Hear the mellow wedding bells,
> Golden bells!
> What a world of happiness their harmony foretells
> Through the balmy air of night
> How they ring out their delight!
> From the molten golden notes,
> All in tune
> What a liquid ditty floats
> To the turtle-dove that listens while she gloats
> On the moon!

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 1629.

RIVER BOAT OF THE FAR NORTH



From Great Bear Lake comes the Radium King loaded with precious freight. At Fort Smith the freight is carried overland for sixteen miles, then the Radium Queen carries it to the railroad at Waterways. The miners speak of "down North" and "up South."

Photographs, courtesy The Northern Miner.



Copyright, Canadian Airways

The airplane lands on skis in winter. The engine is blanketed while the pilot "warms up."

TREASURE FROM FAR PLACES

GOLD! The gleaming yellow metal has fired the imagination of men for many centuries. Wars have been fought for gold, strange treaties made and solemn pledges broken. You have often read how the Spanish people in the fifteenth and sixteenth centuries dreamed of El Dorado, the land of gold, which they thought lay across the sea. To find this mythical land, many a frail ship hoisted sail and journeyed out from Cadiz, sailing west and southwest, through long days and weeks of peril.

Francisco Pizarro, a Spanish adventurer, believed that El Dorado must be somewhere along the west coast of South America and set out with a small party to find it. In a few years he had made himself master of the Peruvian empire and had captured the Inca, Atahualpa, promising to release him on the payment of a huge ransom. His followers are said to have brought in from the hills great burdens of gold, until a room was filled from wall to wall, from floor to ceiling, and even then Pizarro did not keep his promise.

Whatever we may think of this quest of the Spaniards for a fabulous land, there is today, in Canada, a true El Dorado. It is a district containing not only plentiful supplies of gold but also of pitchblende, the mineral from which come both radium and uranium. Radium first opened up to scientists the secrets of the atom. It has also been used to relieve suffering from cancer. Uranium is now even more important than radium, for it is used in the production of atomic power. This district of Canada is far north, distant and bristling with difficulties. The story of its discovery and development is as exciting as any of the tales of Spanish adventure; and this story is both modern and true. Its most exciting part begins in 1930.

Turn to your map of Canada and find the Northwest Territories, an immense tract of land bordering on the Arctic Ocean. We are interested in its central section, the vast Mackenzie river-basin. This district has never been entirely surveyed, and until a very few years ago anyone wishing to travel there had to go on foot or in a canoe, carrying food, bedding, clothes, medicine and tools. Even the canoe had to be carried overland from one river to another.

In the eighteenth century the explorer Alexander Mackenzie traversed the country, naming the Mackenzie River and the two large lakes, Great Slave Lake and Great Bear. He established a few temporary trading posts, but they could not flourish so far from the world of white men; and during the next 150 years only a few Indians and Es-

kimos found a slim livelihood in the region. In 1900 two government scientists, Camsell and Bell, explored on foot and by canoe the regions around the two lakes. These brave men suffered many hardships but they succeeded in bringing back a description of rock formations which, as we shall see, proved very valuable thirty years later.

With the coming of the airplane these conditions were changed almost at one stroke. The first flight north from Edmonton was made in March, 1921, and nine years later the famous prospector Gilbert Labine made a round trip of nearly 4,000 miles. As the plane was passing over the east end of Great Bear Lake, he kept a sharp lookout for colorations in the rock below, since he knew that this was an especially favorable place for minerals. Let us see how he knew.

THE PRE-CAMBRIAN ROCKS OF CANADA

You have read elsewhere that some of the oldest rocks in the world, millions of years in age, are called Cambrian rocks. Much of the foundation of America is of Cambrian stone. Part of Canada rests upon rocks even older, called pre-Cambrian, whose great age can only be guessed. These rocks, which produce most of the mineral wealth of Canada, occur in the shape of a huge shield stretching from the province of Quebec on the east across northern Ontario and Manitoba into the Northwest Territories. The most natural place to look for minerals is along the edge of this shield where it juts into territory of a different geological kind. The great gold mines of Quebec, Ontario and Manitoba were found by the process of "scratching" the southern rim of the shield. But in 1930 its western edge, seen by Camsell and Bell, was still unexplored. This edge extends northward from Lake Athabaska straight across Great Slave Lake and past the east end of Great Bear, ending up at the Arctic Ocean about 150 miles east of the mouth of the Mackenzie. At only one point does it cross to the western side of the river system, at the great sixteen-mile portage between Fort Smith and Fort Fitzgerald just north of Lake Athabaska. Along the 1,600 miles of this western edge the region has been broken up by violent glacial action. Sudden hills rise abruptly to a thousand feet or more. Small lakes less than a half mile apart differ in level by 500 feet. Such a terrain (land surface) often contains hidden mineral treasure.

What did Labine discover at the point where the shield skirts the eastern end of Great Bear Lake? He found silver, cobalt, nickel, copper, but above all in importance was his discovery of pitchblende. You may read elsewhere of the wonderful way in which radium is secured from this ore in the earth's crust. See Radium in Index.

Pitchblende is not an attractive-looking mineral. It is brown or black, with a luster much like that of pitch, from which it takes its name. Today Canada produces more pitchblende than any other country except Belgium. Uranium from Canadian pitchblende is used in the great Chalk River atomic-energy plant at Chalk River, Ontario. This plant is operated by the National Research Council in accordance with the policy laid down by the Atomic Energy Control Board.

The ore occurs in three veins which may be imagined as three long irregular walls extending not quite straight down into the ground, sloping off to the northwest and varying in thickness from one foot to fifty feet. Most of this ore is silver-bearing, but in many places there are streaks of pure pitchblende as much as twelve inches thick, and there is no sign yet of an end to the treasure. These facts make this mine the finest producer of radium in the world and, since so much good can be done with radium, we may perhaps say that this is the most valuable mine in the world.

GOLD FROM THE FAR NORTH

The remote far-northern region of Canada contains other treasure, including gold. Shortly after the discovery of pitchblende on Great Bear Lake, important deposits of gold were found on the Yellowknife River where it empties into Great Slave Lake, and also on nearby Lake Gordon. Development was very rapid. In July, 1937, there was a single building on the site where the town of Yellowknife now stands. In 1940 there were homes, a school, a theatre, seven stores and many other buildings and offices. Within one year after being opened in 1939, the Con mine produced a million dollars' worth of gold; while the Negus yields about $50,000 per month. These mines all have the great advantage of being on or near the navigable waters of Great Slave Lake.

The discovery of these rich deposits of treasure so far away created some of the most difficult problems miners have ever had to face. Gold and silver refineries are most profitably operated near the mines; but



Courtesy, Eldorado Gold Mines Ltd.

Loading concentrated pitchblende aboard the radium-silver express at Eldorado, Northwest Territories.

it is not easy to get the bulky machinery to this distant region. The final product can easily be brought out by airplane since a piece of pure gold worth $10,000 is considerably smaller than an ordinary house brick.

In the case of radium, it is practically impossible to have a refinery at the mine. One reason for this is that more than five tons of acid are needed to purify a single ton of concentrated pitchblende, and this acid is available in sufficient quantity only in southern Ontario. Again, the extraction of radium is a very difficult and dangerous operation, requiring skilled chemists at work in laboratories where special supplies of many kinds are at hand. You will understand the danger when you learn how radium was first discovered.

In 1896 Antoine Henri Becquerel accidentally allowed some rocks containing uranium to remain overnight near a photographic plate wrapped in black paper. In the morning the plate had taken what looked like an X-ray photograph of the rocks. Becquerel concluded that uranium gives off rays which can pass through black paper. Two years later, Marie Curie, working with pitchblende and realizing that its effect was too strong to be accounted for by the uranium in it alone, discovered radium, several million times as radioactive as uranium. So far from requiring a night to affect a photographic plate, radium will immediately burn any human tissue with which it comes in contact. With proper care it can be used to burn away cancerous growths, and in this way has been a great blessing to mankind. But while it is first being prepared, the dangers of an unwanted and often fatal burn are very great. The whole process must be carried out in a place where skilled workmen can be protected by every precaution.

For these and other reasons the actual refinery is situated at Port Hope, 60 miles east of Toronto, and 4,000 miles from the mine. Many tons of radium ore must be carried on this long trip every month. In some months as many as 500 tons are carried on scows across Great Bear Lake and down the Bear River, a small turbulent stream leading into the Mackenzie. Here the ore is picked up by boats which carry it 1,200 miles up the Mackenzie River (to where shipments must be carried overland), across Great Slave Lake and up Slave River to the great portage at Fort Smith made necessary by the jutting of the pre-Cambrian shield through the Mackenzie river-system. This portage is crossed chiefly by auto-truck, and at the other end the ore is picked up again by another set of boats. Three hundred miles farther up the river it is loaded on freight trains at the "end of steel" in Waterways, Alberta. (End of steel means end of the

railroad.) At the same time other boats are carrying necessary fuel oil, a very important commodity in a place where the temperature sometimes drops to 60 degrees below zero. Fortunately plenty of oil is near at hand from wells at Fort Norman where the Bear River runs in to the Mackenzie. Oil for the radium mine is delivered by river-scow and pipe line. Oil for the gold mines is generally brought in by boat.

But boats can ply the Mackenzie for only, at most, six months of the year. During the winter their place is taken by airplanes and especially by tractors. The airplanes have no airport problems, since they are equipped with skis and can simply land on the snow. But often, after they have landed, the severe cold makes it very difficult for them to get their engines started again. Special heating of the engine is necessary. The oil is first heated, then the engine itself is warmed by blowtorches under an engine cover, a sort of blanket that conserves heat by extending down to the ice. Equipment for heating the engine must be carried on all winter trips in case of a forced landing.

The tractors, on the other hand, go over rough roads or ground where no roads have been cut, and over frozen lakes. They grind their slow, steady way in long trains, drawing heavy loads over land and ice. These tractor trains never stop, but plod along day and night. There are many hazards. Sometimes the ice on a lake is not heavy enough to bear the weight of the train and, as the drivers say, the tractors are "drowned." But equipment is soon brought to the spot and the train is lifted out of the cold water and sent on its way.

Such difficult problems in transportation could not be solved except for the presence of the majestic Mackenzie River. The vast river-basin, stretching far down into Alberta and Saskatchewan, is the eighth largest in the world. In this part of the world the days are very long in summer and short in winter. The Eldorado mine itself is just a little south of the Arctic Circle and has six months of nearly unbroken daylight. The vegetables there, in the long sunlit days, grow nearly twice as fast as ours. Vegetable gardens, planted near the beginning of July, produce huge beets and carrots and are bare again before the end of August. The whole district, like ancient Egypt, is dependent on one river, and like the Nile, the Mackenzie sometimes plays strange tricks. It is the only great river in the world whose source, being far south of its mouth, thaws first in the spring; and this produces the most outrageous floods, since the spring freshet of water simply piles up on the still frozen ice farther down the stream. The buildings on the shore of the Mackenzie are movable and are pulled out of the way of floods which are sometimes more than sixty feet high. But in spite of all its wildness, this mighty river is one of our greatest benefactors; for only by traveling on its broad surface can men bring to us the treasures of the north, the gold and the radium of Canada's "Northern Empire," the modern El Dorado.



Tractor trains in winter go over the frozen land and across ice-covered lakes and rivers.

HOW OUR BODIES ARE BUILT UP

THE FRAMEWORK, or BONY SKELETON

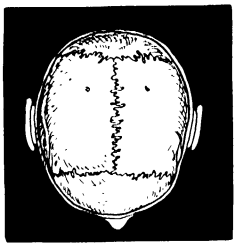
OUR bodies are built on a framework or skeleton of firm bone. There are 206 bones in the human frame.

Some members of the animal world—worms and insects, for instance—have no skeleton. An animal may have its skeleton outside or inside its body. A lobster has its skeleton outside and its muscles and organs inside. Fishes, birds and mammals, including man, have their skeletons inside; such animals are all called vertebrates, or backboned animals. The chapter beginning on page 255 tells you about backboned animals in general. Here we shall speak of the wonderful and useful skeleton which human beings have.

First of all, as in the case of all the other vertebrates, there is a backbone, or spinal column, or spine. It is not a single bone, but a column of small bones marvelously fitted together, one on top of the other. Each of these small bones is called a vertebra. Each vertebra has a hole in it; and strung through these holes is a cord of nerve material which is called the spinal cord.

At the top of the spinal column is a group of bones forming the framework of the head. We call this group the skull. Inside it is the brain; and the spinal cord joins the brain at the base of the skull. In fact, the spinal cord may be considered as a part of the brain that is extended downward from the skull. Below the brain are seven vertebrae, the neck bones, or cervical vertebrae.

Below the neck bones are twelve vertebrae called the thoracic vertebrae. Attached to these twelve are twenty-four (twelve pairs) long, slender bones called ribs, which curve around in front of the body. The fourteen top ribs (seven pairs) are fastened in front to a flat bone, the breastbone. The next three pairs are attached by cartilage to the seventh. The last two pairs are unattached. The ribs and the breastbone form a cavity inside which are the heart and the lungs. So you see it is not correct to say that our skeleton is entirely inside the body. The brain and the organs inside the thoracic cavity are protected from shocks and other damage by the bones that enclose them.



The top of the skull consists of several bones, dovetailed together in such a manner that it is easier to break the skull than it is to disjoint the bones.



This drawing shows us the ball-and-socket arrangement of the hip-joint. Because of this arrangement, human beings are able to move their legs in all directions.

Below the thoracic vertebrae are five lumbar vertebrae. They are in the region we call "the small of the back."

Below the lumbar vertebrae is a bone called the sacrum. The sacrum, in infancy, is really five bones, but it becomes welded together into one. Lowest of all on the spinal column are four bones, in infancy, which usually become welded into one, the coccyx.

The spinal column, with head and ribs, is called the axial skeleton. You know the word axis from geography. Well, your backbone is your axis.

The framework of the body is not the skeleton of a thing that is to stand still, like a house; nor is it the framework of a thing that moves all in one piece, like a ship. The body must bend this way and that. Part must move while other parts stand still.

It is plain, then, that it will not do to have a skeleton made all in a piece or made of pieces that are buckled firmly together like the framework of a house or a ship. So, wherever movement is going to be required we find the skeleton made of separate pieces with joints between them. The bones have no power of movement in themselves. The things which pull them are the muscles, and most muscles run from one bone to another *across a joint*. When the muscle shortens, it moves the one bone on the other at that joint.

Watch a snake twisting and crawling along. It has wonderful freedom of movement because its body is made up of little segments. Our backbone has somewhat the same freedom, and for a similar reason; it is made up of little pieces. Even when we move our arms slightly, or one arm,

we alter the balance of the body, and it is necessary that the curve of the backbone should be slightly altered.

The vertebrae that make up the backbone differ in size and shape. Those in the neck, for instance, are much smaller than the large ones in the small of the back, which have a great weight to carry; those between the two are different again, because they have attached to them the ribs. We find that in all sorts of animals the shapes and even the number of the different vertebrae correspond wonderfully. For instance, there are seven vertebrae in the neck of nearly every mammalian animal, as there are in ourselves. The giraffe, with its long neck, has seven cervical vertebrae, and so has the whale, which seems to have no neck at all.

THE CURVE OF THE SPINE HELPS TO CONTROL THE BODY'S BALANCE

There is a great difference between the curve of a baby's backbone and that of a grownup. In the baby and in four-footed animals, and even in half-erect monkeys, the backbone is so curved that the weight of the body is bound to fall forward unless a very special effort is made. A dog can be made to walk on its hind legs, but this is not natural and needs a special effort. But the curve of the backbone in ourselves after we have passed the first baby stage changes; and, as a result, the weight of the whole upper part of the body tends to roll backward.

Now, on the front of our hip-joints we have two great straps of strong fibers called ligaments, which prevent the body from rolling backward when we stand up. Other creatures have these bands of fibers, but in them they are tiny, while in us they are the biggest and strongest in the whole body. It is because our backbones are curved as they are and because we have these bands of fibers in front of our hip-joints that we can stand erect with scarcely any effort at all.

Let us take a closer look at the vertebrae. They are of several sizes, but they have a general likeness. Each one is an irregularly shaped bone, having a solid piece called the body; and these bodies are piled upon each other like a pile of coins, and so make the spinal column. In back is a projecting point, and we can feel the long row of these points running down the middle of the back. These points, and the others at the side of the vertebrae, have muscles and strong cords of fibers attached to them.

There are cushions of cartilage between the vertebrae which help to ease many a shock and strain—just as the springs in your father's automobile ease the shocks and bumps when you are riding.

Between every two vertebrae, on each side, there is a hole. Through these holes pass the spinal nerves from the spinal cord to the other parts of the body. When we look at the skull as it is balanced on the backbone, the most noticeable thing at the base of it is a large hole, and on each side of it there is a very smooth little place. These smooth places fit on to corresponding smooth places on the top vertebra, and every time we move our head the skull rocks on the top vertebra at these two places. The hole between them exactly corresponds to the large hole in the top vertebra—which is, indeed, scarcely more than just a ring of bone—and it is here that the lowest part of the brain is continued into, and becomes, the spinal cord.

Every message sent by our body and limbs to the brain travels along the nerves to the spinal cord, and then through its great hole at the base of the skull up into the brain. Every message from the brain passes out through the spinal cord to the nerves. The spinal cord is wonderfully protected by the backbone. Inside the backbone it lies inclosed in three sheaths, or coats, with fluid between them.

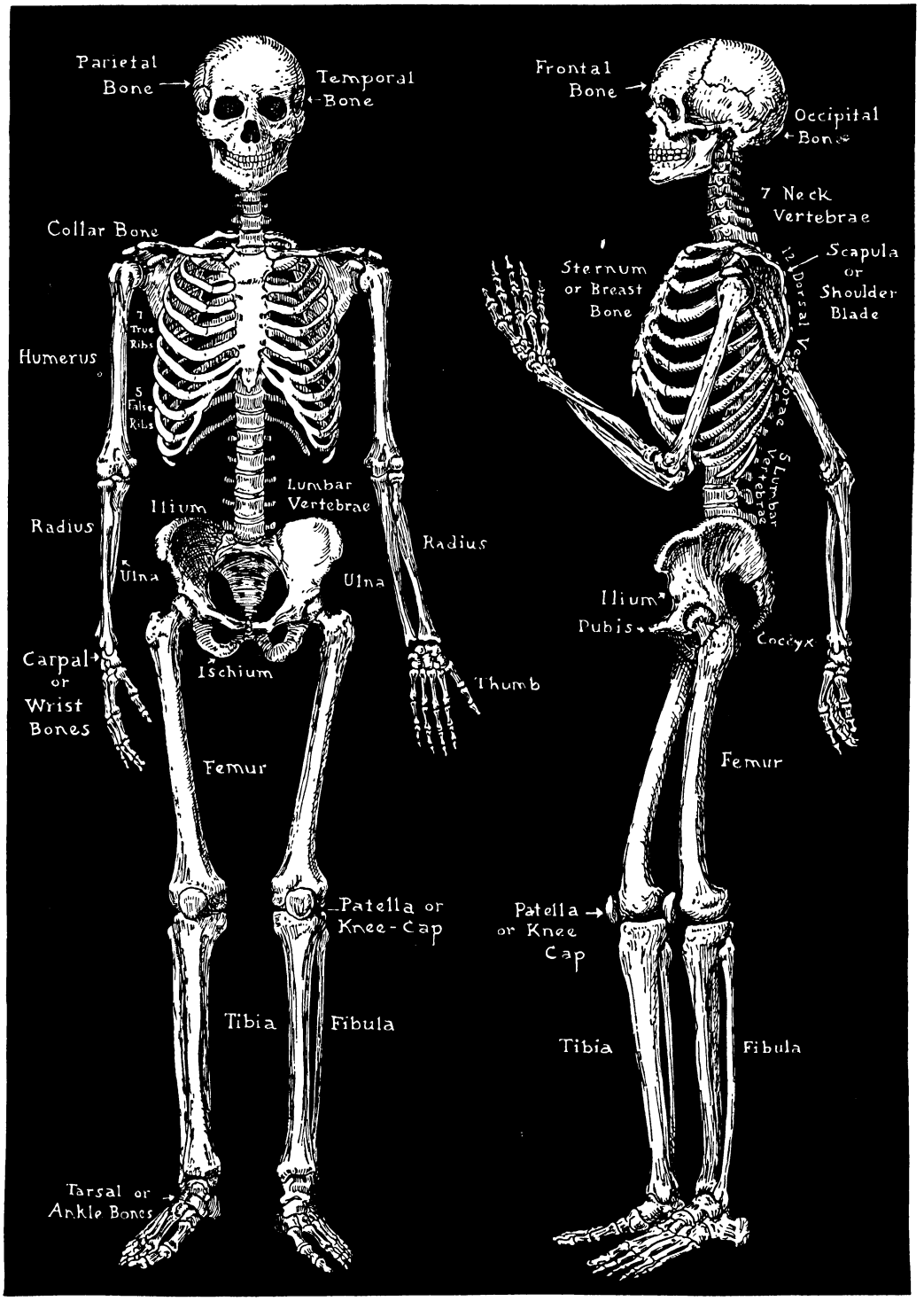
THE SKULL, BONY PROTECTOR OF THE ALL-IMPORTANT BRAIN

Let us take a closer look at the head. If we look at a very simple backboned animal, like the fish, or even at a more complicated one, such as the dog, we see that the head is made in two parts. In front there is a part which is thrust forward, which we call the face. Behind the face is a rounded part, the skull. It is the most important part of the whole skeleton, for it contains the brain. Our skull is large and is not all behind the face. It grows forward, over the face, and part of the brain grows in this forward cavity.

If we look at any man, woman or child we see at once something which shows this, and that is the great forehead—the part of the head that has "come to the fore," as we say. So, while we still have a great expanse of skull behind our faces, we have a large part placed above the face.

The whole growth and development of the body depends on the brain; and so if we look at a young baby we find that, although its brain has yet such a lot to learn, the skull is very large in proportion to the

THE BONY SCAFFOLDING OF MAN'S BODY



This diagram shows how cleverly the bony framework of the human body is hinged to permit free movement.

rest of its body, particularly the trunk.

The baby's face seems rather absurdly small, tucked away under the big skull, which is actually the widest part of the whole body of a baby. If we look at ourselves and see how narrow the head is, compared with the shoulders or the hips, we can scarcely believe that when we were born the head was wider than either. But so it was, for it had to hold a brain big enough to control and direct the growth and development of the whole body.

THE BODY'S SHOCK-ABSORBER, THE STRONG "ROCK" BONE

The base of the skull is very strong and very thick, and much of it is made of the densest and hardest bone in the body. Part of it is called the petrous bone, from the Greek word for rock. The reason that the base of the skull is so tremendously strong is that it always has to bear great shocks. Every step we take means that a great shock runs up our legs, along the backbone, and so reaches the base of the skull. A far greater shock comes when we run or jump. If this part of the skull were not so strong, it could not stand these constant shocks.

The base of the skull is pierced with many holes, small and large. The most important one is the great hole through which the brain is joined to the spinal cord. The other holes exist for the blood vessels to enter the skull and supply the brain with oxygen and food, for veins to carry the used-up blood away from the brain, and for a host of nerves to travel to and from the brain and connect it with the face, tongue, lips, nose, eyes, ears, voice-box and many other important parts of the body.

Only in one or two places do we find that the brain rests on a floor of bone which does not protect it thoroughly. The wall of the space which holds the eyeball is one of these places. Here the plate of bone is quite thin.

The great vault of the skull is composed of bones that are thin and beautifully curved, and are most exactly joined to one another. These are among the few cases in the body where bones are jointed together but are not meant to move at the joints. Most bones in the head do not move. The only exceptions are the joints where the lower jaw hangs from the head, and the joints of certain tiny bones inside the ears which carry the sound-waves from outside on their way to the nerves of hearing. These bony plates forming the vault of the skull are remarkable because they are formed, not from gristle or cartilage, as most bones are, but from fibrous material, or membrane.

When a baby is born, and for a long time afterward, there are at least two places in its skull where this membrane has not been changed into bone. This part of the baby's skull must be very carefully protected.

Each of the bony pieces that make up the vault of the skull begins to form in the center of the piece of membrane that corresponds to it. Even in the head of a fully grown-up person these places can be felt as bumps, for the bone is a little thicker there than it is anywhere else.

You will be able to feel five bumps at least on your own head. On each side of the forehead there is one; at the opposite corners of the head are two others, and these are the places where the side bones of the skull started to be made; and in the middle line of the skull, behind and low down, is the sharpest bump of all. This is of a different kind, though it is a true bony bump. It is a sharp piece of bone meant to hold the muscles and strong elastic fibers of the back of the neck, which hold up the head. They prevent the chin from falling on the chest, as it does when anyone is very sleepy and his brain forgets to tell the muscles at the back of his neck to keep on pulling.

A woman's skull is usually lighter and smoother and more rounded than a man's. It is also usually smaller, and holds a smaller brain. But a woman's brain is quite as big as a man's in proportion to the size of the body; that is to say, it is not in any sense inferior to a man's brain.

The bones of the face that are most important are the jaws, which hold the teeth. We have learned something about them already, in the article on the Mouth and Teeth.

BONES OF THE ARMS AND LEGS, THE APPENDICULAR SKELETON

So far we have been considering the axial skeleton, that is, the spinal column, head and ribs. Fastened to the axial skeleton are the bones forming our appendicular skeleton (from the word appendages)—that is, our four limbs or extremities, two legs and two arms. Look at the picture on page 1561. See how the collarbone, or clavicle, is fastened to the breastbone, and carries a shoulder blade on each side. The collarbone lies near the surface of the body.

The shoulder blade is a rather flat bone, having a rounded socket into which fits the head of the bone of the upper arm. This

makes a ball-and-socket joint. The great feature of a ball-and-socket joint is that it can move in any direction. A finger-joint or a knee-joint allows movement in only one or two directions; but the shoulder-joint, and the hip-joint, which corresponds to it, are ball-and-socket joints and allow movement in all directions.

The forearm has two bones; they lie side by side when we stretch out the arm with the palm of the hand uppermost. When we turn the hand over, the outer bone crosses the inner bone. At the elbow both bones are jointed to the bone of the upper arm.

DELICATE BONES GIVE HUMAN WRISTS AND HANDS WONDERFUL DEXTERITY

Then comes the wrist, with eight pieces of bone all wonderfully jointed. Beyond the wrist we find five long bones; and the first of these has two bones beyond it, making the thumb; while the other four have each three bones beyond them, making the four fingers. Our fingers are a little webbed on the palm side. That makes the palm a little bigger and helps to prevent things from slipping out of it between the fingers. The toes have the same arrangement.

The human hand is a very wonderful thing. Perhaps the greatest of its wonders is the fact that the thumb can be opposed to the fingers, so that it is quite easy to touch the tip of the little finger with the tip of the thumb. This means easy grasping and writing and many more skills. In other animals, except in those most like us, the thumb is not opposable any more than the big toe is in us. The big toe is opposable in some animals, so that they can use feet as well as hands in climbing.

In the lower part of the body, or trunk, we find bones firmly jointed to form a sort of basin. This is called the pelvis, which means "basin." It is built round the lower part of the backbone; and you can feel the edge of the pelvis in your side. The pelvis unites the lower extremities (legs) to the spine as the shoulder girdle does the upper extremities (arms).

On each side of this pelvis, outside it, we find a very deep and strong socket for the head of the hip-bone to fit into. This is many times stronger than the socket the upper arm-bone fits in, because the hip-joint has to do with walking, and its strength must be tremendous.

The thigh-bone, corresponding to the upper arm-bone, is the longest, biggest and strongest in the body. At its lower end is the knee-joint, the largest and most wonderful joint in the body.

The part of the leg below the knee has two long bones in it, like the forearm. Only one of the two bones of the leg is jointed to the thigh-bone. That is the shin-bone. The other, which lies along its outer side is very slender, and its upper end is simply jointed to the large and strong upper end of the shin-bone. You can feel the head of this outer bone in your own leg lying well below the knee-joint itself.

The leg also has an extra bone, the kneecap. There is nothing of the sort over the elbow-joint. The kneecap is a bone developed inside the strong rope, as we may call it, of the muscles of the thigh, as they pull upon the shin-bone. This rope, as it passes over the knee-joint, has the kneecap imbedded in it.

At the lower end of the shin-bone is the ankle-joint where the foot is attached to the shin-bone. The bones of the ankle differ from those of the wrist, as they have such different work to do; and the most notable is the bone of the heel, on which such great strain falls when we stand or walk. But more remarkable than any one bone is the way the foot bones form an arch which gives spring and grace to the gait. This arch is beautifully supported by the rope, or sinew, of one of the muscles on the outside of the leg, for this sinew runs right under the ankle and braces it up. Another sinew on the inner side does much the same, and the two together form a sort of stirrup to support the arch of the foot. The bones of the foot correspond exactly to those of the hand.

BONES, WHICH BEGIN AS GRISTLE, ARE MADE OF LIVING CELLS

What is this material we call bone? Is it a lifeless substance? By no means. It is living tissue made up of different kinds of cells, as truly as muscles are living. Most of our bones grow to three and four times their size at birth. Most of the bones begin their existence as gristle, or cartilage; then true, hard bone is formed inside the cartilage. The bones of young children are more gristle than bone, and sometimes, in a fall, where the bone of a grown person would have broken, the bone of a child simply bends.

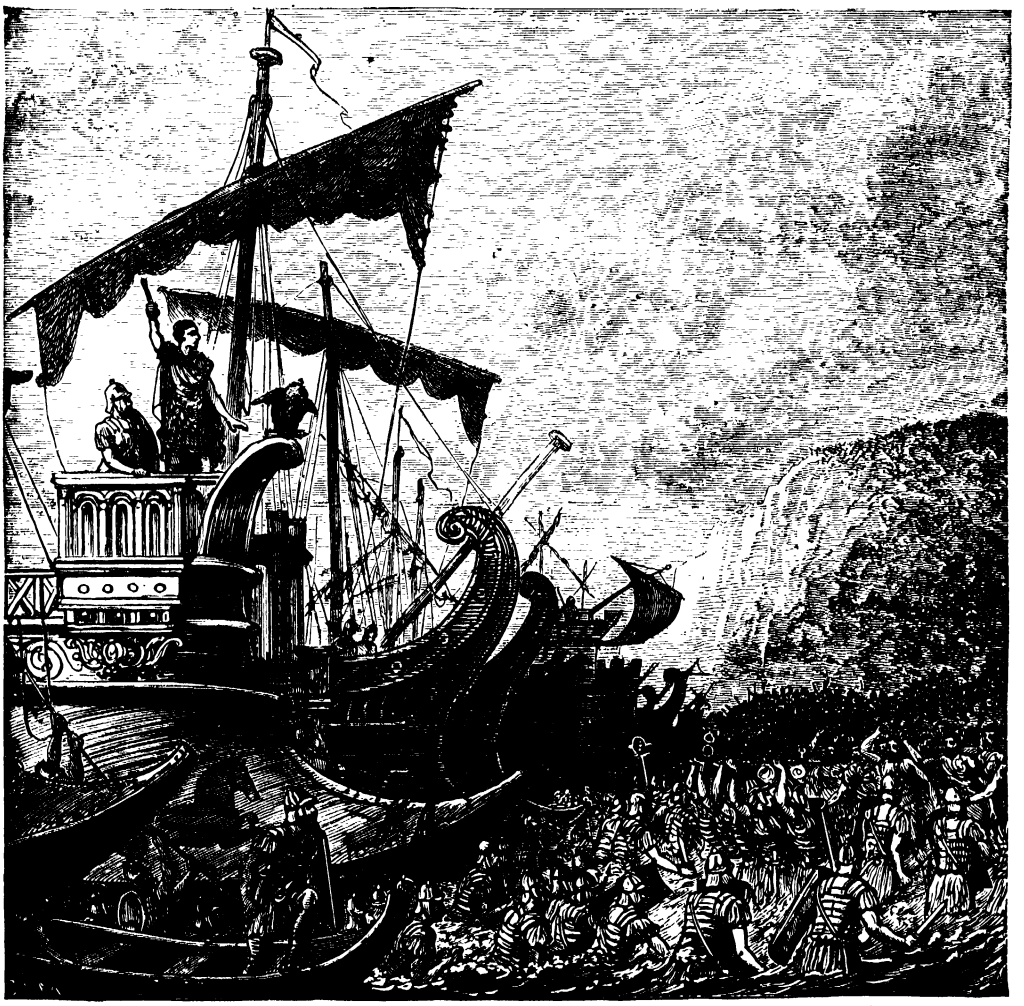
As you read in the chapter on The Blood, many of the bones contain inside them a soft substance which we call marrow, and in the marrow new red blood cells are manufactured.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 1673.

THE STORY OF ENGLAND

I. FROM EARLIEST TIMES THROUGH HENRY III

ENGLAND, Scotland and Wales are three countries on a small island off the coast of France and Belgium. Because England is the largest of the three countries and has controlled the other two for hundreds of years, we often say "England" when we mean the whole island. The fact that England is an island is important in her history. It has prevented many invasions of English soil and has made successful invasions gradual rather than sudden conquests. Because she is an island, her people from earliest times made friends with the sea. The English have been fishermen, sailors, explorers and, finally, the makers of a vast commonwealth of nations and colonies, spread over the earth and held together by a life-line of shipping, as well as by other bonds.

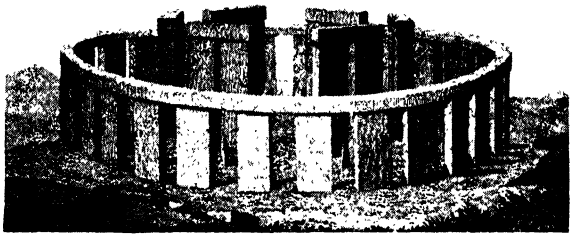


From an old print

The invasion of Britain by the Romans in 43 A. D. The commander, Plautius, directs the action from his ship.

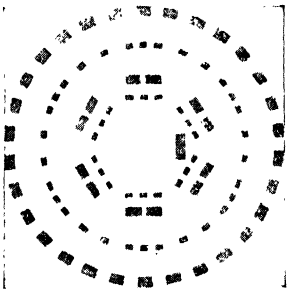
In ancient times the centre of the world's civilization was in the countries around the Mediterranean Sea. The small island of England, which at that time was called Britain, was at the edge of the known world. Very few people from the continent of Europe went there, and the people left no written records, so we have not been able to learn much about them. In 55 and 54 B.C., Julius Cæsar, the famous Roman general, invaded Britain. Most of what we know about the island of that day, and its people, comes from his records.

At that time large stretches of Britain were covered with great forests and many other places were damp and swampy. Living along the coasts, and in clearings in the forest, Cæsar found tribes of Brythons, or Britons. (From them the island of Britain and the French province of Brittany got their names.)



How the temple rocks at Stonehenge may have been arranged.

These Britons belonged to the fair-haired race of Celts. They had probably driven an earlier Celtic people, the Gaels, into the hills of what are now Wales and Scotland and across the Irish Sea to Ireland. The forests and swamps kept the tribes separated, so the Britons never united into one group. In fact, the tribes were jealous of each other and often fought.



Possible plan of Druid temple.

The ancient Britons lived a rough, crude life. The houses in the villages were built in the shape of a wigwam and were made of a kind of wickerwork. Even the chiefs lived in these crude houses. Sometimes mud walls were built around the villages to defend them from attack. The people raised grain and cattle and they could weave cloth. They had utensils and weapons made of bronze and of iron, and they made clay pottery and ornaments of gold, silver and beads. The armor of the warriors consisted of wickerwork shields. The Britons had small, swift horses which they used with chariots. In battle, sharp knives were fastened to the wheels of the chariots.

The Britons were nature-worshipers and had many gods. Their priests, who were called Druids, were very powerful men. The Druids were the only men in Britain who knew all the stories and laws of the people. They were the teachers and the judges; they settled disputes between people and between tribes. These priests lived in sacred groves of oak trees and did not mingle with the people. The mistletoe was also considered sacred, and later, when the English became Christians, they brought the mistletoe into their celebration of Christmas. At Stonehenge on Salisbury Plain there are remains of a great stone circle which some people believe the Druids built as a place of worship. This may not be true; the stones may have been set up by a still earlier people.

Before the coming of Cæsar, some traders had been to the island and reported that tin and other wealth could be found there. When Cæsar landed in Britain (which he called Britannia) in 55 B.C., he had with him only two legions (about 9,000 men). They forced a landing in Kent, but soon withdrew.

The following year, 54, Cæsar returned with five legions and 2,000 cavalry. This time he was able to make his way into what is now Middlesex (around London). He crossed to the north bank of the Thames, but the expedition was not really a success. The Britons, under the chieftain Caswallon, harassed the Romans. The Britons' armor was, of course, no match for that of the Romans, yet the war chariots of Caswallon, with their sharp knives, did much damage. Cæsar demanded tribute from the Britons (which was never paid), then he seems to have sailed for home and never to have thought of returning. From both of these invasions, Cæsar carried captives back to Rome, but he did not attempt to occupy Britain.

For about one hundred years after Cæsar's invasion, the Romans left Britain undisturbed. During this time traders often

crossed the channel from the continent and the Britons became more civilized. The tribes were still jealous of each other and still fought among themselves. In the year A.D. 43 the emperor Claudius sent an able general, Plautius, with four Roman legions and some cavalry and other troops, to conquer Britain. They landed on the southeast coast, overcame the tribes in that section and moved inland.

Although the Romans had conquered part of the land, the other tribes did not submit easily. It took the Romans about forty years to gain control over Britain, and they were never able to extend their rule over Scotland. The Britons had some brave chiefs to lead the tribes against the Roman conquerors. One of these, Caractacus, resisted the Romans for nine years. Then he was betrayed by another leader. Caractacus and his family were captured and taken to Rome. The emperor Claudius was impressed with the British chief's proud manner, and Caractacus and his family were allowed to live quite freely in Rome; but they were never permitted to return to Britain.

The Roman officials were not always fair to the Britons and one of the most famous revolts was caused by their mistreatment of a tribal queen. When Queen Boadicea's husband died, the Romans seized all his property and treated the Queen and her daughters very cruelly. The enraged Queen rallied the men of her own and neighboring tribes against Rome. They destroyed three towns and killed many people before the Roman legions defeated them. Boadicea took poison rather than become a Roman captive.



From an old print

Hengist and Horsa, two Jute chiefs, are welcomed to Britain by the Celtic prince Vortigern, who desires their help in fighting the Picts.

Now that Britannia was part of the great Roman Empire, the Roman way of life was brought to the island. The conquerors, on the whole, tried to rule justly. Officials were carefully chosen and told to treat the tribes fairly. The Britons were encouraged to speak the Roman language (Latin) and to adopt Roman customs. The Romans built towns surrounded by stone walls and houses far superior to the small huts of the Britons. These towns were first built as forts for the soldiers, but merchants, traders and other settlers soon came to them from the continent. The names of some modern English cities indicate that they were once Roman forts. The word for camp was *castra* and cities with names ending in *caster,* like Lancaster, or *chester,* like Manchester, or *cester,* like Gloucester, were once fortified Roman towns.

As the years went on, the frontier was pushed back, and more and more of the island came under Roman sway. The tribes in Scotland, the Picts, or Caledonians, refused to be conquered, so, in

about the year 120, in the reign of Emperor Hadrian, the Romans built a huge stone wall across the island, from the Tyne to the Solway. This fortification, known as Hadrian's Wall, was seventy miles long, eight feet thick and from twelve to fifteen feet high. Along it were eighteen permanent camps where soldiers were stationed to protect the country against sudden attack. On the southern side of the wall was a military road so that messages and reinforcements could go swiftly from one camp to another. The Romans built many other roads so that their troops could move rapidly around the country.

For about three hundred years Britain was prosperous and fairly peaceful under Roman rule. But in the north of Europe there were many savage tribes that were gradually fighting their way southward, and the Romans withdrew their troops from Britain in order to protect their empire nearer home. The last Roman troops left the island about 407. The Britains had their island again, but soon had to fight other invaders.



Saxon warriors, mounted: one carries a spear; the other, a double-edged battle-ax.

The civilization developed by Rome gradually disappeared. The British kings fought among themselves and the country had many foes outside the borders. The Scots, who came from Ireland, attacked in the north, killing people and destroying their possessions, and the Picts in Scotland swarmed over Hadrian's Wall.

The fiercest enemies of all came by sea and attacked all along the eastern coast. These fierce, blue-eyed, fair-haired warriors came from the northern coast of what is now Germany and Denmark, and, probably, the Netherlands. They came from many different tribes, but the most important were the Angles, the Saxons and the Jutes. All belonged to the Teutonic group of peoples. (The Britons and the earlier Gaels belonged to the Celtic group, as we have said.)

The Britons were not strong enough to fight off these savage warriors. For years the Roman soldiers had protected them, and kept them in order. Now the Celtic tribes fought among themselves and did not band together to defeat the invaders. No one knows exactly what did happen, because there are very few written records of this period. Most of the stories of battles were told by poets and singers and not put into writing until centuries later. By that time the history was clouded in legend.

Some of the Teuton invaders decided that they would rather live in Britain than in their colder country, so gradually the invaders became settlers. The first real settlement is said to have been made by the Jutes as the result of an agreement between Vortigern, a British prince, and two Jute chiefs, Hengist and Horsa. These chiefs helped the British drive the Picts back into Scotland. In return for their help they were given land and allowed to settle on the Isle of Thanet. They not only made homes for themselves, but also sent for more of their tribesmen to come over. As they needed more land they took it by force from the Britons. Soon other tribes of Angles, Saxons and Jutes came over and settled. As these settlements grew, many Britons were killed and the rest were forced back into the southwest and west. It took hundreds of years for these tribes from northern Europe to conquer and overrun Britain, but they did it so thoroughly that the Britons as a people disappeared. Remnants of the Celts lived on as small groups in Wales and Cornwall.

One of the great Celtic names during this long period of struggle was Arthur, king of a tribe in the west. Many are the wonderful tales told about him by the minstrels; it is impossible to believe half the stories. Yet such a king does seem to have lived, from about 501 to about 542. He united many British tribes, and, as their commander-in-chief, drove off invading hordes of Teutonic tribes and also Picts and Scots.

By the seventh century the conquered parts of the island were ruled by seven kings and a number of smaller chiefs and princes. The seven great kingdoms were Kent, Sussex (South Saxony), Essex (East Saxony), Wessex (West Saxony), East Anglia, Northumberland and Mercia.

The Teutons brought their own religion with them. They believed in the same Norse gods that you read about in German myths. One reason these beliefs are interesting to English-speaking people is because the names

of some of the days of the week come from these gods. Woden, or Odin, was the chief god and the god of war. From his name we get Wednesday. Thor, the god of thunder and lightning, gave his name to Thursday, and Tuesday and Friday were named for other Norse gods.

The conquerors of Britain destroyed practically all traces of the civilization that the Romans had left behind. They did not like to live in towns, so the towns were destroyed and the walls pulled down. They lived by hunting, fishing and crude agriculture. Since they were not skillful enough to make woven material and ornaments, there was practically no trade. Even the name of Britain passed away. Gradually the island became known as the land of the Angles, the Angle-land, and finally England. This period of English history is usually called the Anglo-Saxon period.



From a painting by W. Dyce, R. A.
The baptism of Ethelbert, King of Kent, by Saint Augustine, at Canterbury, in 597.

One of the most important influences in changing the Anglo-Saxons from barbarians to civilized people was the Christian Church. We are told that in the sixth century Gregory, a young priest in Rome, saw a group of captives being sold as slaves. Attracted by their strong bodies, handsome faces, blue eyes and golden hair, he asked who they were. Someone replied that they were Angles from Britain. "Not Angles, but angels," said Gregory. Years later, when Gregory became pope, he remembered these people and sent Augustine with a group of priests to bring Christianity to them.

In 597 Saint Augustine went to Kent, which was occupied by the Angles. Bertha, *Queen of Kent, was the daughter of the* Frankish king (the Franks occupied the land around Paris in France) and she was a Christian. When the Christian missionaries arrived, the Queen succeeded in having King Ethelbert meet them. He was much impressed by Augustine, and before long Ethelbert and many of the people of Kent accepted the Christian religion. Gradually Christianity spread through England, and by 650 only Sussex still remained pagan.

Soon the Christians organized monasteries, and this was a very good thing for England. A monastery is a place where monks or nuns live. (A nuns' home is often called a convent.) Monks and nuns are men and women who devote their lives to prayer and good works. In the early Saxon monasteries, the student-monks learned to read and write, and the first written records of Anglo-Saxon England were written in these monasteries. The monks developed better methods of farming and taught them to the people. They also introduced manufacturing. They built stone churches and sent abroad for glass windows and brass, silver and gold ornaments for the churches. Before long they were even buying books and copying them by hand. These new contacts with civilized Europe led to the development of manufacturing and the revival of trade in Britain.

While the monks and priests were organizing the country on a religious basis, the kings of the Anglo-Saxon realms were fighting among themselves for control of all the kingdoms. The man who finally succeeded *in winning control was Egbert (775?–839),*

King of the West Saxons. As a boy, Egbert had lived at the court of Charlemagne, in France, where he learned a great deal about the art of fighting. He was called home in 802 to become King of the West Saxons (Wessex). Slowly he built up strength in his own kingdom; then, by a series of successful campaigns, managed to get the other kings to accept him as overlord. This was accomplished by 830. Do not think of him as king of England. He was far from that, but rather a feudal overlord.

The union of England, such as it was, did not last long, for a new group of Teutonic invaders started to trouble the English. From the shores of Sweden, Norway and Denmark came bands of cruel, hard-fighting warriors. They called themselves Vikings, but the English called them Danes, Norsemen or Northmen. Just as the Angles, Saxons and Jutes had fought the Britons, these Danes fought the Anglo-Saxons. They took whatever treasure they could find in the monasteries; they stole all the grain and cattle they could seize; and what they could not carry away they burned and destroyed. They also killed many people.

The English fought hard, but they never knew where the Northmen would land and often there were not many fighting men to oppose the invaders. The Danes had huge battle-axes and were armed with coats of chain armor and heavy helmets. The swords and spears of the English were no match for the Danish battle-axes and most of the English soldiers had no armor, so usually the Danes won. Presently some of the barbarians (like the Jutes and Angles and Saxons before them) decided to help themselves to land and settle down in England.

The strongest resistance came from Wessex and it was Alfred the Great (848–900?), King of the West Saxons, and grandson of Egbert, who finally stopped the Danes for a while. Later even Wessex was fighting for its life against the invaders and for a time Alfred was forced to hide in the forests. He succeeded in gathering his men about him and defeated the Danes in battle. He forced the leaders of the Danes to become Christians and to sign the Treaty of Wedmore. Under the terms of this agreement the Danes were given, as vassals of Alfred, land north of the Thames River. This section was called the Danelaw. In return, the Danes promised not to fight the West Saxons. This was in 878.

The English hated to allow the Danes to remain on the island, but King Alfred's treaty brought peace for a little while.



From an old print

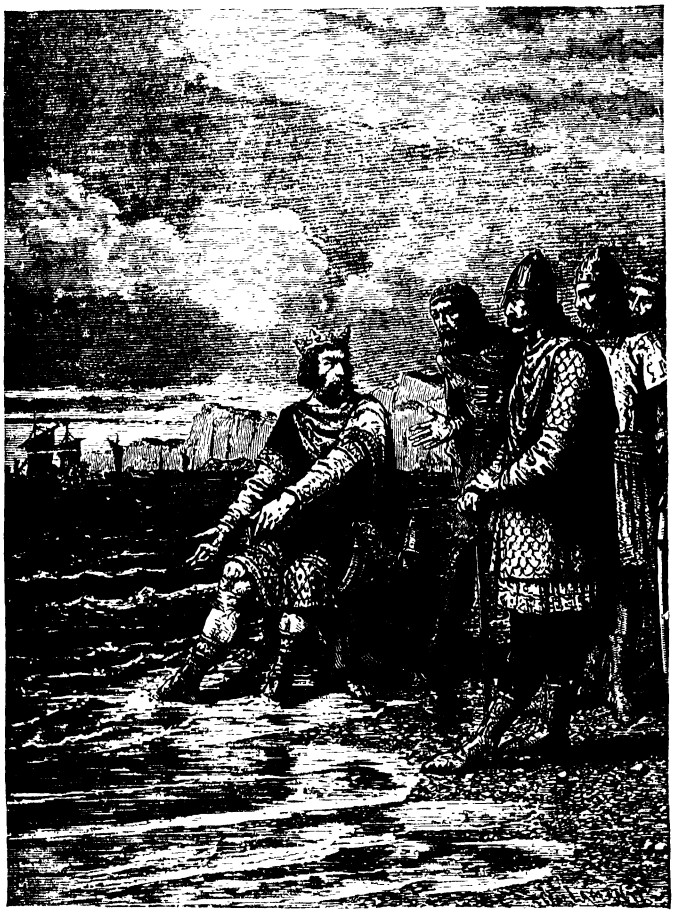
Alfred, hiding in a cottage, allows the cakes on the hearth to burn, and is scolded for his carelessness.

Alfred was not only a great warrior, but a leader in peace as well. He organized the laws in his country and had them written down so that everyone could be treated fairly. He encouraged education and brought teachers from Europe so that the sons of nobles and other wealthy men could learn to read and write. He built new monasteries and helped some of the old ones to repair the damage done by the Danes. King Alfred is the only English king to have "the Great" written after his name.

In the years after Alfred's treaty with the Danes, not all the Norse leaders kept the peace, and little by little Alfred and his descendants won back the Danelaw. Athelstan (895–940), Alfred's grandson, also conquered Wales and Scotland, and by the end of his reign he called himself the Ruler of All Britain.

For some years after the reign of Athelstan, England was a peaceful country. Agriculture, industry, literature and art developed, and the people became prosperous. Toward the end of the tenth century this peace was again broken by fresh waves of invading Norsemen. This time the king, Ethelred II, called Ethelred the Unready (968–1016), tried to bribe the Danish rulers to keep their men away. The first nation-wide tax ever laid upon English people was to collect the money to keep the Danes out of the country. This tax was called the Danegeld. In 994, Swegen, King of Denmark, invaded England and King Ethelred fled to France. By 1013 Swegen had conquered the island.

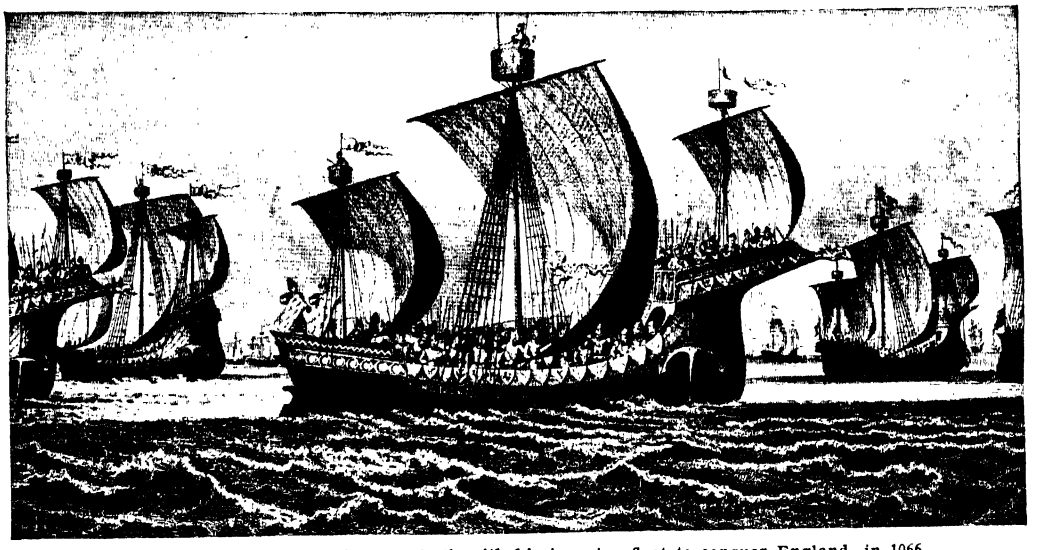
When Swegen died, Ethelred returned to England, but he soon died, also. After his death, the Witan, an assembly of Anglo-Saxon nobles, elected Swegen's son, Canute (995?–1035), as king. Edmund, son of Ethelred, claimed the title also, and Canute promised to divide the kingdom with him. But Edmund died the same year, 1016, and Canute became sole king of England. He proved to be a good ruler. He spoke a language similar to Anglo-Saxon, and in blood and customs he really was no foreigner. He sent most of his Danish warriors back to Denmark and during his reign there was peace.



From an old print

King Canute commands the sea to fall back. When the waves still roll in around his feet, he reminds his courtiers that a king's power is limited.

The two sons of Canute were not good rulers and when the second son died, the Witan chose Edward (1003?–1066), a younger son of Ethelred, as king. Although Edward (called Edward the Confessor) was a Saxon by birth, he was really more of a foreigner than the Danish kings had been. He had lived most of his life in Normandy, a part of France, and understood and spoke Norman French much better than Anglo-Saxon. He was a pious, good man, but not a strong ruler. The real strong man was his father-in-law, Godwin, Earl of Wessex. At first these two were friends, later they quarreled.



William, Duke of Normandy, sets forth with his invasion fleet to conquer England, in 1066.

Edward began the building of Westminster Abbey on the site of an older church in London. This huge cathedral is the most important church in English history. For more than eight centuries the kings and queens of England have been crowned in this church. Many kings and queens (including Edward himself), and other important people, are buried there.

When Edward had lived in Normandy he had been very friendly with his cousin, Duke William of Normandy. When Edward died the Witan chose Harold (1022–1066), son of Earl Godwin, as the king of England. Duke William was very angry when he heard this; he claimed the throne for himself and said that Edward had promised it to him, and that Harold himself had once sworn to uphold William's claim to the throne. When Harold refused to listen to William's protest, the Norman duke threatened to invade England and seize the crown.



Both pictures, old prints

The Battle of Hastings. The picture shows the death of King Harold upon the field.

Harold expected Duke William to attack, and all during the summer of 1066 he kept an army waiting on the southern coast, but the Normans did not appear. When fall came the men went home to harvest their crops. At this moment the Norwegian king invaded England from the north, claiming that he was the rightful king. Harold was forced to leave the southern coast, gather an army in the north, and make a hasty stand. He met the Northmen in the Battle of Stamford Bridge and defeated them.

While King Harold was driving out the Norwegian invaders in the north, Duke William and his army landed at Pevensey in the south. With Harold in the north and the southern army disbanded, he met no resistance and started marching inland. When Harold received word of the landing of William, he rallied his men, weary and sore from the battle against the Norwegians, and they started on the long march south to meet the Norman invaders.

THE DEFEAT OF HAROLD AT THE BATTLE OF HASTINGS

Anglo-Saxons and Normans met and fought the Battle of Hastings. It was a long, hard battle that lasted from nine o'clock in the morning until six at night. Time after time, the Norman army tried to break through the Anglo-Saxon lines, only to be thrown back. Finally the Normans succeeded in charging through the middle of the line, King Harold was killed, and his army was defeated and scattered.

Duke William continued his march up the coast toward London. Although their king had been killed and their army defeated, the Anglo-Saxons still resisted. The Witan met and elected another Saxon king. This angered Duke William and he showed no mercy to those who resisted him. Finally the Witan was forced to yield, and on Christmas Day, 1066, William of Normandy was chosen king of England by the meeting of Saxon nobles, and he was crowned as William I in Westminster Abbey. He is known to us as William the Conqueror, and William the Norman. He lived from 1027 to 1087.

WILLIAM STERNLY COMPLETED THE CONQUEST OF ENGLAND

The coronation of William did not mean that all the people accepted him. It took four more years to complete the conquest of England. In those four years William and his men defeated all who resisted him and he punished the leaders severely. By 1071 there was no one in England strong enough to question William's right to the throne.

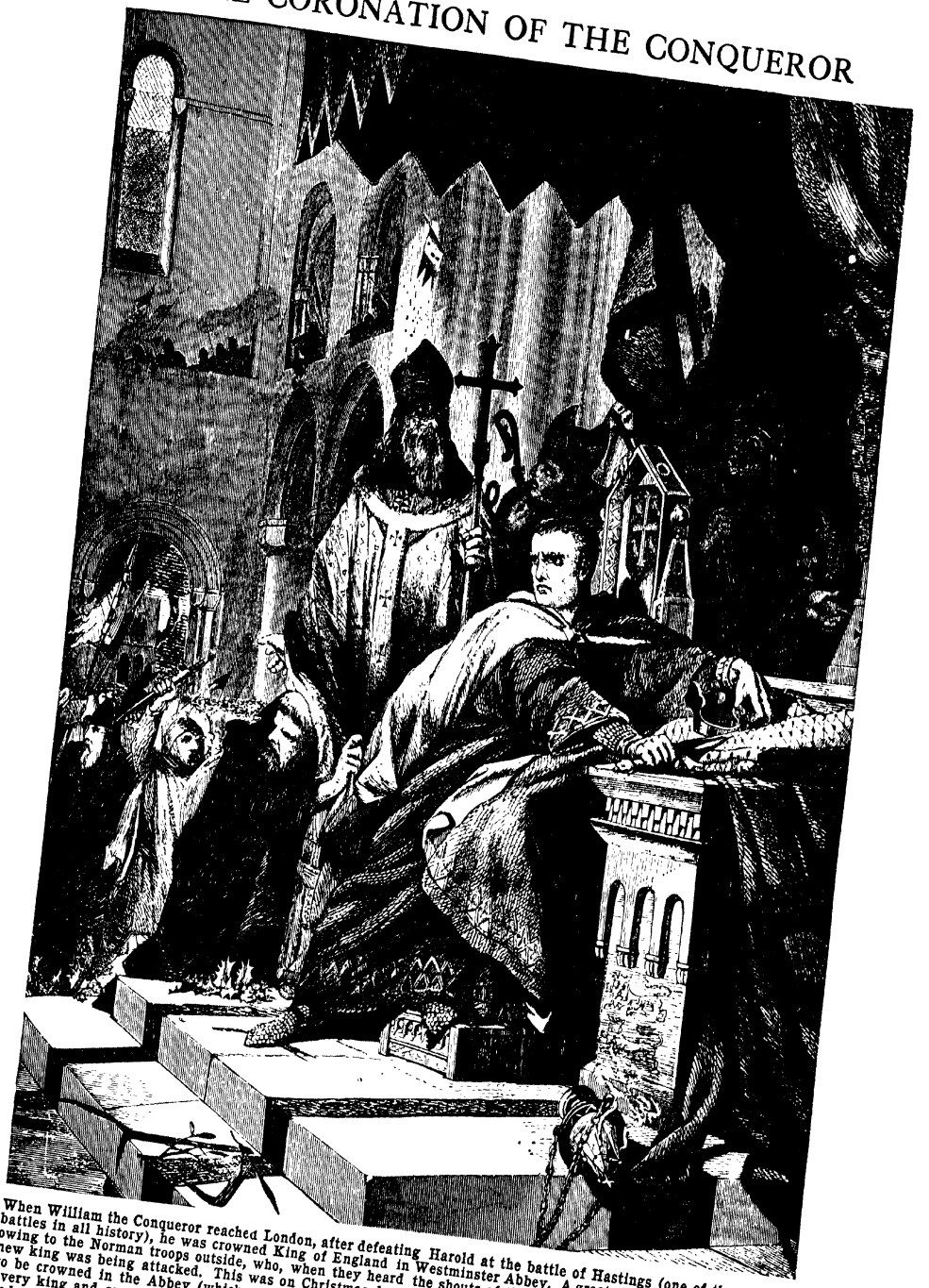
HOW THE NORMANS CHANGED THE COURSE OF ENGLISH LIFE

This Norman conquest is one of the most important events in English history. William I established a strong central government in England many years before this was done on the continent of Europe. The Norman kings improved the laws and the law courts. Now the people of England began to have more contact with the other people of Europe, and they learned much about art, culture and industry. Trading increased greatly and a new style of building was introduced. On the heels of William's Norman nobles and his army, a great many of the Norman common folk came into England. These people were mainly skilled workers, artists or merchants, and they went to the towns to live. Thus town life, which the Anglo-Saxons had not liked, began to develop once more under Norman rule.

The language of England also changed greatly. The Normans spoke a form of French and that became the official language of the government. The Anglo-Saxons clung to their own speech and gradually the two languages began to mingle. The English language as we know it to-day is a combination, or blending, of Anglo-Saxon and Norman French, with some other elements. We must remember this: the Anglo-Saxons were Germanic Teutons, and the Normans were Norse Teutons who had conquered a section of France and had learned to speak a debased form of Latin, that is, French. English and Norman were distantly akin.

William I took care to see that no Anglo-Saxon noble would be in a position to rebel against his power. The land of the great lords was seized and given to William's favorite followers, and they, of course, were mostly Norman nobles. Most of the Anglo-Saxon nobles were reduced to the position of common people or even of villeins. (Villeins were farmers for a lord; they were compelled to remain on his estate all their lives.) William summoned all his nobles to a great meeting, and forced them to swear allegiance to the king of England not only for themselves but for every man attached to their estates. This was the first time in the history of England that every man in the country owed his allegiance to one man, the king. Another thing William did was order a survey made of the whole country,

THE CORONATION OF THE CONQUEROR



When William the Conqueror reached London, after defeating Harold at the battle of Hastings (one of the greatest battles in all history), he was crowned King of England in Westminster Abbey. A great riot immediately followed, owing to the Norman troops outside, who, when they heard the shouts of the people in the Abbey, thought that the new king was being attacked. This was on Christmas day, in the year 1066. William was the first English monarch to be crowned in the Abbey (which was not completely built at this period). From his time on, the coronation of every king and queen of England has taken place in the Abbey, except those of Edward V and Edward VIII (who had no coronation). William reigned for twenty years. He died at Rouen, in Normandy. This picture shows William wearing a suit of chain mail, or armor, under his flowing coronation robes.

its land and livestock. This report, which was made for tax purposes, was written in a book which the people, with a laugh at their own misfortune, called the Doomsday (or Domesday) Book, and so it is known to this very day.

HENRY I BECAME KING AFTER WILLIAM'S DEATH

William the Conqueror died in 1087. According to his will Normandy went to Robert, his oldest son, and William (1056–1100), his second son, became William II of England. From his red face he was called William Rufus, or the Red. The powerful Norman barons in England who now had large holdings of land and many soldiers under their command, at first rebelled against William II in favor of Robert. William gained their support, however, by promising to reduce their taxes and to give them other privileges, and so he saved his throne.

William's reign was marked by a series of wars through which he tried to get control of Normandy. The people suffered under high taxes in order to pay for these wars. He also found himself in difficulties with the Church. Much rich property belonged to the estates controlled by the bishops, and this income was supposed to go to the Church. However, when a bishop died, William would wait for years before he would appoint a new bishop and in the meantime he would collect the income for himself. Finally Robert wanted to go on a Crusade, so he mortgaged Normandy to his brother; and the English were heavily taxed in order to pay for it.

By this time there was a great deal of discontent in the country and another rebellion might have broken out, but William the Red died very suddenly and very mysteriously. His body was found in the forest where he had been hunting. An arrow had killed him. Whether he died by accident or whether the unpopular king had been murdered, no one was ever able to find out.

William II left no son to inherit the throne. His older brother, Robert, the rightful heir, was in Jerusalem; but his younger brother, Henry (1068–1135), was in England and succeeded in becoming the next king. Henry I was the only son of William the Conqueror to have been born and raised in England. This gave him popularity with the English people and he made his position stronger by marrying a descendant of King Alfred. He also issued a charter, or promise of good government, in which he promised not to do the things that had made William II so unpopular. In addition to these promises to the great lords, the charter ordered the lords to give their people fair treatment. This charter is important in English history because it was the first time that a king admitted that he had certain duties to his people.

HOW HENRY STRENGTHENED THE POWER OF THE KING OVER THE BARONS

Henry I continued the work of William the Conqueror in building up the power of the king and of the central government. He appointed able assistants and the powerful Norman barons were forced to pay their taxes and obey the laws. He established king's courts which were more important than the barons' courts. He was victorious in an argument with the bishops and forced them to agree to swear allegiance to the king before they could become bishops. These measures made the king and his ministers, rather than the barons, the most powerful men in England.

When Henry died he left England and Normandy to his daughter, Matilda. Matilda's husband was a French count and the English did not want a Frenchman as king. Nor did they wish to be ruled by a woman. Henry's nephew, Stephen (1135–1154), also French, felt that he should be the next king, and he immediately sailed from France to England. He gained the good will of the people of London, seized the royal treasury in Winchester, gained the consent of the council of barons and was crowned king of England.

THE STRONG CASTLES BUILT BY THE BARONS IN STEPHEN'S REIGN

Stephen's reign was a period of civil war, anarchy and general misery. Matilda and her husband fought against Stephen in England and in Normandy. Throughout the civil war the power of the king became weaker and that of the barons became stronger. Many barons built fortified castles, which the other kings had not allowed them to do, and when the war was over, each baron had made himself an absolute ruler over his own possessions. The strong royal government developed by William the Conqueror and Henry I was gone.

After nineteen years the civil war was ended by agreement. Stephen's son had been killed, and so the King consented to name Matilda's son Henry as his heir. Stephen lived for only a year after the end



From a painting by J. Cross

A group of barons of Henry II, murdering Thomas à Becket.

of the war, and Henry II (1133–1189) came to the throne.

Henry II was the first of the Plantagenet kings. This name was given to the family because of his father's custom of wearing in his hat a piece of broom-plant, called *planta genet* by the French. The first important thing that Henry did after mounting the throne was to destroy the fortified castles which the barons had built during Stephen's reign. This made it more difficult for the barons to resist the power of the king.

Henry II was richly endowed. Besides being king of England, he inherited wide French dukedoms from his father, and Normandy from his mother. By marriage with Eleanor of Aquitaine he gained further enormous domains in France. When he was only twenty-one, he was one of the richest kings who had ever ruled in all history. His subjects boasted that his realm stretched from the Arctic Ocean to the Pyrenees.

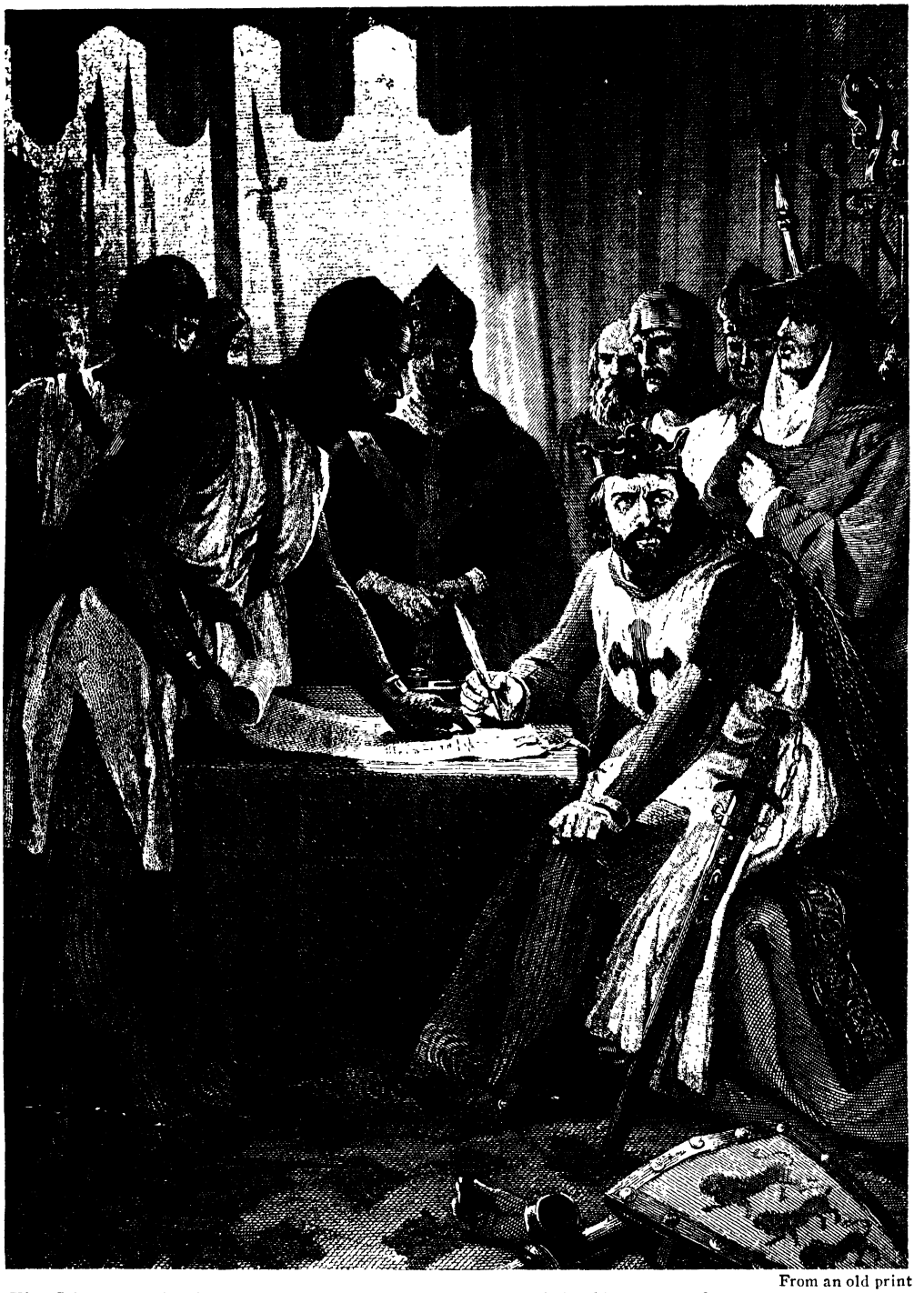
Yet he had to keep fighting to hold the French possessions. When the barons in England refused to send troops, Henry taxed them and used the money to hire soldiers. This was the beginning of taxation for a paid army. Henry also required all free men to be provided with armor so that they could be called upon to fight for the king. This was the beginning of a national army. Before that time soldiers had been sent to the king by the barons.

Henry had an important quarrel with the Church. The King levied taxes upon church property and Thomas à Becket, the Archbishop of Canterbury, protested that church property could not be taxed by the king. Henry also tried to force priests and monks accused of having broken the law to be tried in the king's courts. In those days the Church had its own courts for the trial of church officials. The King and Thomas à Becket quarreled so violently over this that the Archbishop was forced to go to France for a while. Shortly after he returned, Thomas à Becket was murdered by some knights who hoped to please the King.

Henry passed the last part of his reign improving the law courts. Among other things he introduced trial by jury. By this, twelve men of the district in which the crime has been committed listen to the evidence and decide whether or not the man is guilty. This work of Henry's was the beginning of the system used in courts to-day when a man is accused of having broken the law in any important matter.

When Henry II died, his oldest son, Richard (1157–1199), became king. Richard I was interested in the Crusades and spent most of his reign fighting in the Holy Lands. The Christian people had been very much disturbed when Mohammedan Turks conquered the land in which Christ lived and worked and died. Large armies led by Christian kings and nobles made expeditions, called Crusades, to Palestine, to try to regain this land. Richard was a leader in the Third Crusade, and although he did not

KING JOHN SIGNING THE GREAT CHARTER



From an old print

King John was such a bad king, and brought England into so much trouble, that the barons and bishops forced him to grant a great charter to the people, promising to maintain their rights. There was a meadow called Runnymede, on the Thames, near Windsor, where John met the barons to sign the Charter. John was furiously angry, and it is said that he threw himself on the ground in his rage and gnawed bits of wood.

succeed in freeing the Holy Lands, his skill and courage as a warrior earned for him the name of Richard Cœur de Lion, which means Richard the Lion-hearted.

In order to go on the Crusade, the King needed a great deal of money. He got much of it by taxing the people and he raised more by selling town charters. These charters freed the towns from control by a lord and allowed the townspeople to make their own local rules. They mark the beginning of local self-government, which is important in all democracies.

On his way home from the Crusade, Richard was captured and held prisoner by the German emperor. A huge ransom was required for the King, and each English freeman was taxed one-fourth of his belongings in order to raise the amount of the ransom. Richard lived for only about a year after his return. His brother John (1166–1216) succeeded him.



Henry III.

John I was one of the worst kings England ever had. Three important things happened during his reign. First, by his greed and poor management he lost all his French possessions. Second, he had a quarrel with the Pope over the right to appoint bishops and, because of his unpopularity in England, he was forced to yield. The third and most important event was the signing of the Great Charter.

During his reign King John had done a great many things to cause the barons and bishops to dislike him. He had kept money and property from the Church; he had forced money from the barons; he had imprisoned people on false charges and refused to allow them to be tried; he had taken away the town charters and made the towns buy them back; and he had forced merchants out of business when they refused to share their profits with him. When the nobles could bear it no longer, they had a great meeting and made a list of some promises which they wanted the king to make. They called the list the Great Charter. This was the first time a group of subjects met with the purpose of telling the ruler what they wanted him to do. Before that day, a king had called the barons and told them what he wanted them to do.

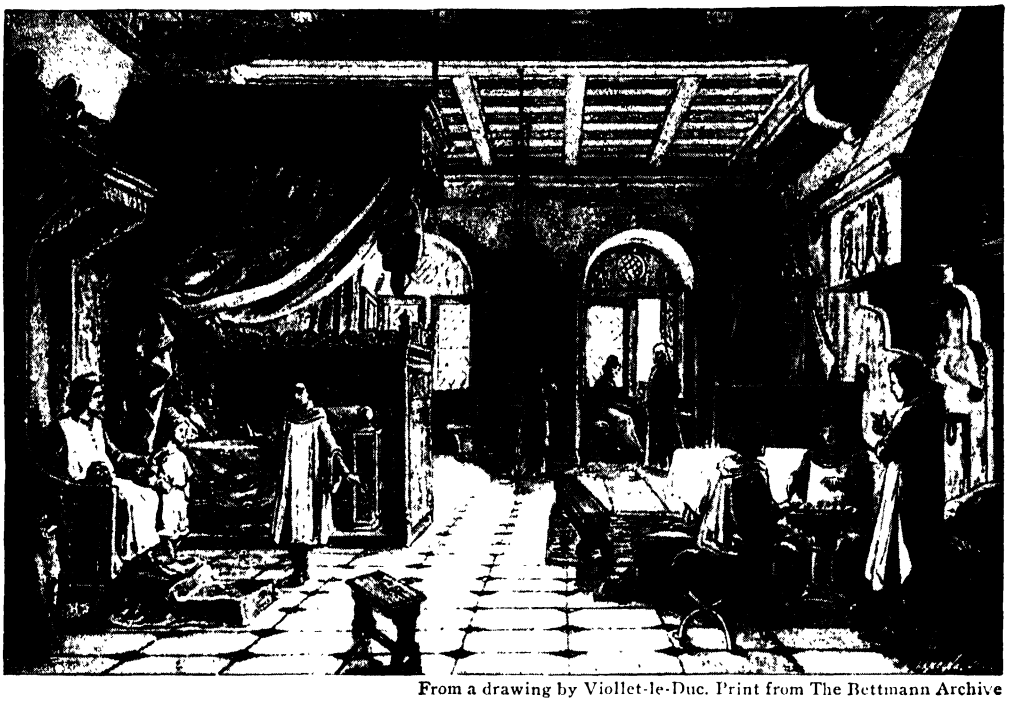
When the Great Charter, or Magna Carta, was prepared, it was sent to the King. John refused to sign it and the barons prepared for war. When the King realized that none of his people would support him, he yielded to the barons' demands. On June 15, 1215, at Runnymede, a meadow near London, King John met the barons and signed the charter. Here for the first time a king was forced by his subjects to admit that those he ruled had certain rights.

It is important to know something about the Great Charter because many of our modern ideas on government have developed from that document. In it the King promised that people would not be imprisoned unless they had been tried by a jury or had broken the law of the land. Second, he promised that justice would not be sold, denied or delayed. Third, the King agreed that no new taxes would be levied without the consent of the national assembly. This control over the taxes which provide the government with money was important in the development of democracy and self-government in England.

After he had signed the Great Charter, King John tried to disregard it and, as a result, civil war broke out. However, John died in 1216 and his son, a boy of nine, became King Henry III (1207–1272).

Henry III's long reign was marked by many disagreements between the King and his people. Henry was extravagant and easy-going. He showed special favor to foreigners and the English resented the fact that most of his advisers came from France, Italy or some other foreign country.

During the reigns of John and Henry III, the Great Council had met at least once a year. All important nobles and churchmen



From a drawing by Viollet-le-Duc. Print from The Bettmann Archive

The great hall in a wealthy baron's castle during the reigns of John and Henry III.

attended these meetings and they grew brave about speaking out their opinions. Thus meetings of the Great Council gradually came to be called Parliament. (That word comes from the French word *parler,* which means to speak, and it was used because the Great Council gave the important men of the kingdom a chance to speak their minds.) The barons finally became so angry over the deeds of Henry III that they forced the King to allow three committees of Parliament to have some control in the government. These committees were the forerunners of cabinets in modern democracies. Henry III was also forced to renew the promises of the Great Charter.

Henry tried not to keep the promises he had made and the discontent finally broke out in civil war. The leader of the forces against the King was Simon de Montfort, the King's brother-in-law. In the Battle of Lewes, Henry III was taken prisoner and Simon de Montfort called a meeting of Parliament. This meeting was important in English history because not only were the earls, barons, bishops and abbots called, but representatives were also called from the towns and boroughs. This was the first time that the common people were allowed to choose representatives to look after their interests in the government. From this beginning developed the House of Commons, which to-day is the most powerful body in the English government.

In less than a year after the Battle of Lewes, civil war broke out again between Simon de Montfort and the King. This time De Montfort was killed, and King Henry remained in control until his death in 1272.

In spite of all the arguments between the kings and the barons during the reigns of Richard I, John I and Henry III, the thirteenth century in England was a period of advancement. The great universities at Oxford and Cambridge flourished, and England produced many learned men. Some, such as Roger Bacon, were famous all over Europe. There was a great religious revival and groups of pious men, called friars, began to go around the country and the towns, preaching to the common people and devoting their lives to the sick and needy. The number and populations of towns became greater during this period. As the towns increased in size and number, skilled workers produced fine goods and trade became important. England had been behind other European nations in becoming civilized. Now she was forging ahead.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 1678.

HOT THINGS, COLD THINGS AND TEMPERATURE

WE know that matter may exist in a solid, liquid or gaseous state, and we know that, as a general rule, what we call heat makes a great difference in this respect. We take water and make it cold, and if we make it cold enough it becomes solid. If we begin with this solid water, or ice, and add enough heat to it, it becomes liquid. If now we add more heat to this liquid water, to cause it to boil, it takes the form of steam, or gaseous water.

We can say that steam is liquid water plus heat, and liquid water is ice plus heat. But what is heat? Is it a kind of matter? No, though we may add heat or take heat away from matter, it is not matter. Heat is a form of energy in the molecules and atoms of which matter is made.

Let us imagine that we have some liquid water before us; it may be cold or hot water, but, in any case, it has a certain amount of heat in it; in other words, its molecules are in motion.

If we add heat to the water (or to any liquid or gas) this is what happens. The molecules of the gas or liquid are already moving, darting about in random paths in the substance (with many collisions). When we add heat, this motion speeds up—the velocity of the darting molecules increases. Then a point comes where the energy is stored up in the vibrating molecules (think of a weight-thrower, storing up energy in the weight by rotating it before he hurls it). Finally, the molecules start vibrating along an axis. As the vibration occurs in longer or more rapid swings, or both, the molecules spread farther apart. The liquid becomes gas. The gas, if it is not confined, expands.

Now let us travel in the other direction. Instead of adding heat to the water, let us take from it the heat that it has. We know that when we cool the water down to a certain point it becomes a solid rather than remaining liquid. You see this happen whenever you put water in your icebox to make ice cubes, or when cold weather freezes the water in the lake. When we take too much heat from the molecules of water, their motion is slowed down, and they no longer form a liquid. Deprived of much of this motion the molecules come closer together. So we



The teakettle handle conducts heat well; it is hot to the touch. The other handle is insulated, and safe to touch.

have a solid; we have what we know as ice.

Though we all know that liquid water may be hotter or colder, perhaps we are not all quite sure that ice may be hotter or colder; yet it certainly may. We can cool the ice as we cooled the water, and all the time we are taking away from it this particular kind of motion called heat; we may go on and on, steadily lessening its heat down to a certain point.

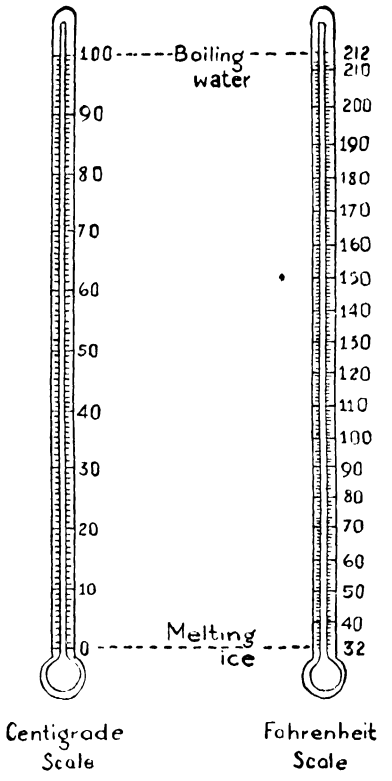
If a man has a certain amount of money, it may be added to, and there is no particular point at which no more can be added; and so it is with the addition of heat to anything. But if we start taking away a man's money, say, at the rate of one cent after another, the time is bound to come—whether he started with a dollar or with a million dollars—when he has no more money.

What is true of money is true of the kind of motion we call heat. As we cool the ice we are taking this motion away from it, and in course of time, if we go on steadily, we shall take away all the heat that was in the ice; if we could actually make that happen, we should have something absolutely cold.

Let us suppose we can do that. At this point there is no heat in the ice; the utmost part of the kind of motion we call heat has left it. So far as that kind of motion is concerned, its molecules and atoms are absolutely still. This must be a possibility for matter of all kinds—ice or anything else. This point we call absolute cold.

This would seem to be the natural and logical point from which to start, when making an instrument to measure temperature. However, we live our lives within a comparatively narrow range of temperatures; therefore the measuring instruments commonly used have a rather short scale. We call these instruments thermometers.

The one best known to most of us is called the Fahrenheit thermometer. It was made by a German scientist in 1714. Fahrenheit took as zero on his scale the lowest temperature to be obtained by a mixture of salt and ice. The temperature of the human body he took as the upper point. The range between he divided into 96 degrees. Since Fahrenheit's day there has been some revision of his scale. The temperature of the human body is now 98.6 on the modern Fahrenheit thermometer with which you are acquainted.



The two most common heat scales.

Fahrenheit showed that the temperature of boiling water is always the same at the same pressure; in his scale the freezing point of water is around 32 degrees and the boiling point around 212 degrees.

Scientists found this scale rather clumsy because the zero point really does not mean anything in nature. So in 1742 it was suggested that the freezing point and the boiling point of water be taken as the ends of a scale, and that the scale between be divided into 100 degrees. This suggestion met with favor and has been generally adopted by scientists all over the world. It is called the Centigrade scale, meaning "hundred steps." Scientists also use a resistance thermometer by which temperature is measured electrically.

We now know that 273 degrees below zero on the Centigrade scale is absolute cold. This means, on the Fahrenheit thermometers, over 459 degrees below zero.

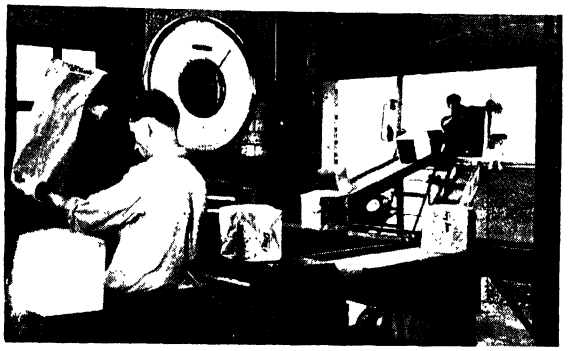
In absolute cold we have something actual to go by for our measurement of temperature. We have the point at which the motion that we call heat does not exist. Plainly, that point must be nothing, or zero, on the best possible scale of temperature. So, while there is a zero on the Centigrade scale and on the Fahrenheit scale, and on various other scales, we now have discovered the *real zero*, where heat and temperature really begin; and this we call the *absolute zero* of temperature.

It is possible to take the mixture of gases which we call air, and first to make it liquid by cooling, and then by further cooling and

increased pressure to make the liquid become solid. Liquid air looks like water, but it is far colder than ice. A rubber ball soaked in liquid air becomes brittle and shatters when bounced.

The use of liquid air is one of the most convenient ways of making low temperatures —that is to say, for making other things cold—and it is now very largely used in chemistry for this purpose. Solid air is, of course, very much colder than liquid air.

By the use of liquid helium, and with the aid of expensive machinery, it is possible to liquefy all the known gases. It was a great triumph when Onnes, in 1908, liquefied helium gas. All these gases, too, have now been solidified.



Courtesy Liquid Carbonic Corporation

Dry ice is the common name for carbon dioxide in solid form.

One interesting and important discovery which we make when we study extreme temperatures is that the ordinary processes of chemistry are greatly changed. It seems, indeed, that many ordinary chemical processes, such as happen when a fire is burning, or such as those which are always going on in our own bodies, can occur only within a certain range of temperature. It is believed, for instance, that at the temperature of the sun things are too hot for most chemical processes that we know, and that few compounds are formed. Just so, most of the chemical processes that we know cease at very low temperatures. Elements which ordinarily combine with great force, and perhaps explosive violence, do nothing at all when put together at very low temperatures.

Nevertheless, there is also a low-temperature chemistry. At extremely low temperatures many metals show what is called superconductivity. Their power of conducting heat and electricity is enormously increased. A wire made from lead, for instance, will offer no resistance to electric current; and once a current has been set up in a coil it will keep flowing for days.

Extremely low temperatures have been reached by liquefying helium. The gas is first cooled by means of liquid air and then subjected to very high pressures. Using this method scientists reached 0.7 degree above absolute zero. This liquid helium can be further cooled by pumping off the vapor above the liquid. The vapor consists of the faster moving molecules which have escaped from the liquid, and if these are removed, only the slower moving molecules remain. Slow-moving molecules mean that the substance has a low temperature. A limit is reached by this method of cooling, however, because the flask in which the liquid helium is kept is not a perfect insulator; there are no perfect heat insulators. When the number of molecules that evaporate is so small that the latent heat just balances the inflow of heat due to imperfect insulation, the temperature drops no more.

The earth's lowest temperature was reached by means of certain crystals and magnetism. These crystals possess an unusual property when they are placed between the poles of a strong magnet. The atoms which make up the crystals act like tiny atomic magnets and tend to align themselves in the direction of the magnetic field. Let us think of a single crystal. The crystal is placed in a thermos flask which is refrigerated by liquid helium, thereby bringing the temperature of the crystal down to 0.7 degree Centigrade. The atoms of the crystal, which act like tiny magnets, are not arranged in any special way when they are not placed between the poles of a magnet. When, however, the crystal is placed in a magnetic field the atoms line up. This turning of the atoms produces heat which is quickly removed by means of liquid helium. The next step is to remove the thermos flask from the magnetic field. Since there is now no magnetic field to align the tiny atomic magnets, they will return to their previous haphazard condition. This takes energy—heat energy! The only place the crystal can still find energy at this temperature is in the vibration of the atoms, so it takes heat from this source. Energy thus removed slows down the vibration of the atoms—a condition necessary for lowering the temperature. Under the conditions just described, a temperature of 0.004 degree above absolute zero was reached. This is the

lowest temperature ever reached on earth.

These temperatures are measured by using similar crystals.

Let us now pass on to another interesting question: how heat travels or spreads from place to place. It travels by several means. First, it travels by means of radiations, or waves, which pass in straight lines through space. The speed of these waves, whether they be of heat or of light, is hard for us to believe—186,000 miles in one second. The intense heat of the sun and from incandescent and hot, dark bodies, travels in such waves, and this method of heat transmissions is called *radiation*. Hold your hand under a lighted electric-light bulb. Do you feel the heat? This heat has traveled from the bulb to your hand by radiation.

Heat also travels by what we call *convection*. Let us heat some water in a glass kettle, and then add some sawdust. We can see that the heat is imparted first to the water nearest the bottom of the kettle. We can see water and bits of sawdust from the bottom rising to the surface. As the heated mass of water near the bottom is pushed up by the cold water which is denser, of course the heated water carries its heat with it. When heat is carried, or conveyed, bodily from place to place in this way, we say it travels by *convection*.



A glass of cold water "sweats" when it takes heat from the moisture in the surrounding air. This moisture, being cooled, forms as liquid on the glass surface.

HOW THE GREAT OCEAN CURRENTS ARE SET IN MOTION

In time we see all the water in the kettle moving. By heating one part of the body of water (that near the bottom of the kettle), we have set the whole body in motion. This applies not only to the kettle, but also to the oceans. It applies equally to other fluids, such as the atmosphere. In all the water of the earth and in the earth's great coat of air, different parts are at different times heated more, or less, than other parts, and so convection currents are started.

Heat travels also by what we call *conduction*. The conduction of heat occurs in all circumstances, in solids, liquids and gases, from solids to liquids, from gases to solids, and so on. It is the constant law, true everywhere and always, that whenever one thing is hotter than another, heat will flow from the hotter to the colder. Just as we say that water must find its own level because of the constant action of gravitation, so heat must find its own level.

WHY DOES THE HANDLE OF A POKER GET HOT?

What is conduction and how does it differ from convection? In conduction, the heat is passed on, or conducted, but the matter which contained it stays where it was. It is like a row of boys in which each one is slapping the next; whereas, in convection, the boys would change places and take their slaps with them. We can imagine how the vibration of molecules at one end of a hot poker might start molecules farther along vibrating, too, and the vibration, or heat, would be conducted along the poker. Different kinds of matter vary in their power of conducting heat.

Stick a silver spoon in a kettle of boiling soup. The bowl of the spoon becomes hot; then the heat travels, or is conducted, up the silver handle. Yet one end of a piece of firewood may be so hot as to be actually burning and the other end (outside the fire) will be quite cool. The metals in general are good conductors of heat. On the other hand, tissues made by living things are very bad conductors of heat. Wood is such a tissue. Bone, also, and wool and silk, and even linen and cotton tissues conduct heat badly.

Though we rank the group of the metals as good conductors, yet among themselves they vary a great deal. Those which conduct heat best also conduct electricity best—for instance, silver, copper, gold and aluminum. Iron is not so good as these.

Let us now consider the difference between heat and temperature. The general rule is that when heat is given to a certain quantity of anything, or taken from it, its temperature changes. If we take ice at the melting point and add heat to it, we do not at once raise its temperature; if we take water at the freezing point, with any ice in it, we can take some heat from it without a drop in temperature; or if we take a mixture of ice and water, we can add or take away heat without at once altering its temperature.

Lastly, if we take liquid water at the boiling point in the open air and add any amount of heat to it, not too rapidly, we make it no hotter. The liquid water goes off in the form of steam, which is itself no hotter than the liquid water was. All these are illustrations of what is called *latent heat*. What is true of water is true of other things. Now, what we notice in every one of these illustrations is that, though the temperature of the water is not changed, its state is. In one case we have ice turning into liquid water; in another we have liquid water turning into ice; in yet another case we have liquid water turning into steam.

Latent heat is the quantity of heat which must be added to a body in a given state in order to convert it into another state without changing its temperature.

The heat seemed to have disappeared *as heat* when we put it into ice; the ice turned into liquid water no hotter than the ice was, and so we say that the heat became *latent*, using the Latin word meaning "lying hid."

The opposite term to latent heat is *sensible heat*. Here the word "sensible" is used in its proper meaning—a thing is sensible when it can be sensed, or felt. So, when we give heat to a thing and make it no warmer we say that the heat becomes latent. If the heat does not make the thing warmer it must change the state of the thing; the heat has to be accounted for.

The facts of latent heat give us a means of measuring heat itself, for we can measure the amount of ice that can be melted into water without change of temperature. A given quantity of ice may be melted into water of the same temperature, either by being exposed to a great deal of warm water or to a little very hot water. In each case the amount of heat added must have been the same, because it does the same work, turning the same amount of ice into ice-cold water.

The name for the instrument that measures heat is the calorimeter. We must never mistake the difference between a calorimeter and a thermometer; the calorimeter measures the *quantity* of heat in a thing, including its latent heat; and the thermometer measures the *heat-level*, or the average speed of the molecules.

When we say latent heat we mean heat itself; when we talk of summer heat we do not really mean heat itself, but the temperature, or heat-level.

Two famous Frenchmen, Laplace the astronomer and Lavoisier the chemist, invented the first calorimeter, which measured the amount of heat by the amount of ice melted. Another method might be employed. When ice is turned into ice-cold water, heat becomes latent; but heat becomes latent also when boiling water is turned into steam (evaporated), and so it is possible to make a calorimeter depending on measuring the amount of water evaporated by heat.

The term latent heat is rather misleading. The truth is that, when ice is turned into ice-cold water by putting heat into it, the heat which disappears does not really lie hidden. It is turned into something else—this something else is the motion of the molecules of the liquid water.

In the same way, when heat is added to boiling water, and the water is turned into steam of the same temperature, we say the heat has become latent. We really mean that the molecules and atoms making up the water have received added energy—enough added energy so that they can no longer hold together as a liquid, but spring apart and become a gas.

There are many curious facts in nature which require explanation. One of them is that certain islands in the mid-Pacific, even



Courtesy, Johns Manville Corporation

The house on the left has been insulated; its walls and roof do not gain or lose heat easily. The snow on its roof is not melted. The uninsulated house on the right is losing enough heat to melt the snow on the roof.

though they are near the Equator, have a very mild climate. They never get hotter than 85° F. and hardly ever get below 70° F. Another fact which may seem unrelated is that a hot-water bottle is more effective than a hot brick in warming your feet on a cold night. These two apparently unrelated facts have something in common—specific heat. Some substances heat slowly and cool slowly. They absorb more heat while they are being warmed and set more heat free upon cooling. The following simple experiments will bring out this important fact. Two small balls of the same size, one made from aluminum and the other from lead, are placed in boiling water. After a time they will both reach 212° F. Place both of them on a sheet of wax about half an inch thick. The aluminum will melt its way through the wax more rapidly, while the lead melts the wax more slowly. The aluminum has absorbed more heat; hence, it loses more heat to the wax. The lead has a very low capacity for absorbing heat and melts the wax slowly. This illustrates the fact that the heat content of the aluminum is considerably greater than the heat content of the lead, even though they have both been raised to the same temperature.

The calorie has been defined as the amount of heat necessary to raise the temperature of one gram of water one degree Centigrade. Experiments show that about one-fifth calorie is required to change the temperature of one gram of aluminum one degree Centigrade. The amount of heat required to change the temperature of different substances is usually stated in terms of the *specific heat* of the substance. *The specific heat of any substance is equal to the number of calories required to raise the temperature of one gram of the substance one degree Centigrade.*

THE SPECIFIC HEAT OF A SUBSTANCE BEARS A RELATION TO ITS ATOMIC WEIGHT

The chemists have discovered certain remarkable laws about the specific heat of different things. We find that the specific heat of a substance depends to a great extent on the size and weight of its atoms. If an element has big and heavy atoms, fewer of them are required to make up a given weight, say, an ounce, than will be required to make up the same weight of an element which has smaller and lighter atoms. Also, the bigger the atoms are, the less heat will be required to raise the temperature to a given degree. In other words, it takes the same amount of heat to raise the same number of atoms one degree Centigrade, whatever the substance may be. The scientific way of saying this is that, as a rule, *the specific heat of a thing is inversely proportional to its atomic weight.*

The experiment with lead and aluminum shows that the specific heat of solids differ from one another. The specific heat of a liquid differs greatly from that of another, as may be seen by comparison of mercury and water. Water has a specific heat about thirty times that of mercury. If you heated equal weights of mercury and water over a flame, you would find the mercury hot enough to cause a burn while the water would still be cool enough to hold your fingers in it. In this way, it is seen that more heat is required to raise an equal weight of water to a given temperature than is required to raise the same weight of mercury to that temperature.

ISLANDS CAN THANK THE WATER AROUND THEM FOR THEIR MILD CLIMATE

All of this means that water stores up heat better than most other things; and this is as true for a teapot of water as for the ocean. This is the reason why a hot-water bottle is better than a hot brick at our feet on a cold night. It is also the reason why many islands have a mild climate. Earth or soil has only a specific heat of one-fifth that of water. It takes only one-fifth as much heat to warm the earth as it does to warm water an equal number of degrees. For this reason the inland sections of our country have very high temperatures in the summer and very low temperatures in the winter. They are warmed up quickly in the summer and they cool off rapidly in the winter. The coastal areas, on the other hand, have a more moderate climate. The large bodies of water absorb tremendous amounts of heat in summertime and give it off to the near-by land in winter.

We have not yet spoken of the ways in which the form of energy called heat is produced. There are four ways—1) by the sun; 2) by chemical change, as when coal or wood or oil is burned; 3) by friction, as when we rub two sticks together to get a spark, or when we stop a car suddenly and the tires slide on the pavement; and 4) by electricity. Your mother's electric iron grows hot because a current is sent through a coil of material that offers resistance to the electric current. We shall tell you more about these four ways of producing heat energy in the chapter How Heat Works for Us.

THE NEXT STORY OF SCIENCE IS ON PAGE 1845.



The children of Charles I, by Van Dyck.

THE DUTCH AND THE FLEMINGS

AN astonishing change came over the art of the Low Countries in the later sixteenth century. Many Flemish artists, blind to the glories of their native genius, which they had before them in the work of the incomparable Van Eycks and their successors, thought it necessary to travel to Italy and seek inspiration in Italian painting.

A period of imitation set in. The idealism and imagination of the Florentines and Venetians were notes quite foreign to the sturdy and beautiful art of Flanders, and the result of mixing the two strains was a mass of pictures that count for little in European art.

Another influence that made a change in the art of Flanders was the transfer of the trading centre from the old city of Bruges to the newer city of Antwerp. Of the Flemish cities, their buildings and their attitude toward art you may read more in the story of Belgium and her People. Antwerp early became the home of many industries, and before long was a home of the arts as well.

Into this prosperous atmosphere came young Peter Paul Rubens at the age of ten, for, though his father was an alderman of Antwerp, the boy had been born in Germany. He was destined to stand as a giant among the painters of all lands and all times. His lot was not like that of many geniuses, for he had no lonely years of need and hunger and bitterness. Instead, his life was like a triumphal procession, with noble patrons vying with one another to have him paint their portraits, and with pupils waiting to be admitted to his studio. Like Velasquez, he was at home in the atmosphere of courts; but Rubens had the wider experience, going about from one court to another, attended with pomp and received with honor. Indeed, he had friends in most of the princely houses of Europe. Rubens thought of an embassy to a foreign court as a holiday. You remember, it was he who urged Velasquez to go to Italy for a change.

Several years spent in Italy while he was a young man brought into Rubens' painting much of Italian brilliance and Renaissance splendor, but he kept his own distinctly northern character and built from the two elements a style of his own. He had the same largeness of conception as Paolo Veronese, and used great masses of color, with sweeping lines in his compositions. His work should, therefore, be seen as it was planned to be viewed, at a distance, upon an altar or a wall. Otherwise, it looks coarse.

He seems to have worked with his imagination at white heat while his

hand was always under the control of a cool intelligence. He seems to have painted as men laugh and talk—naturally, buoyantly, with extraordinary ease. Yet the hand that used the brush with such ease and freedom was sure and exact in execution. Like Titian and Velasquez, Rubens cannot be challenged as a technician. Mind and eye and hand worked together, a masterful trio, whose skill and training were complete.

His figures appear intensely alive upon the canvas. They are robust figures, glowing with vigor and animal spirits. His exuberance indeed indicates a lack of restraint, a restlessness, which may be considered a fault in this unusually gifted artist.

The number and variety of the pictures he left makes us wonder, even when we realize that in some cases part of the painting was done by pupils and assistants working upon his designs. The master always put in the finishing touches. Portraits, landscapes, historical and other story-telling pictures he treated with equal ability, showing at his best, however, in large compositions like the Coronation of Marie de' Medici, in the Louvre. Of his religious paintings, that of the Crucifixion (known as the *Coup de Lance*) and The Descent from the Cross, both in Antwerp, are considered the greatest. Splendid in color and form, these pictures which present the death of Jesus are lacking only in spiritual appeal. Here the somewhat restless, theatrical excitement of the groups is out of keeping with the solemn event portrayed.

Rubens' full and active life came to an end in 1640.

THE FLEMISH ARTIST WHO BECAME COURT PAINTER TO CHARLES I

Another man who stands out among the mediocre artists of the times is Jacob Jordaens. He lived between 1593 and 1678. He is like Rubens, vulgar at times and boisterously good-humored. His pictures are more florid in color and coarser in type, but there are brilliance and strength in his work which give it a place in the story of art. An interesting study of his is The Three Musicians, in the gallery at Madrid. The Family Banquet, in the Dresden Museum, shows his sparkling style and his flourish.

It is strange to think of Anthony van Dyck, the reserved, aristocratic gentleman, in this boisterous company. Van Dyck (1599–1641) was Rubens' best pupil, and in his early days painted in much the same way as his master, though, even then, with a slight difference. It has been said that "if Jordaens is Rubens at the Kermess, Van Dyck is Rubens as ambassador." In Italy, where he lived and painted for some time, Van Dyck was called the "Cavalier Painter." Through contact with Italian artists, especially the Venetians, his style and method were changed. And in England, where he went to be court painter to Charles I and his aristocracy, still further changes came about. He painted the royal family a great many times, and always he showed the same dignity and restraint, the same low-toned beauty. His portraits of the children of Charles and Henrietta Maria are famous throughout Europe.

THE FINE COLLECTION OF VAN DYCKS IN THE NATIONAL GALLERY, LONDON

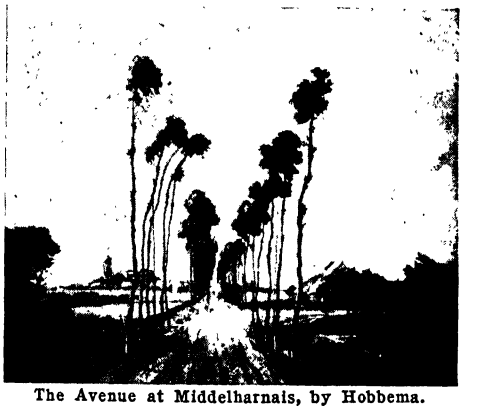
Great strength was never his; he is sometimes charged with being effeminate. His art nevertheless is to us a precious possession, partly because the eye is always pleased by his modesty of treatment, his wonderful delineation of character, his pure drawing, and partly because in his pictures survives the history of a long-dead time. Several of his paintings of the Stuarts are in the Royal Galleries at Windsor. His fine equestrian portraits of Charles are among his best known works. They still hang in the British National Gallery in London.

It is especially interesting to remember that although he was not himself an Englishman, Van Dyck was the father of English portraiture. In successive generations, when Englishmen began to paint for themselves instead of inviting foreigners to do their portraits, Van Dyck was taken as their model and inspiration.

While this artist was painting industriously in England—he was responsible for about fifteen hundred pictures in all—another artist was becoming known in Flanders, whose work was of a very different type. This was David Teniers, the younger. He was born in 1610 and lived till 1690. He was a follower of Rubens, but his work was more akin to that of the Dutch. He stands out among a group of men in Flanders who loved to paint workmen and shops, booths and fairs, and to make still-life pictures. His picture Kermess, in Munich, is a fine study of peasant festivity.



The Mill on the Dyke, by Jacob van Ruisdael.



The Avenue at Middelharnais, by Hobbema.



Frans Snyders and his wife, by Van Dyck.



Andrea Brignole-Sale on Horseback, by Van Dyck.



Lady Reading a Letter, painted by Gerard Terborch.



Man with a Sword, by Frans Hals.

THE PASSING OF ART IN FLANDERS AND ITS RISE IN HOLLAND

After Rubens' grandiose and florid work the homely pictures of Teniers, painted none the less with strength and brilliance, are very delightful to come upon. They show a style of Flemish art which was unique in its day and has not been rivaled since.

The work of Teniers has a melancholy interest, for all its liveliness, because it marks the ebbing of the art which had stayed so long in Flanders and brought glory to the Flemish people. Meanwhile, a new art was growing, across the little border in the neighboring land—the land of dunes and dikes.

The art of Holland in its great period was an original art which did not borrow from the outside. There was a kind of stubbornness in the independence of the Dutch people that affected their whole experience. Stubbornly they had resisted foreign rule. Stubbornly they now went about finding their own kind of art expression, without relying upon the lore of Italy or even Flanders.

Perhaps it was because the Dutch did not trifle with their painting, perhaps because they saw no need to experiment and work on "foreign" lines, that their pictures are so distinctly national, so much part of themselves. To take any twelve Dutch pictures is to take a piece of Holland, with its sturdy, clean strength and intense home feeling. The painters chose for their subjects themselves and their country; absorbed in these themes they were supremely content.

THE LITTLE DUTCH MASTERS AND THE HOMELY SCENES THEY PAINTED

Their independence had cost them dear; there was a saying that every artist in Holland was a son or a grandson of the men who had made the republic. Holland being thus their great love and joy, they asked nothing more than to mirror her in their pictures.

But it was not only national pride that set the Dutch artists to painting their homely interiors and tranquil landscape: Holland was staunchly Protestant, and would have nothing to do with carving statues or decorating church walls, painting Madonnas and saints. Her artists seemed, with a few exceptions, to turn their faces from religious subjects altogether: instead of thinking about the visions and miracles of the saints they thought about everyday people and the doings of the town.

This stay-at-home genius produced an array of pictures without parallel in European art. They are known as the work of the "Little Dutch Masters"; and they deal with firesides and kitchen tables, butchers' and fishmongers' shops, a girl's new string of beads, visits to the doctor or the dentist; people eating together, singing, making love; people gay in their youth, tranquil and wise in their old age.

THE COLOR PAINTINGS ON THE WALLS OF THE DARK DUTCH HOMES

In addition to these *genre* pictures—a name, as we know, given to studies of everyday life—the Dutch artists painted a great number of little landscapes, their canals and boats, their fields and trees, and cattle. But whether the pictures presented likenesses of men and women, or landscapes, or cattle, or indoor scenes, or still-life groups, they were all really portrait studies, made with the intention of representing things as faithfully and truly as possible. The whole art was "intimate and sincere." The colors in the paintings gleamed in the houses like jewels against sombre dresses. The homes of the Dutch citizens were rather dark and narrow buildings, extraordinarily clean and neat; and the light entered from the open doorway or crept through the rather scarce windows, and fell on the rich hues of the canvases on the walls, making them glow and seem alive.

It is when we realize how intensely these home pictures mattered to the people of Holland, what care and joy was spent on them, that we see the great distance the spirit of art had journeyed, so to speak. It is a far cry from the magnificent frescoes and public paintings of medieval and Renaissance Italy to these little pictures of ordinary people on the walls of ordinary people's houses. Instead of being adored and worshiped from afar, art has come to be lived with and loved at home.

The first of the great Dutch masters—those known by individual names, and not spoken of as a group like the little islands in an archipelago—was Frans Hals, the artist of Haarlem, who lived from about 1580 to 1666. Next to Rembrandt he was the finest portrait-painter Holland produced. The sense of life itself comes from each pictured form and

FAMOUS PICTURES BY RUBENS



A Garland of Fruit, in the Munich Gallery.



Mother and Child.



The Painter's Sons, Vienna.

face which his brush set on the canvas. He was a merry, jovial person—the laughing artist who recorded human laughter in almost all its forms. From his Laughing Cavalier to the smiling portrait of himself and his wife, Hals gaily presents a long line of merry people.

THE CHANGE THAT CAME WITH AGE IN THE WORK OF FRANS HALS

But their laughter is not senseless and inane. This jolly artist had a shrewd eye; life, thought and experience are behind the twinkling eyes and smiling lips of the men and women he painted. In addition to his many portraits, he executed from time to time large pictures for the Haarlem Town Hall, of which his masterpiece is the Reunion of the Officers of the Archers of St. Andrew—perhaps the finest of all the corporation pictures. The last two group paintings that Hals made were painted when he was over eighty years old.



Photo, Metropolitan Museum of Art.
Portrait of a Woman, by Frans Hals.

When Hals lost the boisterousness and animal spirits of his youth and middle age, a great change came over his work. He had always had command of a brilliant technique, in some instances rivaling that of Velasquez; his brush was free and fresh, rioting in color, seeming to slip about here and there, yet all the time recording faultless work. His figures were set forth in clear light, and his colors given in great masses. When he was an old man his palette lost its vivid colors and, instead, a beautiful array of grays ranged themselves on either side of black and white. His brush seemed to work of itself, with its old freedom, but within narrower limits.

The Haarlem school, which was predominant in Holland until Rembrandt turned everybody's eyes to Amsterdam, produced not only Hals, but the Ruisdaels. These two, Salomon and Jacob, were landscape-painters who stamped the art of Holland with their peculiar and individual genius. Jacob Ruisdael (1628–1682), the nephew of Salomon, has two different periods. In his earlier life he studied and painted scenes near the cities of Amsterdam and Haarlem. These are stretches of open country, seashore or wooded dunes, and at their best give evidence of a largeness of conception, a freedom of outlook, that have seldom been equaled. Perhaps no other painter of nature has more truly rendered the transparent quality of water and of air, or has shown a more intimate knowledge of the ways of trees—their forms and growth and habits.

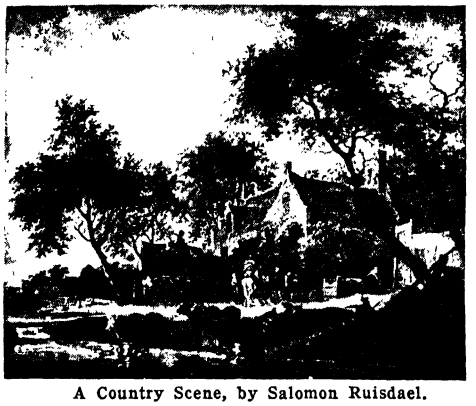
The skies form usually a most important part in these pictures, helping to produce the effect of endless space and, where there are clouds, to give an impression of movement and energy with the wind at large. The sea, too, conveys the feeling of boundlessness and distance and power. Ruisdael at the height of his genius seems to have grasped the bigness of nature and expressed it so nobly in color that anyone who looks at his landscapes can feel the majesty and beauty of nature in them.

The Swamp in the Wood, a fine example of Ruisdael's best period, in Leningrad (St. Petersburg), depicts a mood of calm, while there is still a breadth and bigness brooding over the scene. And in the Rijks Museum, in Amsterdam, is The Mill near Wyk-by-Duurstede, another of the great pictures of Ruisdael's maturity.

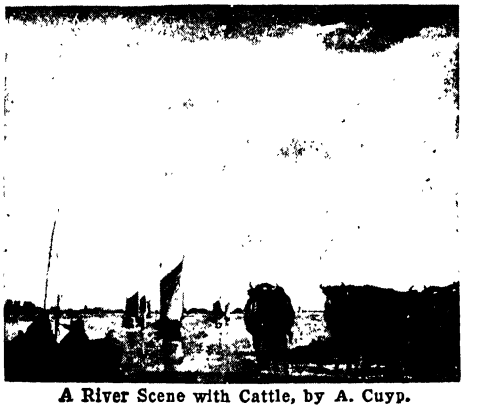
But, finding that his countrymen did not appreciate these fine, sincere representations of the country they knew, the artist, poor and in ill-health, became discouraged and embittered. First, he turned to painting mountain scenery and waterfalls such as might be seen in Norway or Switzerland, for there was in Holland at the time a demand for such pictures. Even these more forced compositions of unfamiliar scenes he handles with a mastery and a grandeur of effect that are beyond the accomplishment of other artists who attempted the same work.

Unhappily, Jacob Ruisdael during his lifetime did not find recognition and sup-

HOLLAND INDOORS AND OUT



A Country Scene, by Salomon Ruisdael.



A River Scene with Cattle, by A. Cuyp.



Singing the Old Songs, by Jacob Jordaens.



The Young Mother, by Gerard Douw.



The Prodigal Son, by David Teniers.

These pictures are from photographs of the paintings, by Messrs. Alinari, Bruckmann and Hanfstaengl.

port. He died in poverty and neglect in the almshouse at Haarlem. Besides the landscapes we have named, there are excellent canvases of Ruisdael's in Amsterdam, The Hague, London, Paris, Berlin, Dresden, New York, Boston and Philadelphia.

Jacob Ruisdael holds the honor of being the greatest landscape-painter of Holland. Three or four others did very fine work in the same direction; one of them, Hobbema (1638–1709), the last great Dutch artist, comes sometimes very near the genius of Ruisdael.

But his work is very uneven, the best pictures standing out brilliantly from among a number of literal, rather commonplace records of mills, trees and water views. The Avenue of Middelharnais, in the National Gallery, London, is the picture by which the world will most surely remember Hobbema, although The Water Mill, in the Louvre, is another favorite which is worthy of the admiration it has won, and several others might be mentioned. The beautiful Avenue is "depicted with such intimacy of truth that the road to Middelharnais seems as real to us to-day as it did over two hundred years ago to the artist."

Long lines of tall, slender poplars, bordering the road, lead into the distance, their plumy tops waving against the high, far background of sky where clouds are rolling across. Ditches, a farm with its orchard, and the village on the horizon—sights familiar and homely enough—are all given with a loving touch, a sort of tender imagination that reveals something more than the objects themselves. It is a picture that one can enjoy living with. The eye is continually gratified by the alluring perspective of the uneven and fragile lines of trees and the open road between them.

While the bright day of Dutch art was still clear there was another man painting fine landscapes and two at least were making pictures of cattle. The first of these was Van Goyen, whose paintings show us the Holland that he loved, by land and river, in summer and in winter. Van Goyen was a fine painter of snow scenes. The Skaters, in the Orléans Museum, is a wonderful piece of work, showing an icebound river under an immense wintry sky.

The two great animal artists of Holland were Paul Potter (1625–54), and Albert Cuyp (1620–91). They stand quite apart from the rest of the animal-painters of Europe. There is something very real in the cattle in their pictures—solid, strong, as if the artists had mixed the art of sculpture with that of painting. But the animals have not the coldness of statuary. In Paul Potter's pictures you can almost see the warm, smoking breath coming from the damp nostrils of the cattle, and the skin is a little wet from contact with the dewy grass and soft air.

Potter is rather more vigorous and real than Cuyp. There is an intense, brute force in his pictures, as if within the horizon of his mind little except beautiful, strong animals had moved, and he painted them naturally—the things he most loved. In his most famous picture, The Young Bull, in The Hague Museum, he has made an astonishingly true portrait study of the bull itself, but the other features of the picture are far less skillful in treatment and less interesting. All his work is that of a young man, as he died before he was thirty.

CUYP, WHOSE CATTLE AND LANDSCAPES ARE SERENE AND COMFORTABLE

Unlike many of the Dutch artists we have been thinking of, Cuyp lived at ease and in comfort. Yet he did not choose elaborate or luxurious surroundings; rather, he enjoyed a simple country setting, where he could paint as he pleased.

This simple pleasure in life and nature can be felt in his pictures, where big comfortable-looking cattle stand or graze or lie on gentle slopes and beside calm waters, with warm sunshine over and around them. All is quiet and peaceful, reflecting a contented spirit.

The best of Cuyp's landscapes are in private collections. His painting was not limited to this one subject, but included portraits, still-life, genre and historical pictures.

Turn almost where we will in Dutch art, we feel an intimate and homely atmosphere. It is as if we were having a glimpse of people's lives and sitting at home in their houses. Naturally this feeling is strongest when we are looking at the pictures of interiors—intimate and domestic scenes that were painted with great charm and exquisite craftsmanship by some artists whose names grow more famous as the years pass. There is no air of being on inspection, no self-conscious posing, in most of these scenes.

DUTCH AND FLEMISH GENRE PAINTINGS



Young Girl Peeling Apples,
by Nicolaes Maes.



Young Woman with a Water Jug,
by Johannes Vermeer.



Players at Tric-trac, by David Teniers the Younger.
Upper photos, courtesy Metropolitan Museum of Art.

They keep their privacy undisturbed. They are as natural and unconstrained as the movement of an animal or a bird.

Among the painters of this genre we shall especially consider four—Terborch, Vermeer, de Hooch and Steen.

FOUR PAINTINGS OF THE HOMELIKE AND INTIMATE DUTCH GENRE

Gerard Terborch (1617–81) lived at different times in several cities of Holland and traveled about in foreign countries, coming into contact with men of various interests and gifts, and responding to the influence of Hals, Rembrandt and Velasquez. Dignity and refined taste, self-respect and respect for the rest of mankind are felt in his pictures, whatever may be their subjects. He could make an interesting small painting of an officer writing a letter, of a lady washing her hands, of another lady with her back toward us playing a violoncello, or of an old woman peeling apples. His technique is hardly rivaled by any other artist, and his color is used with distinction and beauty of tone.

Jan Vermeer of Delft (1632–75) was an artist who left few canvases, if we judge by the number (thirty) now certainly known to be his. He seems to have taken his time in producing pictures and to have sold but few. However, those which we have we hold increasingly dear, for Vermeer painted in a way that belongs more to our day than to his own time. He was by far the most modern of the Dutch genre painters. The distinction is in his way of treating light and atmosphere, seeing his subject surrounded by natural light and presenting it by giving to different surfaces delicately differing values.

Often, you may notice, in his pictures a figure is shown standing beside a window, through which the daylight shines, touching the figure and diffusing itself through the space around the figure. Terborch's paintings, on the other hand, do not indicate where the light falls from, but have it toned as suits the artist's scheme of composition. Vermeer gets harmony by imitating nature, making a balanced arrangement of the colors and showing them unified by the effects of the diffused light. This method is best used on small canvases such as Vermeer produced during the greater part of his life. His colors are cool and luminous as well as exquisitely arranged.

Pieter de Hooch (1630–77) in the work of his best years gives us reason to remember that he came into contact with Vermeer and learned from him something of the secret of diffused light. He could make a cheerful poem of light and color by painting a picture of a courtyard depicting its share in the home life, or of a cool, dim room opening into a brighter one or giving a glimpse of canal or street beyond. All is characteristically clean and in neat order in these Dutch homes to which he introduces us. His finest pictures were done between 1655 and 1665.

Jan Steen (1626–79) has been spoken of as the "chameleon of Dutch painting," so varied are his subjects, his styles, and even the sizes of his pictures. So we cannot give him an exact place, like most of his fellow-artists. All phases of life—high life and the life of the middle and lower classes—are represented in his pictures. The life of children plays a large part in scenes of family groups, where his own household furnished his models.

HUMOR, TENDERNESS AND LARGE-HEARTEDNESS IN STEEN'S PICTURES

When one studies the "varieties of character, depicted in the personages of all ages from the baby to the grandparents, and notes the humor and tenderness in the sentiment and the embracing large-heartedness that has inspired the whole, it is to marvel at and rejoice in the uniqueness of Steen's genius." He was sometimes coarse in his humor, but never ill-natured. For Jan Steen had a genial attitude toward humanity, and welcomed any incident that gave a subject for a story-telling picture, especially an amusing one.

He sometimes cared more for the story than for the picture as a picture. In this he differed from the others, who were interested simply in the making of a picture and cared not at all how simple the subject might be. On the whole, he succeeded in bringing art and nature together in a happy union.

The smaller of the men of Holland, Gerard Douw and Mieris, and many more, lost something of strength by being absorbed in detail; but we like them, all the same; we could not bear to part with any of them. Like the great Dutch masters, they are part of the art of Holland, a separate and individual creation in the mighty growth of the world's art.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 1709.



Hamilton Wright, Inc.

A camel caravan stops at an oasis in the desert.

THE CAMELS

WHEN Mohammed was composing the Koran, which is the Bible of over two hundred million Moslems, he solemnly described the camel as an instance of the wisdom of God. Many men, many tribes, many nations, many empires have endorsed that verdict.

To the big populations of the East the camel has for centuries been meat and drink, house, dress, war-steed and baggage animal, the one animated vessel capable of carrying man and his wares from side to side of an ocean of sun-scorched sand.

We cannot date the domestication of the camel. It runs back to prehistoric times. A papyrus more than thirty-three centuries old mentions this priceless beast. Heat and barren land in the Near East, cold lands more bitter and barren in the Far East, have made the camel necessary to human life in those regions.

What the Atlantic and the Pacific Oceans are to us, the deserts of Africa and Arabia and the sterile steppes of Central Asia are to the East. We have our ships. The camel is theirs. It is their ship of the desert. Camel caravans are their fleets, and their drivers and conductors are the desert navigators of these strange carriers of cargo.

All the great human tides of war and migration in the distant past moved and spread from land to land by camel-power.

The Old Testament scenes always have camels in the background. They stride through the Bible. They were wealth to Abraham. Job was the "greatest man of the East" because in addition to sheep and oxen, he had three thousand camels.

All the great Bible journeys—the Queen of Sheba's gorgeous cavalcade to Jerusalem and the long journeys from all parts of the Holy Land; the convoys bringing merchandise to the Mediterranean ports for distribution throughout the West—were carried out by camel labor. And there is this romantic fact to be added, that the camels have given us a noble literature.

The first-fruits of Arab genius are camel songs—literally that. As they made their long, monotonous journeys across the burning deserts the old poetic sons of space composed verselets, keeping time with the footfall of the beasts they rode.

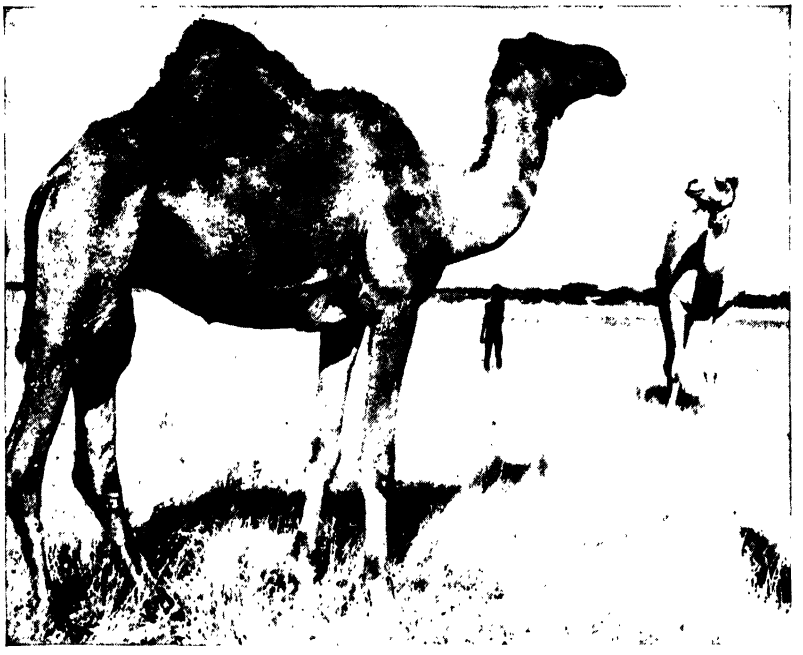
They sang songs of dark-eyed maidens and streams tinkling clear in dreamland oases; fierce rhymes of battle and of con-

test for wells. The metre was fixed by the tread of the camels, and it came about that the beasts marched better in time to their masters' voices than in silence.

With a quickening of the songs they raised their heads, lengthened the paces, and hastened their speed; and new rhythms, more complex lines, and couplets grew to match the hurry of gladdened feet. And so Arabic literature, or at least Arabic poetry, grew in the desert, beaten out beneath the burning sky by men swaying and swinging to the lurching gait of the marching camel.

The secret of the camel's unique value lies, as we all know, in the fact that these animals are so footed that they do not sink,

ONE AND TWO HUMPS



Courtesy, South African Railways and Harbors.

The Arabian camel, seen at the left, has one hump, and long legs. Its coat is sandy in color.



Courtesy, S. Stroock and Co., Inc.

The Bactrian camel of Asia has two humps, short, sturdy legs, and a good, thick coat of hair, dark-colored or fawn.

as a hard-hoofed mammal sinks, into the sand. They walk on it as a reindeer walks on snow, upon a spreading, padded foot.

HOW THE CAMEL CAN MARCH FOR DAYS WITHOUT DRINKING

In addition to that, they can march for several days through the desert without drinking—though it is not true that a camel can support a huge burden through the wilds for two or three weeks at a time without any chance of drinking. The camel is as fond of water as a thirsty human being, and it has no special way to store up the water. Like other animals water is stored in the tissues all over the body. A large amount of salt must be eaten to enable the camel to retain quantities of water without bad effects, but if plenty of salt is available a thirsty, shrunken camel will plump out amazingly.

It was once thought that the peculiar "cells" in the first two compartments of the camel's stomach were used to store water, but the water contained in the stomach is not enough to do much good in the desert.

The hump, while not used to store water as such, is more important. It is almost all fat. When this fat is used up by the body, water is produced—as much as ten gallons in a large camel. In addition, the animal's body draws upon that reservoir of fatty nourishment for the energy that it exhausts over its work and under privation.

THE ONE-HUMPED ARABIAN CAMEL IS WELL SUITED TO DESERT TRAVELING

There are two distinct species of domesticated camels in the Old World. One is the one-humped Arabian, covering a wide domain in northern and eastern Africa, Syria, Arabia and other parts of Asia Minor, and in northern India, Mongolia and south-central Asia. It is long-limbed with large spreading feet, soft for the desert sands. Callous pads, or cushions, upon its feet, and upon its chest, and on the joints of its legs protect these parts from being cut by the sharp grains of sand when the animal is walking, kneeling or lying down. Over its large dark eyes it has long eyelashes to protect it from the glaring sun and the whirling sands. Its nostrils, set slantwise above the split upper lip, can be closed also against drifting sand. That upper lip is very sensitive. Sight and smell are especially keen and the animal can tell at a great distance away where water is to be found. Its teeth are strong, just right for cropping the sparse plants of the desert. Its coat is shaggy, with a fringe of hair along the top of its neck and under its chin. The coat is colored like the sand. We know the shade as "camel's hair."

THE TWO-HUMPED CAMEL OF ASIA'S MOUNTAIN PASSES

The other species of domestic camel is the two-humped Bactrian camel of eastern Asia, similar to the Arabian but built more heavily, with longer, finer hair, which is dark-colored or fawn. Its feet are harder, for this camel lives, not in sandy deserts, but among the rocky wastes and mountain passes of northern and eastern Asia, in China, Siberia, Mongolia and India. It stands well the rigors of Arctic cold and of fierce heat.

No wild species of camel has ever been found, but a two-humped variety is said to roam in Central Asia and Siberia. Even these animals may be only offspring of tame camels that escaped from man centuries ago. They may be runaways from dead civilization.

The long hair of the Bactrian camel is very valuable for making fine cloth. In spring the hair loosens and falls off in clumps. The hair is carefully gathered, cleaned and sorted. The fine undercoat makes the best cloth; the hairs are as fine as the finest Merino wool. Shawls of this material have been woven in central Asia for thousands of years; the best ones are nearly priceless. Nowadays camel's-hair coats are its most common use.

THE DROMEDARY, A SWIFT CAMEL USED AS A RIDING STEED

You have heard the word dromedary. It is popularly taken to mean a one-humped camel. However, it has another, more special, meaning. Transportation camels are those which carry baggage and those trained for riding. The riding beasts are the dromedaries. They are chosen for their speed, and can go fifty to seventy-five or, occasionally, a hundred miles a day. The baggage camels are less fleet, but, going at fifteen to twenty-five miles a day, can carry five hundred to six hundred pounds. Camel caravans of 1,000 animals or more are not unknown. The beasts proceed with a pacing motion, lifting the two left feet, then the two right feet, and so on. As you can imagine, the traveler must learn to ride, and at first it is not easy.

The camel's bone is the finest thing nature has ever made for the frame of an animal. It is like ivory, dense and hard and splendid. In fact, camel bone is used in enormous quantities as a substitute for ivory. The



Courtesy, S. Stroock and Co., Inc.

A camel caravan in central China. The heavily-built two-humped Bactrian camels pick their way through snowy mountain passes where no other pack-animals could go. They can stand great extremes of temperature.

shape of the blood corpuscles in the camels and their relatives, the llamas, is oval, like those of the birds and the reptiles, but unlike these, the camel's red corpuscles have no nuclei. In all other mammals the blood corpuscles are circular.

We find another feature in the animal. Its temperature is not constant, like that of man and some other mammals. It rises with the surrounding heat, it falls with the drop of night's fierce winds. We humans vary little more than a degree whether we are in the tropics or the Arctic; the camel's temperature may rise and fall several degrees in the course of twenty-four hours. This is less change than in reptiles.

One would imagine that it must endure agonies in the noonday glare, for there is only one small patch behind the neck from which sweat glands pour out perspiration to relieve the heat of the animal's body. However, when resting the camel actually prefers to kneel in the full glare of the sun rather than to seek shade. The rareness of sweat glands helps to conserve water.

The camel goes grumbling beneath its burden through a desert in heat. He always grumbles. He hates his master and everybody else; and many are the stories of camels trying to kill their drivers, and sometimes succeeding. Some camels are more morose and wicked than others, but they are never gentle or amiable. This is particularly true of the common burden-bearing camels. The swifter riding camel, the dromedary, is often better treated, and his disposition is not always so bad; but even he is not a gentle or affectionate beast.

There is not a moment of the day when a camel will not bite its master's arm off if it has the chance. It can inflict one of the worst crunching nips possible by any pair of jaws. It will seize the hand that feeds it; it will take a piece out of a man's back or leg; it will fasten upon a man who rides past it in a narrow mountain way and dash him down to death. It is possible that thousands of years of ill treatment have bred viciousness into it as fixedly as hardihood.

Even among themselves they fight dreadfully. Lacking horns, they use the teeth, and with these they seize a leg, and wrench and tug until they have thrown the rival, then they drop upon him with the knees, and pound him to death. A contest between two bull camels is a grim spectacle; and it is a dangerous one, for the example of the first two is infectious, and will set the other males roaring and battling among themselves with a fury not to be described, and a damage to merchandise not to be mentioned in the hearing of a native owner.

What would be rich abundance to a horse would not be acceptable to a camel. For him

the lush grass of the meadow is not food; give him the prickly thorn, the scrubby thistle-like growth, and the camel paradise is there. One has seen a gaunt Arabian camel stride across a field ready for haymaking, and paddle through a brook, which camels abominate, to reach a hedge composed of forbidding briar and bramble, and feast with every sign of rapture.

The natural food of the animal is the ungenerous product of the desert. Where other animals would perish of starvation he waxes sleek and prosperous. The Bactrian luxuriates on bitter weeds and mineralized water, salt to the taste. It is marvelous to what ends such food can be turned. Had it been otherwise, had the camel required sustenance like that of deer and cow and antelope, human history would have been different.

We never could have crossed the deserts; the steppes would have been a barrier between Asia and Europe not to be passed. Solomon could not have built his temple at Jerusalem; the Phœnicians could never have got their wares to the coasts; during the Middle Ages tea, spices, the silk and satin and gems of the East could never have come to Europe had not camels on poverty's fare carried the burdens asked of them.

The camel serves in more ways than as a bearer of burdens. Milk from the females; flesh from the young and the old; ropes, tents, fine shawls and rugs and clothes from the hair—all these are derived from the animals. Hides and bones are also converted to human use. In time of war, a camel corps is more useful than horse cavalry in parts of Africa and India, and both British and French maintain camel units.

We shall need the camel for a long time. The desert parts of the world in which he is useful are not likely to have many railroads or motor roads soon, if indeed they are ever built, through some of the wastes. Airplanes, to be sure, are being used in the East for long trips, but a camel can go where airplanes can not land. No other means of transportation seems likely to replace the camel soon.

Yet, for all his wondrous mastery of a melancholy, forbidding land, the camel is not a native of the place in which we find him. The story of his origin and wanderings matches all the romance of his latter-day career in domestication.

Though fossil camel forms suggest that



© Ewing Galloway, N.Y.

Camels in the market place in a small town in Algeria. One is just rising from its kneeling position. In walking the camel lifts both right feet, then both left feet, and so on. This gives a peculiar rolling gait.

the Arabian camel may have arisen in India, the camel tribes began in North America. Many types of camels were found in the West, from the early beginnings until the coming of man.

THE FIRST CAMELS WERE ONLY ABOUT AS BIG AS FOXES

The first camels were about the size of a fox and had four toes on each foot, the side toes small and soon to disappear. From these long-extinct ancestors many kinds developed, some gazelle-like but others much larger than any still alive. The giraffe-camel was so called because it had a long neck and long legs, like the giraffe, and these features enabled it to feed on the tops of the trees. Just before men appeared on the scene, some of the camels went off into Asia while others wandered down the newly established bridge to South America. Then for some unknown reason the ones left behind in North America died out.

Fortunately those that picked their way along the untrodden mountains throve. They are there to this day. The South American llamas, alpacas and vicuñas are the only existing cousins of the camels.

First we have the wild vicuña, the smaller of two wild species. They are hillmen all. During the wet season of each year they keep to the higher ranges of the Cordilleras. They avoid sharp ridges and glaciers and feed in the meadows which these mountains clothe with a scanty herbage. With the coming of heat the mountain plants dry up. The vicuñas then descend from the heights in search of food.

Soft-footed like the Arabian camel, they are extremely agile in the places they choose for life and liberty. Though the tribe is renowned less for sagacity than toughness, they have the wit to set sentinels to guard the feeding herds.

The guanacos are the larger, heavier species, massing in herds five hundred in number in the mountains, or reveling in the bleak discomfort of the plains of Patagonia. The llama which the ancient Peruvians domesticated was taken from the guanacos. The alpaca is the smallest, bred entirely for its woolly, hairy fleece. But the big tamed guanaco was indeed a wonder.

THE LLAMA, PACK HORSE OF THE ANCIENT PERUVIANS

For when Columbus reached America there was not a horse on all the vast twinned continent, and no animals had been tamed except the wolf, trained into a friendly dog, and, in South America, this useful beast, the llama.

The llama was the pack horse, the hackney and the beast of burden. The mysterious Peruvians had added several remarkable features to their fantastic civilization. They had learned how to grow corn, coffee, cotton and cocoa; their weaving and pottery and gold-working were of a very high order; and above all, they had captured and done with the llama what the ancient East had done with the camel. The male llamas did the work and supplied flesh food; the females were kept for their milk; and, as we have seen, the alpacas were the fleece-bearers.

THE CLEVER INCAS AND THEIR HERDS OF LLAMAS

The Incas had done as well in the breeding and perfecting of these animals for their several qualities as the old mystery men of the past had done, a thousand years before, in persuading sheep to grow flowing wool.

The alpaca's long, fleecy coat makes finer, better wool than the llama wool. Wool from the vicuña is the softest of all. Unfortunately it is becoming rare, and little of it reaches the market to-day.

The types that we know to-day were already fixed, high tribute to the skill of these early geniuses. It is thought that they themselves established the breed of guanaco, the one for weight-carrying and milk, the other cultivated for wool, as we have cultivated the jungle fowl for eggs. Llamas are still used to carry burdens.

Such is the story of the camel tribe. The camel has been taken about the world like cattle. It helped to carry up the wire which fenced in Australian farms from the devouring rabbit, and on the return journey it brought down wool to the ports. It toils in Zanzibar and has served in Italy; it is a valued servant in the Canaries and works for carrier and cultivator in many an odd corner of the world. Automobile and airplane have conquered the deserts, but the camels are useful still.

AN AMERICAN EXPERIMENT WITH CAMELS, WHICH FAILED

Just before the Civil War the United States Government attempted to use camels to carry supplies across the deserts of Arizona and New Mexico. The war interrupted the experiment, and many of the animals escaped. For years hunters and prospectors saw them in the wilds, but it is believed that they have entirely died out.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 1717.

THE DAILY LIFE OF THE CAMEL



EARLY MORNING IN THE DESERT—AN ARAB FAMILY WARMS ITS HANDS WHILE THE CAMEL LOOKS ON



THE SHIP OF THE DESERT—AN ARAB LADY ALIGHTS FROM HER CAMEL



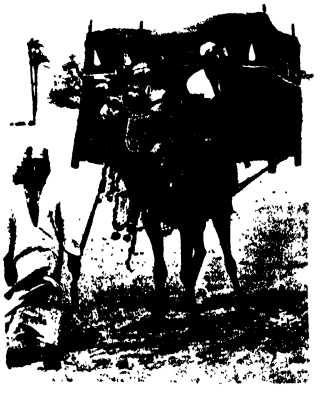
ON THE ROLLING SAND HILLS OF THE DESERT



AN ARAB CARAVAN ON THE MARCH



NEAR THE PYRAMIDS



THE ARAB'S HOME



A PRECIOUS CARGO

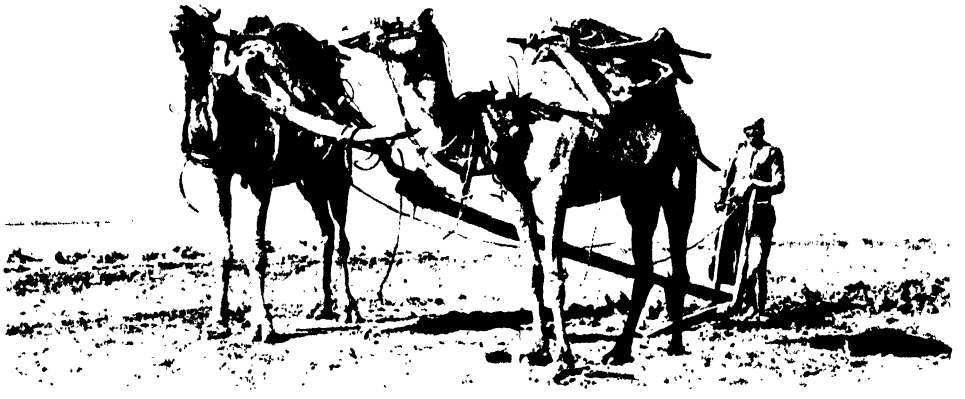
The middle picture at the bottom is copyrighted by Underwood & Underwood, New York



CAMELS LOADED WITH PALM-LEAF STALKS ON THEIR WAY TO MARKET



LADIES OF ALGERIA MOUNTED READY FOR A RIDE



PLOWING ON THE BANKS OF THE NILE WITH A CAMEL TEAM



THE GUANACO OF PATAGONIA



THE LLAMA OF SOUTH AMERICA



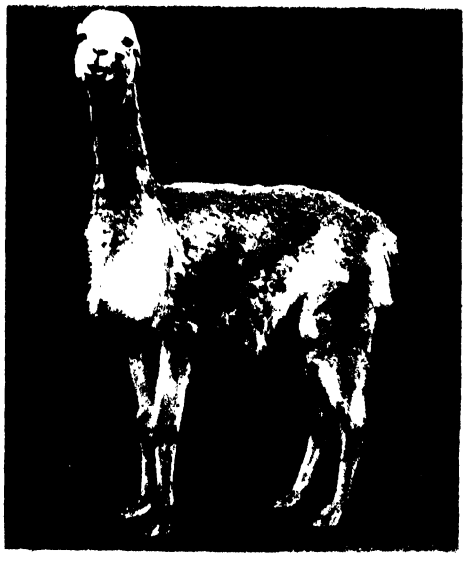
THE ARABIAN CAMEL



THE BACTRIAN CAMEL OF ASIA



THE ALPACA, OR PERUVIAN SHEEP



THE VICUNA OF THE CORDILLERAS



WHICH IS THE BIGGEST NATION?

CONSIDERED in terms of population, the largest nations in the world are made up of Asiatic peoples. The biggest of all is China, which has a population of about 500,000,000. There are also several million more Chinese in Mongolia, Siam, Malaya and the East Indies.

Next to China in population comes the peninsula of India, with about 400,000,000 people. However, India is divided into two nations, the Republic of India and the Dominion of Pakistan; and it has many different stocks and languages, though most of them are closely related. The figure that we have given includes all of the people of this huge sub-continent. China and the Indian peninsula together therefore have about 900,000,000 people, or about two-fifths of the entire population of the world. Though Japan's area is comparatively small, it accounts for about another 100,000,000 Asiatic people. Thus one continent, Asia, while it

is the largest, contains almost half the total population of the world.

Of what we call the white nations, Soviet Russia is the largest, with a population of about 200,000,000. Many of these people are Asiatics, more closely akin to the people of China and Manchuria than to the people of western Europe and the Americas.

Next after Soviet Russia comes the United States of America, with almost 150,000,000 people. The growth of this country has been more rapid than that of any other nation in the history of the world. In 1880 it had only about 50,000,000, so that the population actually increased about three times in less than three-quarters of a century. This is partly because millions of immigrants flocked from Europe across the Atlantic to earn a better living in a naturally rich country. More would probably do so now, but the United States has laws that limit the number of immigrants who may enter her ports in a year. These laws also make sure that those who do come in are of a type that will be most likely to make good citizens.

Before World War II, the third white nation in number was Germany. According to the census of 1939, it had a population of 79,000,000. This number, however, included the populations of several seized territories, principally Austria and part of Czechoslovakia. In 1946 the population of Germany was about 66,000,000.

The British Isles, including Great Britain and Northern Ireland, have a population of about 50,000,000. In addition to the white people in the British Isles, there are about 25,000,000 more white persons in the Commonwealth of Nations, including the French Canadians, and the South African Boers who are chiefly of Dutch descent. In the Commonwealth of Nations as a whole, therefore, there are about 75,000,000 white people. In addition to its white inhabitants, the Commonwealth has more than 425,000,000 people of other colors. This makes a total of more than 500,000,000. Thus, if we take the Commonwealth as a whole, its population rivals that of China and accounts for almost one in four of all the world's people.

Brazil, largely white, has more than 48,000,000. Next in Europe after the British Isles is Italy, with more than 45,000,000. France has more than 40,000,000. Poland has about 24,000,000 people today. In 1947 the population of Czechoslovakia was more than 12,000,000. Spain has about 27,000,000; and Rumania, about 22,000,000.

IS THE POPULATION OF THE WORLD STILL GROWING?

Not only is the world's population still growing, but its people are increasing in number at a very rapid rate. It is not possible to state exactly what that rate is, for it varies considerably from time to time; but there is no doubt that the world is advancing to a much larger population.

Not all countries conduct a census, as we call the official counting of a people, but most of them do. If we take the official census figures (census is Latin for "register") and add to them reasonable estimates for remote districts of Africa, where reliable counts are not made, we find that the world as a whole has almost 2,200,000,000 people.

These 2,200,000,000 are very unequally divided among the five continents. The biggest continent is Asia, which has about 1,208,000,000. Next comes Europe with 522,000,000. America (North, South and Central America together) has about 275,000,000. Africa's people may be roundly estimated at 158,000,000. Australasia and Oceania, including Australia, New Zealand and the various islands of the South Seas, contain about 11,000,000 people. The sum of these figures is 2,174,000,000 for the world.

The great fertile areas of North America, South America, Africa, Russia and Australia could accommodate and support thousands of millions of people. Indeed, until these places are better populated and developed, the world as a whole will not make the best use of its resources. It is therefore very important to know that the world is still growing and that it has grown since 1800 from 700,000,000 to almost 2,200,000,000 in spite of wars and other calamities.

This tremendous growth has alarmed some people. They fear that it may soon outrun the earth's capacity to produce food. Others are just as convinced that science will come to the rescue. What is more, the oceans' food resources have hardly been tapped.

WHY IS THE TONGUE OF A MOTH SO LONG?

The tongues of some moths and butterflies are as long as their bodies. This is a wonderful adaptation of nature, enabling the insect to obtain its food.

The nectar, which is the food of these butterflies and moths, is produced in the deep, hidden pockets (nectaries) of flowers. By unrolling the tongue and thrusting it down into the far recesses of the flower, the

insect is able to reach the nectar and suck it up.

This long tube has been developed in the course of ages from the jaws of the creature. Each jaw is drawn out into a long threadlike body, convex on the outer surface and concave on the inner side. Together they form a tube admirably suited for their purpose, and even the nectar in the very long, narrow bells of some flowers is within reach of the long tongue.

When at rest the tongue is coiled up spirally like the mainspring of a watch, but it is always ready and can be shot out in an instant.

The adaptation of the insect to the flower also works the other way, and in the course of ages the flower has been adapting its form to the creature with the long tongue; for, while it gives up nectar to the insect, it requires a service in return. It is by these insects that the plant is pollinated to produce seeds that will carry on the race for another generation.

In seeking the nectar the insect collects upon its body pollen from the stamens of one flower, and when it goes to another flower the pollen is rubbed off on the pistil, so fertilizing it.

WHY DO THE BRANCHES OF TREES GROW SIDEWAYS?

Our best way of understanding why the living plant we call a tree behaves as it does is to find what use the branches have. They bear the leaves by which the tree breathes, and by which it also feeds on the carbon dioxide in the air under the influence of sunlight. It is the tree's business to grow its branches in such a way that the leaves will be exposed to the sunlight as fully as possible, and so that the branches may provide as many leaves as possible. The branches therefore grow fairly equally on every side, and in growing sideways all round they are thus best arranged to expose the leaves to the sun's rays.

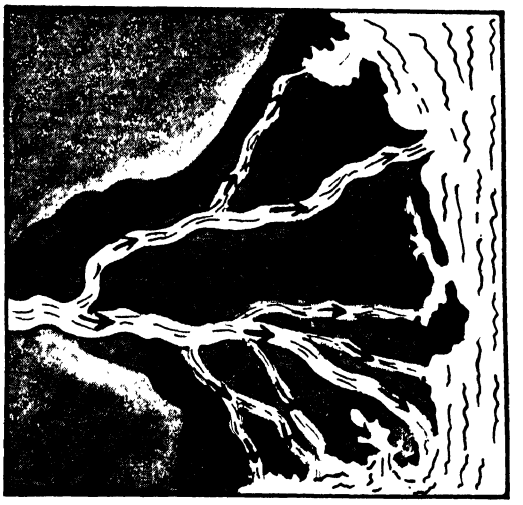
HOW FAST IS A FISH ABLE TO SWIM?

Very few investigations have been made to decide this question, but a Belgian observer timed a number of salmon and concluded that they can swim a short way at the rate of about ten yards a second, or about as fast as a good sprinter can run. An American observer found that a fish called the alewife can swim at about the same rate as the swift salmon.

It is probable, however, that many fish can swim much faster than these figures show. Sharks often accompany swift steamers for days, and even porpoises can keep up with a liner for a long time.

WHAT IS A DELTA AND HOW IS IT MADE?

If we look at a map of Egypt, we shall find the Nile, which is a very good example of a river with a delta at its mouth; and we



shall notice how the river, when it meets the sea, spreads out into a shape something like a triangle. Now that is the shape of the Greek capital letter D, the name for which is *delta;* and so land of this shape and origin made at the mouth of some rivers is called a river delta.

A river consists of moving water, and the motion of the water rubs away from the bed and the banks of the river a large quantity of solid material. This is not melted or dissolved in the river water, but is carried down by it. When the river water meets the sea, its pace slackens, because it is opposed by the force of the sea water. The solid matter held in the river water is likely to sink and form a wide bed or bank of mud.

Deltas are nearly always found at the mouths of rivers that flow into lakes or enclosed seas or sheltered gulfs, because these seas and lakes do not have strong currents or tides to carry away the solid matter. Deltas grow quite fast. The Mississippi River is depositing so much solid matter (sediment) at its mouth that the shore line is moving into the Gulf of Mexico a mile in about sixteen years.

WHAT WORK DID THE LEAGUE OF NATIONS DO?

The League or Nations was an association of countries intended to bring about world peace and co-operation. It was formed in 1920, following the first World War.

Although the United States did not belong to the League, the plan for it was originated by President Wilson, who thought the world was civilized enough to find some other method of settling disputes besides war. When the League was finally established, the United States preferred not to join, fearing that to do so might involve the country in the affairs of foreign nations.

Beginning with forty-two nations, the membership reached its peak in 1935, with sixty. After that time membership in the League steadily declined. World War II dealt it a staggering blow. Only one League organization survived — the International Labor Office, or ILO, which is now a part of the United Nations.

Although the League of Nations is now a relic of the past, it did many good things. When a dispute between Finland and Sweden threatened to destroy the peace of Europe, the League intervened. It made peace in a disagreement between Italy and Greece, and later between Bulgaria and Greece, and between Great Britain and Turkey who were quarreling about Mosul and Iraq. When the murder of King Alexander of Yugoslavia nearly provoked war between that country and Hungary, the League prevented hostilities.

It did much toward the suppression of the sale of opium; fostered better health laws; improved labor conditions; and helped rebuild the finances of various poverty-stricken countries.

Some of the most valuable work of the League before 1939 was in collecting and telling the world facts on plagues and epidemics. If customs officials knew that a certain plague was spreading in a district, they could take steps to see that the disease was not carried across the borders.

The United Nations, formed at the close of World War II, hopes to succeed where the League failed, and to build a peace that will last. See the Index for the article on the United Nations.

WHAT IS A DICTATOR?

In the ancient Roman Republic, two men, the consuls, stood at the head of the state. The Romans thought that one man should not have too much power and that two men were wiser than one.

This worked very well in peacetime, but when war or other emergencies arose, decisions had to be made quickly and there was no time for the two consuls to argue. In such times the Romans appointed one man to whom they gave all the power. He was called *dictator,* which really means "the one who says."

In later times dictator came to mean any man who became the supreme ruler of a country. Today especially we think of a dictator as one who sets aside democratic government to rule as he wishes. Adolf Hitler was a modern dictator.

WHAT IS MEANT BY A TOTALITARIAN STATE

The word "state" is used in many different ways. Sometimes it means a division of a nation. Sometimes it is used to mean the territory, sometimes the people living in it, and sometimes the government of a country. In democratic nations the state is usually taken to mean all of these, namely a fixed area inhabited by people who choose certain of their number to make and administer the laws. The purpose of the state is to advance the general welfare and to protect the individual from those who would interfere with his rights.

A different idea of the state grew up in some countries of Europe after World War I. In these countries the state is thought to be over and above the citizens. It regulates every department of life—business, labor, religion, education and art. The individual citizen has no rights against the state. Only one political party is allowed to exist and the legislature has little or no power. A few men at the head have almost absolute authority. The nazi government of Germany was an extreme example of this idea, which is called a totalitarian state. The theory of the Russian state is different, but in actual practice it is also totalitarian.

WHAT IS THE ATLANTIC PACT?

The Atlantic Pact is a treaty among a number of countries in western Europe and North America, most of which border on the Atlantic Ocean. The chief purpose of the Pact is for defense. If any one of the countries signing the treaty were attacked, the other signers would regard it as an attack against them all. In signing the Pact, each country promises to take whatever action

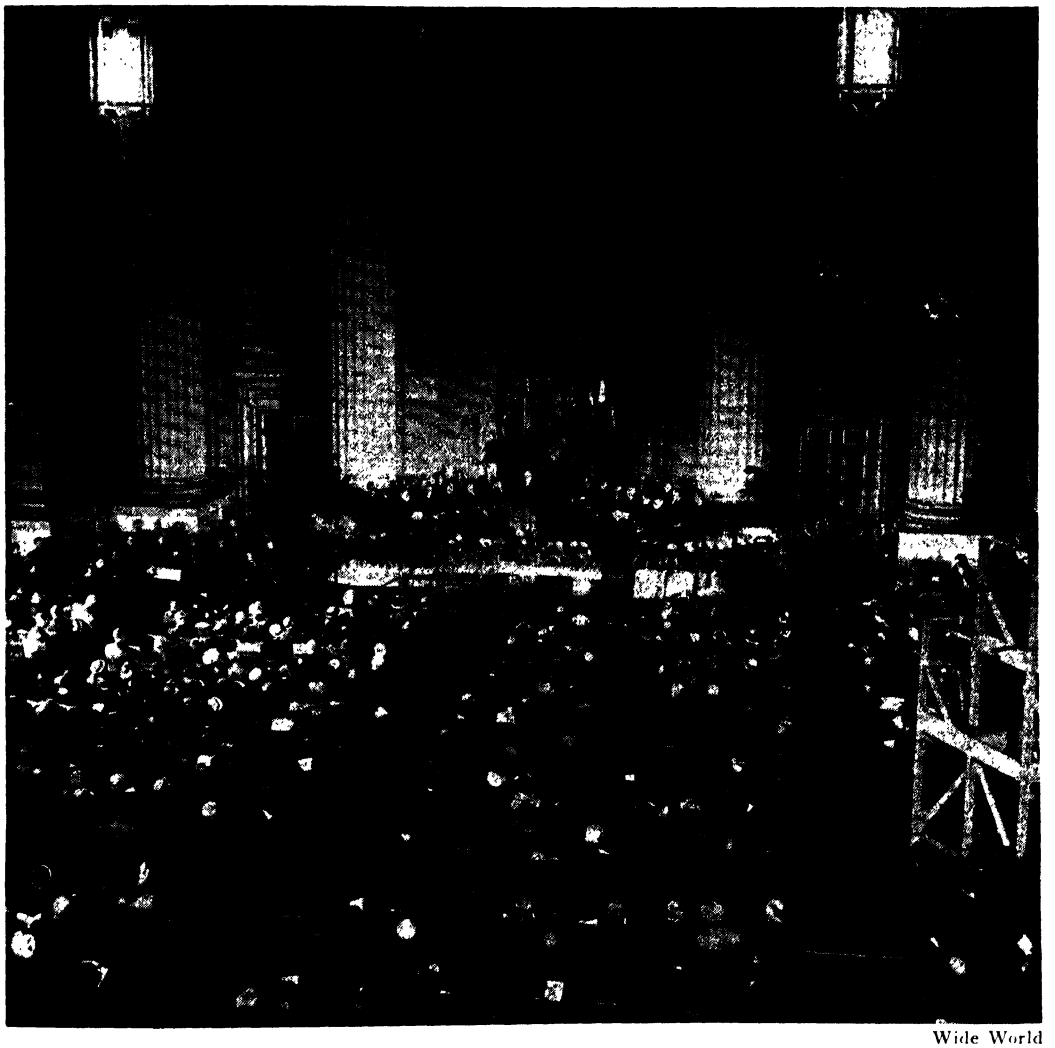
it thinks necessary, even military action, to help another member of the alliance defend itself.

This idea was brought forward by Louis St. Laurent, then External Affairs Minister of Canada, in September 1948. Not long after, such a plan was discussed by representatives of the United States, Canada Belgium, the Netherlands and Luxemburg. In his inaugural address of January 20, 1949, President Truman strongly endorsed the plan.

The terms of the treaty were worked out in March, and on April 4, 1949, it was signed by the foreign ministers of twelve countries: Belgium, Canada, Denmark, France, Iceland, Italy, Luxemburg, the Netherlands, Norway, Portugal, the United Kingdom and the United States. The Pact was to go into effect when it was ratified (approved) by the United States Senate and the parliaments of Great Britain, Canada, France, Belgium, the Netherlands and Luxemburg.

The Atlantic Pact marks a great change in the foreign policy of the United States, away from the old line of "no foreign entanglements." By agreeing to the Pact, the United States might go to war on behalf of another country. However, under the Constitution, only Congress has the power to declare war. So Congress would have to decide at the time when such action was "necessary."

THE NEXT WONDER QUESTIONS ARE ON PAGE 1637.



Wide World

A milestone in history—the signing of the Atlantic Pact in the hall of the United States Department of State.

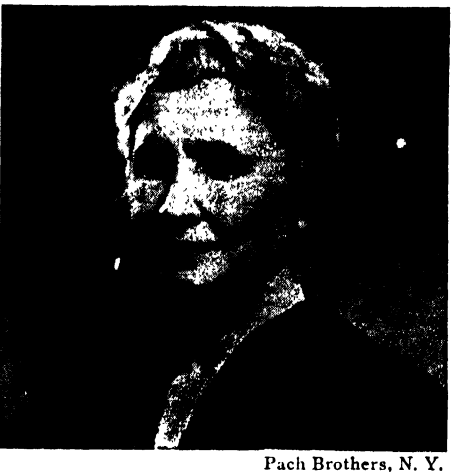
THE MAID OF ORLEANS



Joan of Arc, at the height of her victories, clad in beautiful armor and bearing a sword and the sacred banner. Born into a humble home and uneducated, she yet won great triumphs for France on the battlefield.



General Electric Co.



Pach Brothers, N. Y.

Handicaps did not stop these two: Charles Steinmetz, the wizard electrician; and the invincible Helen Keller.

SOME WHO CLIMBED THE UPHILL ROAD

SUPPOSE you were asked to write a character sketch about the boy or girl you admired most. Whom would you choose to describe? Probably a boy or girl who has earned your admiration through some act of pluck, or courage.

Suppose you were asked to name the most likable character in literature? It would never be a coward. The most famous names in history belong to men and women who differed in many respects, but they all shared one shining quality—courage.

Joan of Arc was a simple, uneducated peasant girl, yet her courage saved France. Helen Keller's magnificent courage has carried her over the greatest obstacles any human being could face, for she is both blind and deaf. We are told that Homer also was blind and the Aesop was a slave, yet they left works that for more than 2,500 years have charmed the world. Socrates made his wisdom shine like a torch down the ages, though he was a poor workman, so ugly and deformed that he was the butt of half the jokes in Athens while he lived, and though he was put to death in prison.

In other chapters of THE BOOK OF KNOWLEDGE we tell you about most of these people. You will find their names in the Index. Here are stories of some other men and women from history's honor roll who battled with misfortune, and won.

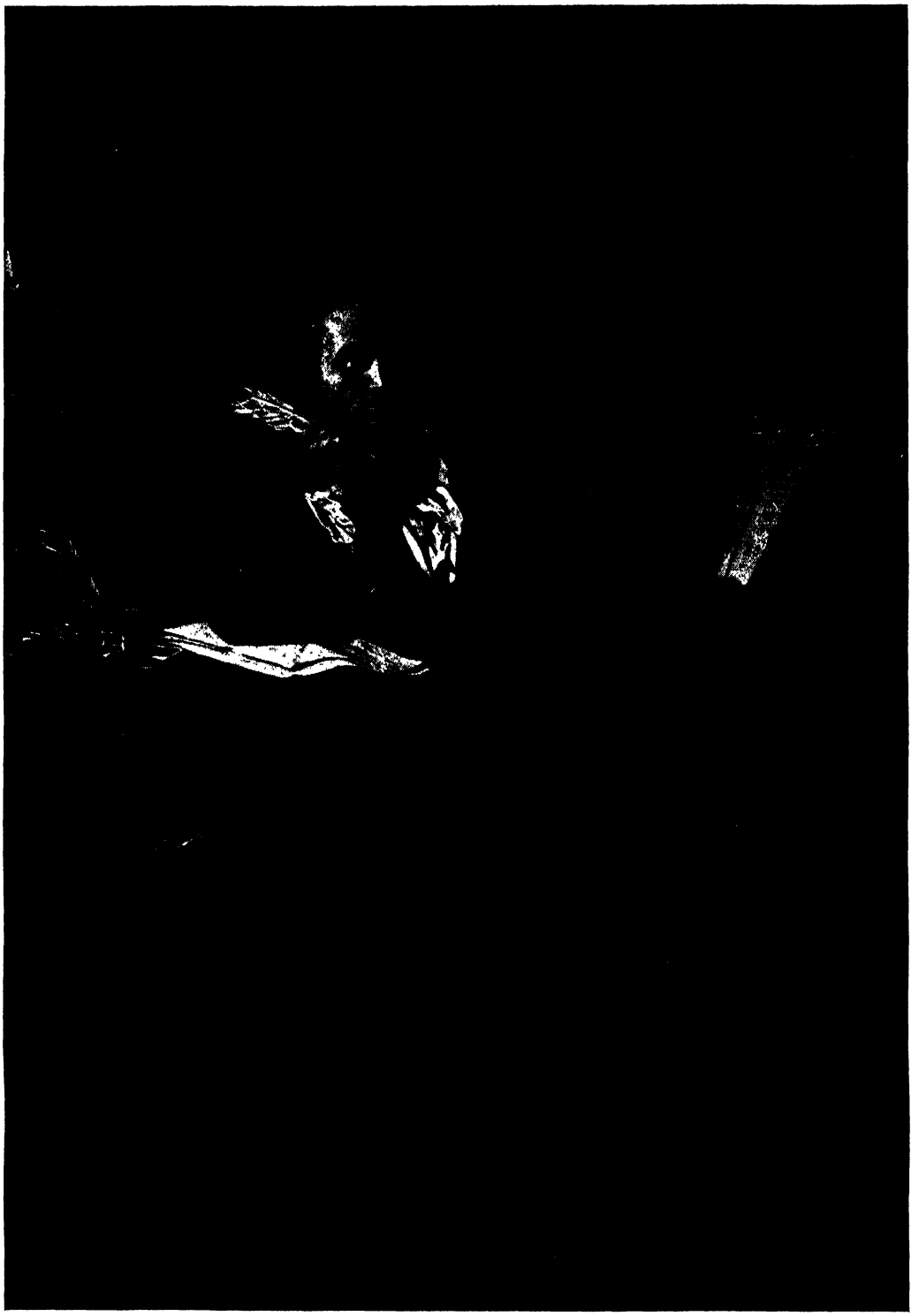
In 385 (or perhaps 384) B. C. there was born to a well-to-do family in Athens a boy who was called Demosthenes. He was not a strong child; his lungs and his vocal cords were weak, and he developed defects of speech that aroused laughter and scorn in all his playmates. His voice was high and shrill, and he could not pronounce the letter "r." From nervousness, and lack of confidence, he began to stammer, and before long he could not speak at all without stammering.

Demosthenes' father died when the boy was still in his teens, leaving a small fortune for the lad, in the care of some friends. The friends proved to be greedy and unworthy of the trust. When he was only seventeen years old, Demosthenes determined to bring these dishonest guardians into court, and force them to give up the money they had stolen.

He wanted to prove that he was quite able to care for his own affairs, so he intended to be his own lawyer in the case. He had studied rhetoric under one of the great teachers of Athens, and in spite of all his handicaps he was able to win the verdict against those who had conspired to defraud him. Yet he made a sorry figure in the courtroom. He was ridiculed for his confused thought, his disjointed sentences, his indistinct utterance. He himself realized that much of the criticism was deserved; if he was to make a career of law, much study and work lay ahead.

He set himself the double task of training his mind and learning to speak with

GREAT HARMONIES SING BEHIND LOCKED EARS



Beethoven's genius and will were so powerful that he wrote some of his loveliest music after he became deaf.

SIR HENRY IRVING AS SHYLOCK



The T. F. Healy Collection

Perhaps because he himself had been reviled, Irving made Shakespeare's Shylock a more dignified, human character.

persuasive force. For the first part of the task he sought out the best teachers of the day. Some say that Isocrates and Plato were among those who instructed him. We must remember that Demosthenes was still scarcely more than a boy. He loved fun, and it was hard for him to stay at his books when others of his age were enjoying the easy-going life of the city. To force himself to stay at home, he used to shave one side of his head, so that he would be ashamed to go out on the street.



Culver Service

Robert Cecil, first Earl of Salisbury. Though he was a hunchback, he became one of Queen Elizabeth's most trusted advisers. After her death he continued in favor under James I.

He chose as master of Greek style the historian Thucydides. Eight times he copied the history, until he had learned from it how to weave words together to bring out his meaning. He went further than his master. The speeches he composed, during his public career, are held before us even today as models of eloquence. His enemies said they "smelled of the lamp," meaning that they showed the effort of laborious composition. But that remark was caused by jealousy.

For aid in overcoming his stammer Demosthenes went to the actor Satyrus, who advised him to practice reciting with pebbles in his mouth, while walking outdoors in steep and rough places. To strengthen his lungs and vocal cords, so that his voice would become deeper, more resonant and under better control, Satyrus advised the youth to walk up and down along the seashore, making himself heard above the waves when they were noisiest. Demosthenes followed the actor's advice and in time became the most brilliant orator of his day. The great Roman orator Cicero, who lived nearly three hundred years later, said that Demosthenes was the greatest of all—"the perfect one." Plutarch said he excelled his rivals "in judicial pleading and majestic utterance."

Because his speeches were always serious, rivals sometimes referred to Demosthenes as an ill-natured fellow. But he was generous to his critics and modest about his success, saying that he owed much to the good will of those who listened to him. His rivals were also jealous because at times he made a good deal of money; they said he was not above writing speeches for other lawyers who would pay him enough. Once it was rumored that he wrote the speeches for two adversaries in a court action. If this is true, how he must have chuckled as he listened to them delivering his words, first on one side, then on the other—like a man playing chess with himself.

Demosthenes became something more than a great and persuasive lawyer. He was an ardent patriot, and with all his strength he fought for the freedom of Athens. Philip, king of Macedon, a land to the north, had ambitions to bring all of Greece under his rule. Demosthenes tried to arouse the Athenians to be on their guard against the danger; he tried to persuade the other Grecian states to drop their petty quarrels and unite for safety's sake. Time and again he thundered against Philip, and stormy accusations to this day are called Philippics.

Too late, the Athenians, Thebans and Boeotians stirred themselves, and gathered a weak army which met the tough soldiers of Philip at Cheronea. The Greeks were defeated. Nevertheless the Athenians were grateful to Demosthenes for his efforts to save them. It was proposed by Ctesiphon that Demosthenes be awarded a golden crown. Aeschines, a lifelong enemy of the orator, charged that the suggestion was illegal. The case was brought to court. Demosthenes defended Ctesiphon, and his oration *De Corona* (On the Crown) was a review of his own life and his work for Athens. He won the crown, and Aeschines was exiled.

Demosthenes was about fifty-five years old at this time. The remaining years of his life were sad, for Athens suffered under the

rule of the Macedonians, Philip and Alexander the Great. Demosthenes died in 322 B. C., on the island of Calauria. He did more than inspire the Athenians with dreams of freedom—he gave his ideals to all the world; and he showed how a man can wrestle with adverse fate, and win the victory, for later ages to honor.

Another man who made a success in public life in spite of ridicule was the famous English actor, Henry Irving (1838-1905). His real name was John Henry Brodribb. He was a country boy, but he went to London to find work and served for a while as clerk. He fell in love with the stage and set his heart upon a career in the theater, though his comical sounding name was against him (well, he changed that); he had no training for the stage (he could manage to get that as he went along); his countrified accent was a very big drawback, and he never quite overcame that. The worst drawback of all was that he lacked the heroic appearance that is expected of an actor. For one thing, he was not a very tall man.

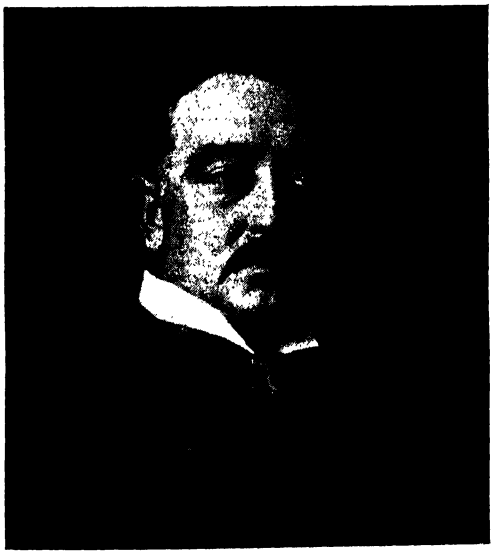


Culver Service

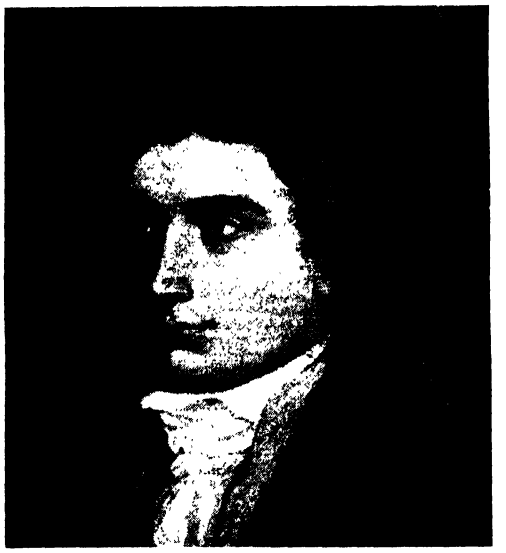
Blind almost from birth, Louis Braille invented the printing method by which the blind can read books and musical notation with their fingers.

He appeared for the first time in a play in Sunderland, a small English town. A friendly critic advised him to take the next train back to London, and to give up all thought of a stage career. Undaunted, he went to Edinburgh, where he stayed for two years, and played 429 different parts in 782 days.

He went then to Dublin, to replace an actor who had been dismissed. The play lovers who thronged the gallery of the theater felt that the man had been dismissed unfairly. They greeted young Brodribb with hissing and booing and catcalls whenever he appeared before the footlights; and they kept up this ungenerous reception for three weeks. Irving wrote later that night after night he had to fight through his part "in the teeth of a theater whose whole energies seemed to be concentrated in

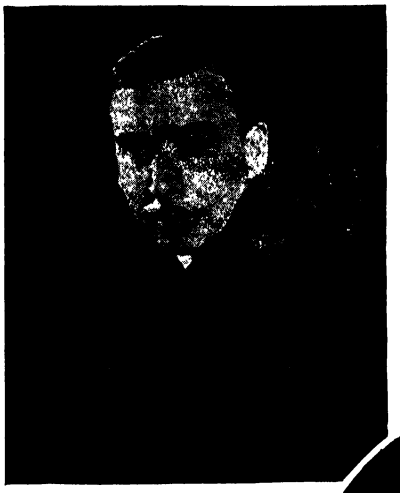


Cecil Rhodes, ill as a youth, found health in the dry air of the South African veldt, and was a pioneer in developing the rich resources of the country.



John Keats was an English poet who died in 1821, when he was only twenty-five years old. Through years of illness he produced some of the world's finest poetry.

GOOD FIGHTERS ALL



For years Booth Tarkington suffered from failing eyesight. Yet novels and stories continued to pour from his pen.

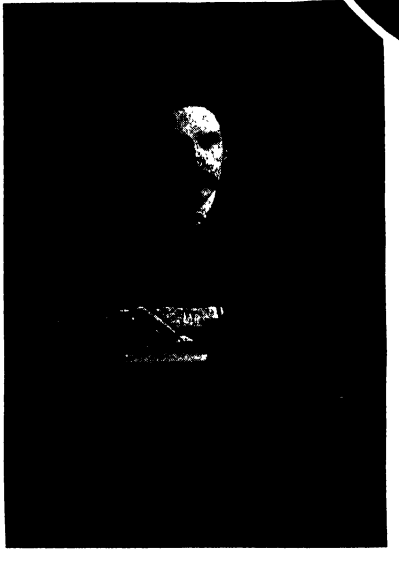
Hobart College, Geneva, N. Y.

Elizabeth Blackwell, first woman doctor in the United States. In her day very few careers were open to women, and she had to fight for her education.



Francis Parkman wrote his fine histories under the double handicaps of near-blindness and general ill health.





All children are indebted to the gentle Robert Louis Stevenson, who, though often ill, gave them gay poetry and adventurous tales.

Columbia Broadcasting System

The beloved songwriter, Irving Berlin, who has risen to fame from humble beginnings and without a musical education.



HANDICAPS WERE ONLY A CHALLENGE



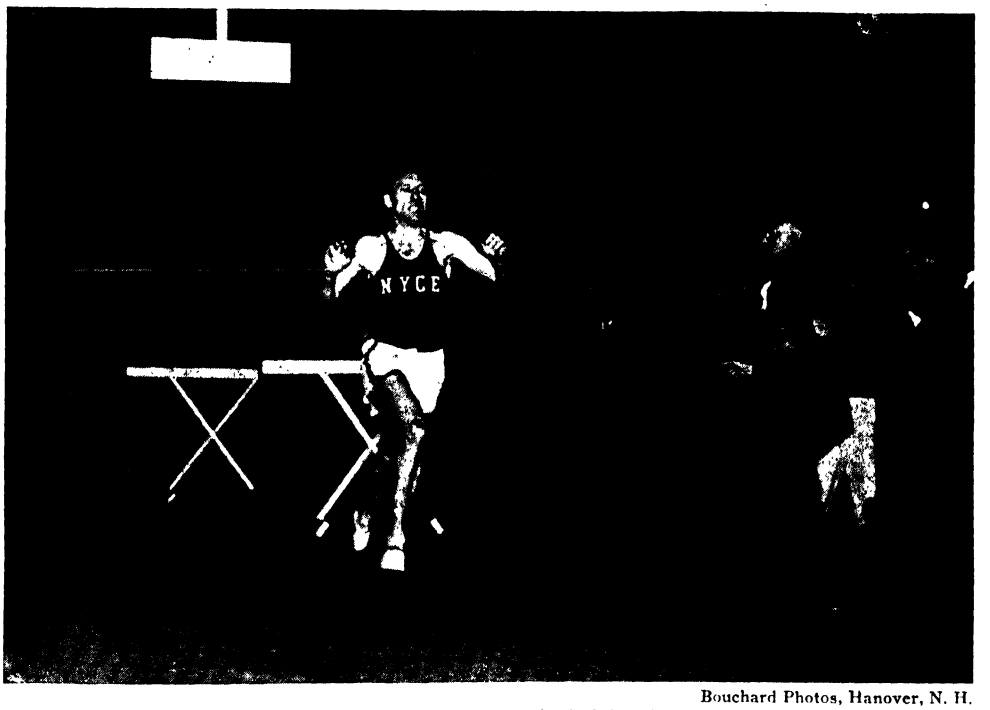
Courtesy, Metropolitan Opera

Marjorie Lawrence, the gifted soprano, was stricken with infantile paralysis. Miss Lawrence has persevered until now she can stand up during her concerts.



Courtesy, USO Camp Shows

Though crippled as the result of a plane crash early in the war, the popular singer Jane Froman continued her good work of bringing cheer to the soldiers abroad.



Bouchard Photos, Hanover, N. H.

It is hard to believe that Glenn Cunningham ever had any physical handicap. Yet it is true. His legs were badly burned when he was a child. He is shown here, at Dartmouth College in 1938, when he ran a mile faster than had ever been done before. His many track triumphs have won him the nickname of Old Man Mile.



International News

Franklin D. Roosevelt brought hope and cheer to all who were crippled, as he was, from infantile paralysis. He was stricken as a young man, before his political career was fully launched.

a personal antipathy to myself." In time the hissing and hooting stopped; but the ordeal had been one that few spirits could have endured.

Brodribb changed his name to the more dignified one of Henry Irving. He played in London, Manchester and other cities, though much of the time it was not "playing" but "working" that filled his nights on the stage—working, learning, perfecting himself in his craft.

When he was twenty-eight he turned once more to London, and the great city became his home for the rest of his life, though he made many a tour to other towns in England and abroad. He was the greatest actor of his day, and one of the greatest of all time. He was knighted in 1895, the first actor to receive this honor. Many universities awarded him honorary degrees; and when he died he was buried in Westminster Abbey.



NBC photo

Alec Templeton has been blind from birth. He loved music; and by pluck and effort he acquired a fine musical education. Perhaps you have heard him on the radio.

Glenn Cunningham was a Kansas boy. When he was eight years old there was a fire in his school, and both Glenn's legs were badly burned. Doctors promised that he would recover, but warned the child that he must run every day, to encourage circulation in his legs. This he did, and as the years went by he won contest after contest on the track. He was on the Olympic Team in 1932. In 1938, at Dartmouth, he traveled faster on his feet than man had ever done before, doing the mile in 4:04.4. This was not allowed as an official record, because of the nature of the track. Because of his many victories, Cunningham came to be known as Old Man Mile. He won seventeen out of twenty-four races for the Wanamaker, Baxter and Columbia trophies.

Alfred E. Smith (1873-1944) and Irving Berlin (1888-) grew up in New York's poverty-stricken lower East Side, when that section was very poor indeed, yet Alfred Smith became a leader of his people, and Irving Berlin gave songs to millions. Beethoven composed great music when he was completely deaf. Frances Brown wrote fairy stories that charm the children of many nations, though she was blind. Franklin D. Roosevelt, Charles Steinmetz, Cecil Rhodes, Robert Louis Stevenson, John Keats were others who achieved greatness against physical odds. How many more can you name who have climbed the steep uphill path? Perhaps you know someone in your own town, or even in your own home, who has been a living legend of courage.

By MORDAUNT HALL.

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 1895.



From an old print

The Old Testament Tower of Babel. For their pride in trying to build a tower that would reach up to heaven, the tribes of men were scattered; and they no longer had one language but spoke in many strange tongues.

A UNIVERSAL LANGUAGE

PRESENT-DAY inventions—the airplane, the radio and the wireless telephone, among others—have brought all the nations of the world very close together. In language, however, they are as far apart as ever. There are almost 3,000 languages in the world, and their existence has set up many barriers between countries.

Scientific progress is sometimes slowed up because discoveries are announced in languages that many scientists do not understand. Free discussion at meetings of international groups is often impossible because there is no one language that all can speak and understand. Business men and tourists in a foreign land sometimes get into trouble because they do not know the language of the country.

All these difficulties would disappear as if by magic if there were only an universal language—that is, a language known by all the peoples of the earth. There has never been a really universal language in the long history of mankind, though certain languages have played a very important part at one period or another.

There was a time, a few centuries before the birth of Christ, when the use of Greek was widespread. The Greeks traded with many different peoples and the knowledge of Greek increased from one generation to the next. Finally, in the fourth century B.C., Alexander the Great of Macedon, allied to the Greeks in blood and language, set out to conquer the world. His troops spread over Asia Minor, Egypt and Persia, and the Greek language followed in his footsteps. But Alexander died at an early age in 323 B.C. and his empire soon fell to pieces. The Greek language was still very influential for several centuries in the Western world. Then it had to yield first place to Latin, the language of the Romans.

As was the case with Greek, Latin seemed

destined to rule the world. Under the Republic at first, then under the Empire, Roman arms conquered one native people after another and the Latin tongue was introduced everywhere. However, after reaching its greatest power in the second century A.D., the Empire began to crumble. In the fourth century A.D., it was divided into two parts—the Western and the Eastern Empires. The Western Empire fell, in the following century, under the constant attacks of the barbarians of northern Europe. The Eastern Empire, which survived for many centuries, came to adopt Greek as its official language.

HOW LATIN BROKE UP INTO A NUMBER OF NEW LANGUAGES

When the Western Empire fell, Latin lost its hold in many regions that had formerly been under the rule of Rome. Even in the lands where the language continued to be used, the Latin spoken by the people gradually broke up into a number of different dialects. In the course of time some of these dialects developed into new languages —Italian, French, Spanish and so on.

The Latin language continued to be used by learned men in many countries of Europe, even after the people had come to speak a different language. In the Middle Ages Latin had a brilliant revival. It was the language of the Christian Church, which was then supreme in western Europe. It was the language of diplomacy, used in all the courts of Europe. It was the language of universities; almost all learned works were in Latin. Most educated Europeans knew Latin as well as they knew their own tongue.

In the centuries that followed the Middle Ages, Latin gradually lost its privileged position. It is still the official language of the Catholic Church; it is still taught in schools and universities. However, outside of the Church, few persons use Latin as a living tongue. A considerable number of educated men can read Latin more or less well; only a handful can speak it fluently.

Two languages have been particularly influential in modern times—French and English. French, which had been popular in the Middle Ages, became very important in the second half of the seventeenth century. At that time France was the most powerful state of Europe. It had the most brilliant monarch, Louis XIV. It had the most famous court, at Versailles. Its literature was known and admired by all Europe.

French remained the leading language of western Europe throughout most of the eighteenth century. It lost some ground following the French Revolution of 1789, and the lost ground has never been completely recovered. Still French is used widely even at the present day as the language of diplomacy, and also in international meetings of various kinds.

The world-wide importance of English dates from about the beginning of the nineteenth century. The astonishing growth of the British Empire and of the United States, another English-speaking nation, has resulted in the spread of English throughout a good deal of the civilized world.

Greek, Latin, French, English—each of these languages has been particularly important at one time or another. Yet not one of them has been truly universal. In the days of its greatest influence, Greek was spoken chiefly in the Mediterranean regions. The use of Latin was more general, but the language was not universal even in the ancient world—and we must remember that much of the world was unknown to the ancients. None of the important modern languages—French, English, Chinese, Russian, Spanish and so on—can claim to be universal.

Yet is should not be beyond the power of man to establish a universal language. He has perfected ships, railroads, automobiles, airplanes, the telegraph, the telephone and the radio. Certainly it should not be more difficult to find some universal language that all men will speak and understand.

SOME OF THE ATTEMPTS TO CREATE A NEW "READY-MADE LANGUAGE"

Some people have tried to solve the problem by inventing a new language. In practically every case the inventors of artificial languages have had no idea of doing away with existing natural languages. What they have had in mind has been an auxiliary language—that is, one that would stand side by side with existing tongues.

The first efforts to create an artificial language go back to the seventeenth century. Most of the earlier artificial languages had no connection with any existing tongue. Ideas were represented by figures and letters and were arranged according to a certain classification. Therefore, languages of this type came to be known as classification languages. Not one of them has been successful. Delormel, Vidal, Sotos Ochando, Lingualumina and the rest are now only names.

In 1817 the Frenchman François Sudre invented a language of a different kind. He had observed that the notes of the scale—

do, re, mi, fa, sol, la, si—were used by all the nations of Europe as well as by the New World countries that had been settled by Europeans. He therefore used the seven notes of the scale as the alphabet of his universal language, which he called, appropriately enough, Solresol. *Dore do milasi, sisol* is not a series of notes of the scale. It is a Solresol sentence, meaning "I do not love you, madame."

This interesting language could be used in seven different ways. (1) It could be spoken. (2) It could be sung. (3) It could be written as music. (4) It could be expressed by colors. (5) It could be spelled out on the fingers. (6) It could be indicated by short-hand signs. (7) The first seven numbers could be substituted for the notes of the scale. The alphabet of Solresol was promising, indeed, but the language itself was put together in a rather silly way and it proved to be monotonous and difficult. Interest in it soon died.

THE STORY OF VOLAPÜK, THE FIRST IMPORTANT ARTIFICIAL LANGUAGE

The first really important artificial language was Volapük, invented by Father Johann Martin Schleyer, a learned Catholic priest of Germany. In creating Volapük, Father Schleyer took his word-roots from existing European languages, including English. He so changed these roots, however, that most of them could not be recognized in the new language. Would you ever imagine, for example, that Volapük was originally the English "World-speech"?

Volapük was odd in other ways. For instance, to indicate different meanings, Father Schleyer changed the forms of his words right and left. The word *löf*, meaning to love, had more than 500,000 different forms! Volapük was a very unsatisfactory sort of artificial language. It was unscientific; it was ugly; for most people it was very difficut. Yet it was highly successful. It was first presented to the world in 1880. By the year 1889 there were Volapük clubs all over the world, with an army of supporters, whose number was estimated at almost a million.

This success did not last very long. An academy had been formed to promote the study of Volapük. The members of this academy recognized the defects of the language and proposed that certain changes should be made. But Father Schleyer held that Volapük was his personal property and he refused to let anybody tamper with it. The learned members of the academy, in disgust, dropped Volapük altogether and took up other artificial languages. Volapük dropped steadily in popularity and it has now practically ceased to exist.

ESPERANTO, THE INTERNATIONAL LANGUAGE OF DOCTOR HOPEFUL

In 1887, while Volapük was still very popular, a young Russian Jew, Dr. Louis Lazurus Zamenhof, published a pamphlet in which he described his new artificial language. He called this language the *Lingvo Internaciona de la Doctoro Esperanto*, or the International Language of Doctor Hopeful. This language came to be known as Esperanto.

Esperanto was much more sensibly constructed than Volapük. It was far more harmonious and much easier. Its grammar could be mastered by the average student in half an hour. Its word-forms were much less complicated than those of Volapük. As for its word-roots, they were taken in general from the Romance Languages—that is, those derived from Latin. (French, Italian, Spanish and Portuguese are all Romance languages.)

At first the progress of Esperanto was slow. After about 1900, however, Esperanto became prominent and thereafter it spread rapidly. World War I held back its development for a time. A revival took place after the war, however, and Esperanto won greater recognition than ever before.

The League of Nations published a favorable report on the use of Esperanto as an international auxiliary language. The London City Council and the Paris Chamber of Commerce took up the teaching of the language in commercial schools. It was used as an additional language in international congresses. It was even used in the programs of certain European broadcasting stations. The progress of the language was furthered by the Universal Esperanto Association, with members in many different countries.

The future of Esperanto seemed bright. The language lost ground, however, in the troubled days that preceded World War II, and the outbreak of the war was a terrible blow to it. You see, a would-be universal language, like Esperanto, can flourish only when nations are at peace and want to meet on terms of friendship. It can not hope to make progress when all but a few nations of the world are grimly determined to crush their foes.

Esperanto has been without question the most successful of the artificial languages, but it has had its rivals. Some of these



Courtesy, Inter-Allied Information Centre

A Czechoslovak officer studying Basic English, which contains only 850 words. These are said to be all a foreigner needs to make himself understood.

rivals have been derived from Esperanto itself. The most prominent is Ido, which means offspring in Esperanto. Ido has greatly simplified the grammar of Esperanto and has changed some of the word-endings. Other offshoots of Esperanto include Antido, Nov-Esperanto and Latin Esperanto.

The great Danish student of languages, Otto Jespersen, invented an artificial language that he called Novial. This consisted of a mixture of the Germanic languages, like German and English, and the Romance languages like French and Spanish. Novial is perhaps the most scientific of all artificial languages, but it has never had a wide circle of followers.

In certain cases attempts have been made to create a universal language by simplifying an existing one. Latin, for example, has been simplified to form what is called Latino sine Flexione—that is, Latin Without Inflection or Simplified Latin. This language was invented by a learned Italian mathematician, Professor Peano. In Latino sine Flexione the complicated rules of Latin grammar have been greatly simplified. The word-roots have been taken from Latin, but only from such Latin words as have come down in one or the other of the European languages. Latino sine Flexione has its good points, but it has not gone far.

Another language derived from an existing tongue is Basic English. It was developed in the twenties of the present century by two Englishmen, C. K. Ogden and I. A. Richards. In Basic English the rich English language has been pared down to 850 words, of which only eighteen are verbs. The pronunciation, which is that of standard English, offers considerable difficulty to people who do not know English. Otherwise, Basic English is easy to learn.

To those who know ordinary English, Basic English often seems long-winded. Since there are so few words in the language, a number of words must sometimes be used to present a simple idea (like "try" or "explain" or "refuse") that could be expressed in a single word in ordinary English. Some people think that the addition of a few hundred verbs would not add greatly to the difficulty of Basic English and would improve the language considerably.

What are the prospects, then, for a universal language. The answer is: None—at least, not until all nations decide to cooperate with one another as good friends and neighbors. If that should come to pass, it is possible that the peoples of the earth might agree on a universal auxiliary language—a language that each one of us would learn in addition to his native tongue.

We can only guess at the sort of universal language that would be adopted. The artificial languages, such as Esperanto, Ido and Novial, have rather faded into the background. We can not tell whether any one of these languages will ever win world-wide backing. Nor can we tell whether they will be replaced by a new and more perfect artificial language.

As for the natural languages of the world, the one that seems to have the best chance of being adopted as a universal language is English—either the language that we know or some simplified form of it, like Basic English. The English language is already spoken by more than 300,000,000 persons, and its use is becoming more and more widespread. In addition to those who know English, there are millions upon millions of other people who know various dialects (like pidgin English) based on the English language. The question is, however, whether national jealousies will ever make it possible to adopt a living tongue, like English, as a universal language.

THE NEXT STORY OF LITERATURE IS ON PAGE 1726.

HOW PLANTS SERVE MANKIND

OUR wonderful civilization could not exist without plants. They provide us with clothing, food and drink, with valuable medicines, with building materials of all kinds. Plants give us the paper in books and magazines, the tires on cars, the wrappers on packages, the great ropes that hold ships fast to their piers.

We even use plants that lived in prehistoric times. The resin that oozed from a tree hundreds of thousands of years ago has become the amber mouthpiece of Father's meerschaum pipe. The decaying plant life of some prehistoric forest is now the coal that generates electricity or that heats your comfortable living room. (See Coal and What It Can Do, page 785.)

Plants have formed an important part of man's food in all periods and in almost every region of the world. It took primitive man a long time to discover what roots, leaves, fruits and seeds he could safely eat. In the course of time many men were no longer content to pluck fruits or to gather nuts where they found them. They learned to grow things, and thus agriculture—the art of cultivating the soil—was born.

Agriculture has now been carried on for many thousands of years. Yet in many places Nature still sows on a large scale so that men may reap. Mushrooms spring up here, there and everywhere and are to be had for the picking. Though the coconut-palm is often planted by man, it grows in a natural state in such numbers on the shores of the South Sea Islands and elsewhere that the natives have but to stretch forth their hands to have food, drink and shelter. Many a boy and girl has eaten of the blackberries, raspberries, currants and crab apples that grow wild in the woods. Generally speaking, however, the plants that provide food for mankind—particularly for the civilized peoples of the world—have been carefully cultivated.

Among all food plants the first place must be given to cereals. This name, which comes



Papyrus, the Egyptian reed from which we get the word paper. From its stems were made sheets of writing material widely used in ancient times, even as long ago as 4000 B.C. When the Romans became rulers of the world, they bought quantities of papyrus (the writing medium took the name of the plant) and the Egyptian city of Alexandria carried on a very prosperous trade in papyrus with the Romans. It was used in Europe up to the 10th century, though parchment (from skins of animals) began to displace papyrus probably as early as 600 A.D.

THE COCONUT PALM, TREE OF MANY USES



Courtesy, Alcoa Steamship Co.

The coconut palm is one of the most useful trees on earth. The fruits (nuts) may be eaten ripe or unripe, raw or cooked. The end-bud (cabbage) of the tree is also good to eat, and so are the centres of the stems of young plants. Oil from the nuts is used for food, and for making soap and candles and other things. From the sap comes sugar, and also a drink. The leaves are used to thatch houses in tropical lands, and to make baskets, mats and other useful things. Furniture is made from the trunks, rope from the centres of the stems, floor matting from the fibres that cover the fruits. The shells of the nuts are often carved into bottles, dishes and ornaments. There are more ways in which this tree serves mankind, but we have listed its chief gifts. The coconut palm grows in many warm parts of the world. It flourishes best near the seashore.

from Ceres, the Roman goddess of agriculture, applies to all the kinds of grasses that yield grains used as food—wheat, barley, rye, oats, rice, corn, millet and so on. Cereals of one kind or another are to be found all over the world. Some of them can grow in very cold regions; one finds barley and oats, for example, within the Arctic Circle. Wheat and corn are generally to be found in the temperate zones. On the other hand such cereals as rice and millet grow in very warm climates.

The phrase "staff of life" has been applied to bread, which is made from one or another of various cereals. The phrase might be applied more truly to cereals as a whole, in whatever form they are eaten by the peoples of the world. (See Wheat, page 1755; The Great Cereals, page 1851.)

SOME OF THE KINDS OF VEGETABLES THAT WE GROW FOR FOOD

Vegetables also supply man with a never ending source of food. The word vegetable is used in several different ways. In the purely scientific sense it applies to plants of any kind. Thus the term "vegetable kingdom" refers to plants as a whole. However, when one is shopping for vegetables, one generally has in mind certain kinds of plants—not grasses—that are grown on farms or in gardens for the sake of food.

There are many different kinds of vegetables. There are the leguminous plants, such as beans, peas and lentils, in which the seeds are contained in a *legume,* or pod. There is the interesting gourd family, to which belong the cucumber, the pumpkin and the squash. We eat the stems of vegetables like rhubarb, asparagus and celery. The leaves of the lettuce, water cress and cabbage serve us as food—these plants we call greens. The members of the tuber family—potatoes, Jerusalem artichokes and so on—make up an important group. The tuber or underground stem of these vegetables is the part that is eaten. One eats the roots of radishes, carrots and some other vegetables. (See The Useful Vegetables, page 2613.)

THE FRUITS OF BOTANISTS AND THE FRUITS THAT WE EAT

The word fruit, like the word vegetable, is used in different ways. When botanists (the scientists who study plants) talk of a fruit, they mean the part of a flowering plant that contains the seed or seeds of that plant. In this sense not only apples, peaches and plums but also beans, peas and pumpkins are fruits. However, when people speak of buying fruit at the store, they have something quite different in mind. What they are referring to is the fleshy and more or less juicy part of a plant which may be eaten without cooking when ripe and which is generally used as a dessert.

THE FIGS AND DATES THAT ARE IMPORTANT FOODS IN SOME COUNTRIES

We give an account of the more important fruits—oranges, lemons, bananas, grapes, apples, peaches and so on—in the article beginning on page 2057. Two of the fruits—dates and figs—are not merely desserts but form important articles of food in a number of countries. We tell the interesting story of these fruits on page 2155.

When the fruit of a tree is shut up in a hard covering that does not open up when the fruit is ripe, it is called a nut. In The Natural History of a Nut (see Index), we describe such common nuts as almonds, walnuts, hickory nuts, pecans, chestnuts and coconuts, among others. The food value of nuts is great; they furnish necessary proteins and fats and are particularly valuable when other foods are lacking in these elements. Indeed, many primitive peoples depend largely on nuts as food during long periods of the year.

SUGAR IS FOUND IN A NUMBER OF DIFFERENT PLANTS

One of the most valuable foods provided by the vegetable kingdom is sugar. It is found in the grass that we call sugar-cane, in the sap of certain trees like the maple, in vegetables like beets and peas, in fruits like peaches and oranges. Sugar is prepared for our use in various forms—in crystals, in tablets, in powdered form and as a syrup. The story of sugar is given in the chapter called Where Sugar Comes From, on page 5428.

Certain plants are used to flavor various foods—to these flavoring plants we give the name of spices. The part of the plant that is richest in the flavor is used. Thus cinnamon comes from the bark of the plant; cloves, from the flower; pepper, from the fruit; nutmeg, from the kernel; dill, from the seed. Some spices are used just as they come from the plant; often they are specially prepared in the form of a powder. (See The Spice Plants, page 2991.)

Almost all the spices come from tropical countries. Though they are widely used at the present time, they were even more important in the Middle Ages than they are

now. Since such methods of preserving foods as refrigeration and canning were unknown, spices were valued because they helped to keep food from spoiling. (Modern science has found that spices slow up the growth of bacteria.) Again, since not a little of the food that was used in the Middle Ages was half-rotten, spices served to disguise the bad taste of the food.

THE BEVERAGE PLANTS FROM WHICH WE GET TEA, COFFEE AND COCOA

Some plants are used to make delicious beverages or drinks. Tea is made from the leaves of a shrub, the tea plant. (See The Story in a Teacup, page 761.) Another shrub, the coffee plant, produces beans which are ground up to make coffee. Cocoa and chocolate are made from beans, too—the fruit of the tropical evergreen tree called the cacao tree. (See Coffee and Chocolate, page 1068.)

Cocoa and chocolate have considerable food value. That of tea or coffee is slight; though of course the sugar and cream that we sometimes add to these drinks are valuable foods. Both tea and coffee are stimulants. In tea the stimulating substance is called theine; and in coffee, caffeine. Their effects are practically the same. They stimulate or excite the brain and usually prevent one from going to sleep. Cocoa and chocolate are also stimulants, but very mild ones.

THE FUNGI THAT TAKE THEIR FOOD FROM OTHER PLANTS OR ANIMALS

Among the most interesting plants are the fungi (this is the plural form pronounced *fun-jie*; the singular is fungus). Fungi get their food from living plants or animals or from dead plant and animal tissues and their products. Such fungi as the molds that form on bread and cake, the rust on wheat, the smut on oats and the mildew on vines cause great loss to man. There are other fungi, however, that faithfully serve him. We get the drug penicillin from the product of a mold.

Chief among these helpful fungi are the yeasts, small one-celled plants that multiply very rapidly. They are particularly important in the making of bread; they make the dough light, so that the bread will not be too tough and rubbery. Yeasts are also used in the manufacture of beer and wine.

A delicious food is offered to man by the fungi called mushrooms. Some are cultivated on a large scale in caves and on a smaller scale in cellars. Others grow wild. Unfortunately, while many kinds of mushrooms are pleasant to the taste and quite nutritious, others are indigestible and still others are very poisonous. We describe various kinds of mushrooms, poisonous and non-poisonous alike, in the article beginning on page 3905.

There are plants called bacteria which are too small to be seen by the naked eye but which affect every one of us. Some are harmful to mankind; they cause decay and disease. Yet some bacteria play an important part in the preparation of many of our foods. For example, bacteria are sometimes used to "ripen" cream—that is, to cause it to ferment—before it is churned to make butter. This process gives the butter a pleasant flavor.

THE WONDERFUL WORK OF BACTERIA WHICH DRAW NITROGEN FROM THE AIR

Without bacteria plants would not be able to produce the valuable substances that we call proteins. You see, in order to manufacture proteins plants must have nitrogen. Bacteria play an important part in making nitrogen available to plants. Some bacteria in the soil draw nitrogen from the air. Others change various nitrogen compounds, which the plant needs but can not use, into nitrates, a form of nitrogen that the plant can use. Bacteria are also useful in industrial processes, such as the retting of flax in linen making and in tanning leather.

There are a number of plants that help man by serving as food for the animals that are useful to him—the animals that he eats, those that provide him with milk, those that serve him as beasts of burden. Many of these animal-feeding plants grow wild in nature. Others are cultivated by man; these are the grasses, called forage plants, that we see in our meadows and pastures. The story of timothy, oat-grass, clover, alfalfa and other forage crops is given in The Forage Plants, page 2409.

A STRANGE OLD SUPERSTITION ABOUT THE MEDICINE PLANTS

From very ancient times there has been a widespread use of plants as medicines. The old doctors often collected medicinal herbs themselves or employed humble herb-gatherers. There was a firm belief in former days that plants gave some evidence or "signature," as it was called, of what they could cure. For example, the petals of the flower known as Canterbury Bell were arranged in such a way as to suggest a throat; hence the plant was supposed to be a cure for sore throats. If some part of a plant

looked like a lung, it must be good for the lungs; if it looked like a liver, it must be a cure for liver ailments!

All this, of course, was mere superstition. Centuries of experiment, however, have proved that many plants are real medicines. They provide a large proportion of the remedies with which your druggist stocks his shelves—quinine for fever, digitalis for heart disease, arnica for bruises, atropine for the treatment of the eyes. You may read about the medicine plants in the chapter beginning on page 2909.



Soybean roots showing nodules in which bacteria live. When they enter the soil these bacteria make it richer by drawing nitrogen out of the air.

Plants give us many of the fabrics that we make into clothes. It is probable that man's first clothing was the skin of some animal. In warm countries, however, from very early times men and women wore aprons made of unplaited grass and reeds ("unplaited" means "not woven together"). Certain primitive peoples, in the South Sea Islands and other places, still wear aprons of this kind. In most places, however, unplaited garments were gradually replaced by fibres woven into a fabric.

Such fabrics as cotton and linen (we make linen from the plant called flax) are called vegetable fabrics—that is, fabrics



Courtesy, Baltimore & Ohio Railroad

One of the most important food elements which plants take from the soil is nitrogen. Now there is a group of plants called leguminous plants, or sometimes simply legumes, which have the power of obtaining free nitrogen from the air in the most amazing way. Certain bacteria invade their root-hairs and set up an irritation so that growths, called nodules, form, and in these nodules the bacteria live. The bacteria are able to take nitrogen from the air. When the plants die, the nitrogen-bearing bacteria enter the soil. Farmers often plant a legume and when it is well grown plow it under the soil to decay and make the land rich again. Such a crop is called a cover crop, or a green manure. Clover, alfalfa, beans, peas and soybeans are leguminous. They bear fruit in pods (legumes). The farmer in this picture is "plowing under" a big field of soybeans.

which come from plants. Non-vegetable fabrics include such materials as wool, which is shorn from sheep, and silk, which is spun from the cocoon of the silkworm.

PLANTS THAT GIVE US ROPES, TWINES AND OTHER TWISTED FIBERS

Twisted fibers that come from plants like hemp, abaca, sisal, flax, cotton and so on are often used to make cordage. This is a general term that applies to such materials as string, twine, cord, rope, hawsers and cables. Nowadays wire ropes, made of iron or steel wire, sometimes replace vegetable-fiber cordage. These wire ropes are used for raising and lowering apparatus in mines, for elevators, for suspension bridges and other similar purposes.

The trees of our forests are often converted into lumber and are used to make houses, articles of furniture, railroad ties, laths, shingles and so on. A useful plant that furnishes great quantities of building supplies to mankind is the bamboo, which is not a tree but a woody kind of grass. The stem of the bamboo provides materials for houses, for furniture, for wickerwork, for paper and for many other useful things besides. Certain species of palms also supply building materials and many other things as well. Most important among these, perhaps, is the coconut-palm which also produces wonderful fruit.

The logs of certain trees are cut into blocks and then ground into pulp. From this pulp is made the paper of books, magazines and newspapers.

RUBBER, THE USEFUL PRODUCT MADE FROM THE MILKY JUICE OF A TREE

The substances that we get from some trees by cutting the bark are very useful. Particularly valuable is the latex or milky juice that we get from the tree called *Hevea Brasiliensis* and from certain other trees and shrubs. The latex from these plants is made into rubber, one of the most essential of all materials in modern industry. Rubber is used for clothing, automobile tires, insulation on electrical work, surgeon's gloves, motor mountings and for many other things.

From the outer bark of the cork oak we get cork, a light, springy substance that resists moisture and heat and that absorbs sound and vibration. Cork is not so widely used as formerly for bottle stoppers of various kinds, but modern industry has found many new uses for this valuable material. Among other things, it is employed in the manufacture of a floor covering, linoleum, and in making room walls soundproof.

When an opening is cut in certain trees, a gummy substance called crude turpentine or oleoresin flows out slowly. From this substance we obtain turpentine, which is used in paints, varnishes, shoe polishes, greases and so on. We also obtain a solid called rosin, which likewise is a valuable industrial product. It is used as size (or filling material) in the manufacture of paper; it is also used in making soap and sealing wax. Boys and girls who play the violin know that rosin is rubbed on the hair of bows to make them "bite," that is, to make a firm contact with the strings.

THE CHEMIST HAS MADE MANY NEW MATERIALS FROM PLANT SUBSTANCES

The science of chemistry has been applied to transform many plants into new materials that are highly important in industry. The substance called cellulose—the vegetable fiber that forms the cell walls of plants—has yielded especially valuable results to the chemist. Cellulose can be transformed into an astonishing variety of articles. The little ball that is used in playing ping-pong, the cement that mends broken plates, the rayon in various fabrics, the films used in making motion pictures—all are derived from cellulose.

HEALING DRUGS FROM PLANT PARASITES

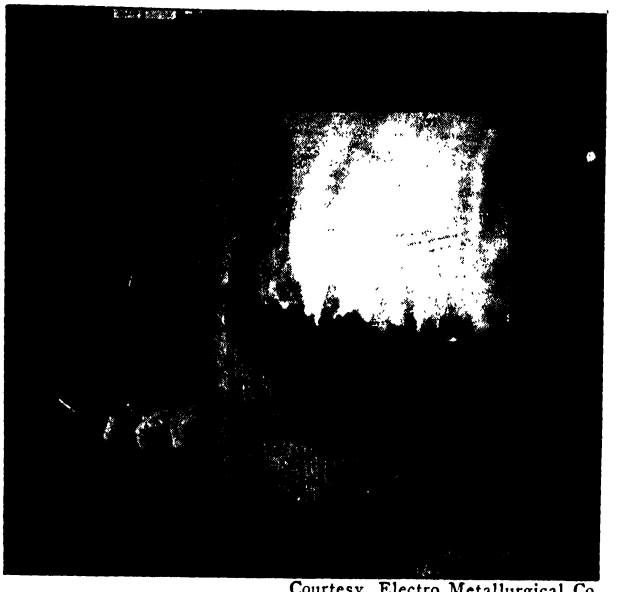
Even from such plants as the fungi, most of which we are apt to think of as parasites, we get some of the most wonderful aids to medicine yet discovered. The most important of these drugs is penicillin, which comes from a common mold. Today intensive research is being carried out on molds in the attempt to find other drugs that may prove equal boons to mankind.

Thus far we have discussed the ways in which plants have been useful to man—useful as food, as drink, as materials to be used in building things and the like. We should not ignore the contribution that plants make to our happiness by filling the world with beauty. What a cheerless place this would be if there were no leafy oaks, no green pastures, no beautiful daffodils, no sweetly smelling roses! To give you some idea of the wealth of beauty that nature has showered upon us, we have described some of the more important trees, shrubs and flowers of North America.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 1754.

ALLOYS

TEAMWORK AMONG THE METALS



Courtesy, Electro Metallurgical Co.
Melting, as here, and electroplating make most alloys.

IMPURITY in metals is as necessary to our civilization as purity in food is important to our health. Scientists often spend years in expensive research in order to add a new impurity to iron, nickel, copper, aluminum and other metals. Each year only about 1,000 pounds of the purest iron possible are produced. This is quite enough to satisfy the world's demand for it, but the production in one year of an impure iron, which we call steel, has at times amounted to more than 100,000,000,000 pounds in the United States and Canada alone.

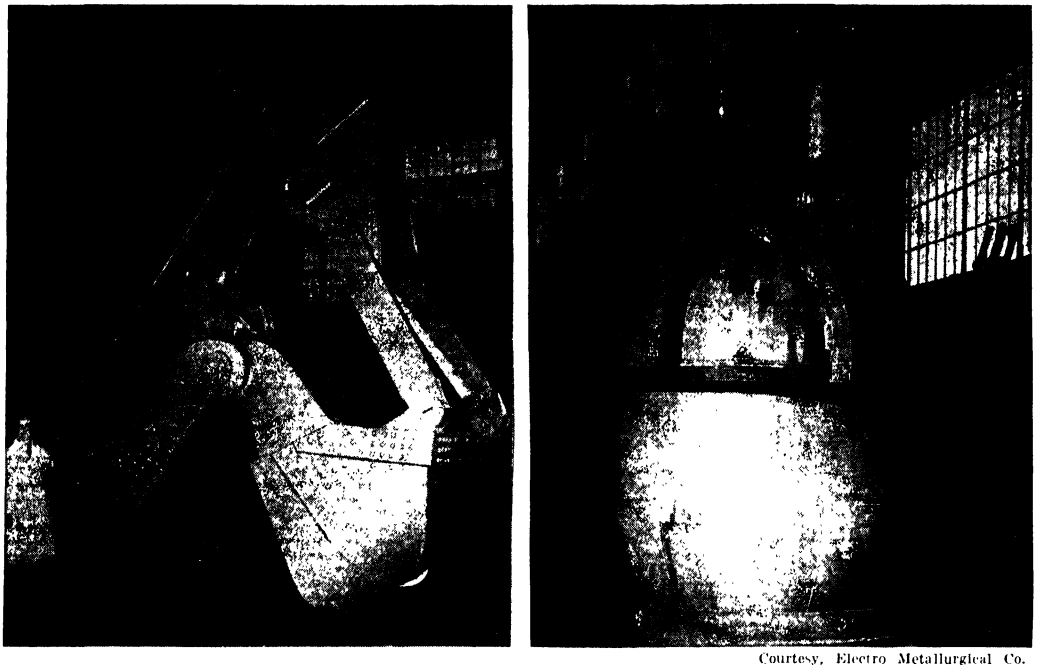
These impure metals are called Alloys. An alloy is an intimate mixture of two or more metals combined while in a molten state and then cooled to the solid form. Some alloys may contain also small amounts of various non-metals like phosphorus, sulphur, nitrogen and oxygen. These alloys are eagerly sought because they are better for many purposes than the metals themselves. Alloys are often custom-made metals to fit particular jobs.

Does your mother require a grapefruit knife that will not become stained by fruit acids, or do you want a jack-knife that will keep a sharp cutting edge; does the electrical engineer need a metal which will easily acquire magnetism or lose it; does the airplane designer seek a metal that will be light and strong; does the safety engineer ask for fuses that will melt at a lower temperature in fire sprinkler systems? The answers to these and many similar questions come from the laboratories where scientists called metallurgists combine metals and non-metals in different ways to provide alloys which do jobs that pure metals cannot do as well or as cheaply.

Of the more than ninety elements known, some seventy are considered to be metals. Three of the elements, carbon, boron and silicon, are called *metalloids* because their chemical behavior is unlike that of the metals, though they conduct heat and electricity like the metals, have a metallic lustre, and combine, that is, alloy, with some of the metals. We are likely to be familiar with many of the common metals like iron, copper, nickel, lead, aluminum and tin, and with some of the precious metals like gold and silver.

Mercury is a liquid at ordinary temperatures, and for many years was not recognized as a metal until it had been solidified. Zinc and bismuth when first discovered were called semi-metals. We commonly think of metals as being dense and heavy, but sodium, lithium and potassium are light enough to float on water.

The strange behavior of some of the metals can hardly prepare us for the surprising antics of many of the alloys, for alloys have properties which differ, often considerably, from those of the metals and non-metals which compose them. Though metal-



Courtesy, Electro Metallurgical Co.

This dredging bucket is made of a special chromium steel. The other vessel is used in the chemical industry.

lurgists know generally which substances to combine to form an alloy possessing certain desired properties, it is still impossible to predict exactly the behavior or properties of a new alloy.

Usually an alloy will be stronger and will have a lower melting point than any of the metals or non-metals which are combined to form it. Brass is stronger than either the copper or zinc of which it is composed. The marvelously magnetic material, permalloy, is more magnetic than either the iron or nickel of which it is made. A magnetic substance, Heusler's alloy, is made up of three metals, copper, manganese and aluminum, which are not magnetic. Manganese steel is practically non-magnetic though it contains over 85 per cent of iron which is magnetic. An excellent conductor of electricity, copper, becomes unfit to carry electricity if a few ten-thousandths of arsenic are contained in it. Steel is made brittle by a minute addition of phosphorus. The United States 5-cent coin has a silvery color, although it contains 75 per cent copper and only 25 per cent nickel. These are but a few of the unexpected results which the metallurgist finds when he tests the products from his melting pot.

Most metals mix with one another when liquid and these can be used to form alloys. Some metals do not mix at all when molten and these do not form alloys. Liquid lead and liquid aluminum when mixed separate into two layers like oil and water; consequently there are no lead-aluminum alloys. Bismuth and iron are two other metals which do not mix in the molten state and hence do not form an alloy. Copper-iron alloys are limited because molten iron will dissolve only a little molten copper, and liquid copper will dissolve only a small amount of liquid iron.

IRON AND STEEL ALLOYS ARE THE MOST IMPORTANT

The study of alloys may be divided into two broad classes: the ferrous alloys in which iron and steel are present, and the non-ferrous alloys in which there is no iron or steel. Because iron is plentiful and the steel made from it is strong and capable of being further alloyed to suit many requirements, the ferrous alloys are the most important and the most used.

In the scientific sense the purest iron yet produced is an alloy, for more than twenty elements exist in it as impurities. In this sense many "pure" metals are alloys. In the practical sense an alloy is a mixture of a metal with other metals or non-metals, to secure certain properties.

In most alloys one metal is usually present in a far greater amount than any of the other

ingredients. It is the custom to consider that this more plentiful basic metal is the one alloyed. Bronze is considered an alloy of copper, since the amount of copper present is about nine times as great as the amount of tin. Similarly steel is an alloy of iron and not of carbon, though carbon added to iron in certain small proportions produces steel.

HOW ELECTRICITY CAN MAKE ALLOYS

Most alloys are formed in a melting pot, but other methods have been developed to form alloys. Electroplating, which is one of the more recent and one of the best methods developed, is much in use as an alloying method. Solutions of the metals to be combined are placed in the electrolyte. These form the anode or positive pole. An electric current is passed through the electrolyte and plates the metals in alloy on the objects attached to the cathode or negative pole. In this way jewelers produce the "red gold," "green gold" and "gold" of other tints in alloys of gold, silver and copper, by making these metals the anode in the electrolytic bath.

Alloys are also made by pressing into molds finely powdered forms of the metals to be combined. The mixed powders in the molds are then exposed to great heat while under pressure. By this method of powder metallurgy alloys are obtained which cannot be had by the ordinary processes of melting and casting. Powder metallurgy produces castings which cannot be machined, but they are desirable in many cases, especially in automobiles, because they withstand wear and strain to a phenomenal degree. This process is still in its infancy.

Some metals and alloys, like all human beings, show the effects of age. When these metals and alloys are tested soon after they have been made or treated, they show one set of characteristics; when tested at a later time they exhibit a marked change in these characteristics. As with us, this change in behavior is known as aging.

DURALUMIN, AN ALLOY LIGHT BUT STRONG

Duralumin, an alloy of aluminum containing generally about 4 per cent copper, 0.5 per cent magnesium and frequently a small proportion of manganese and of silicon, is an example of the change which takes place with age. After aging for about four days at room temperature, duralumin shows



Courtesy, International Nickel Co., Inc.

This is a gigantic valve made in Pittsburgh of "Monel" metal and other alloys, for Boulder Dam.

an increase of about 50 per cent in its tensile strength (which is its resistance to breaking as a result of pull) as compared to its strength immediately after quenching, a treatment many metals and alloys undergo when they are heated and rapidly cooled by being plunged into water or other liquids. After aging, the tensile strength of duralumin may be about 60,000 pounds per square inch, which is the strength of mild steel. Duralumin is often used in the construction of airplanes and airships because it combines lightness with relatively high strength.

Several pure or almost pure metals were known to early man. Gold, silver and copper ornaments and coins have been found in the ruins of races of great antiquity, but such pure metals were soft and unsuited for general use in agriculture as plowshares, or in hunting or battle as spear tips and arrowheads; nor could these pure metals be given a lasting sharp edge for use as knives or ax blades. Iron, rarely found in a pure state because of its tendency to rust, was known and used by man thousands of years ago.

The first alloy, bronze, was discovered by primitive men in different parts of the world about four thousand years ago. Bronze provided them with a superior material that could be used instead of stone, shells, bone and wood for their tools and weapons. It was indeed a great discovery for early man that about nine parts of soft copper combined with one part of soft tin gave a metal alloy, bronze, which was harder and which could be melted more easily than either tin or copper.

Copper and antimony will also produce bronze, but this alloy is not so hard as the bronze formed by the combination of copper and tin. The bronze first produced was often inferior because antimony is more plentiful than tin, and early man could not easily distinguish between the two. When sufficient quantities of tin were made available to replace the less desirable antimony, better grades of bronze were produced.

For hundreds and thousands of years,



Courtesy, International Nickel Co., Inc.

Modern kitchens contain many articles of "Monel" metal, including the sink and the top and legs of the table.

until man was able to build fires hot enough to separate iron from its ores, bronze was the chief metal in use in many parts of the world. This period of time is called the Bronze Age. With the development of crude methods for extracting iron from its ore, the Bronze Age passed and the Iron Age began, though not all tribes and races of early man were in the same age at the same time.

With the passage of time, knowledge and errors about metals were slowly gathered. In the Dark Ages and Middle Ages, the experimental scientists of those times, the alchemists, divided metals into those which were noble like gold and silver, and those which were base like lead and copper. Because of color resemblances, the alchemists believed that lead was a base form of silver and that gold was a noble form of copper. Hence in their experiments, the alchemists tried to remove the baseness of copper so that it might be revealed in all its nobility as gold, and to change base lead into its other self, noble silver, just as the ugly duckling in the story is changed into a beautiful swan. Basing their decision on color, the alchemists supposed that gold was generated by the yellow golden sun, and silver by the whitish, silvery moon.

The production of iron in sufficient quantities awaited the development of satisfactory forges and methods for the separation of iron from its ores and for the further treatment of the metal. Thus, for a long time, iron remained a precious metal. During the reign of England's King Edward III, in the fourteenth century, the iron pots and frying pans in the king's palace were classed among the royal jewels. The Spanish invaders of Mexico found that the Aztecs possessed iron knives which they valued above gold. Though no longer so costly as gold if we buy it by the ounce or pound, iron is certainly more valuable. Try to imagine a world without gold and you will probably find that your own life is hardly affected; then try to picture a world without iron and its alloy, steel, and you will surely realize why this metal



Courtesy, S. Blickman, Inc. and Electro Metallurgical Co.

Stainless steel equipment is used in this kitchen in the Medical Center at Jersey City, New Jersey.

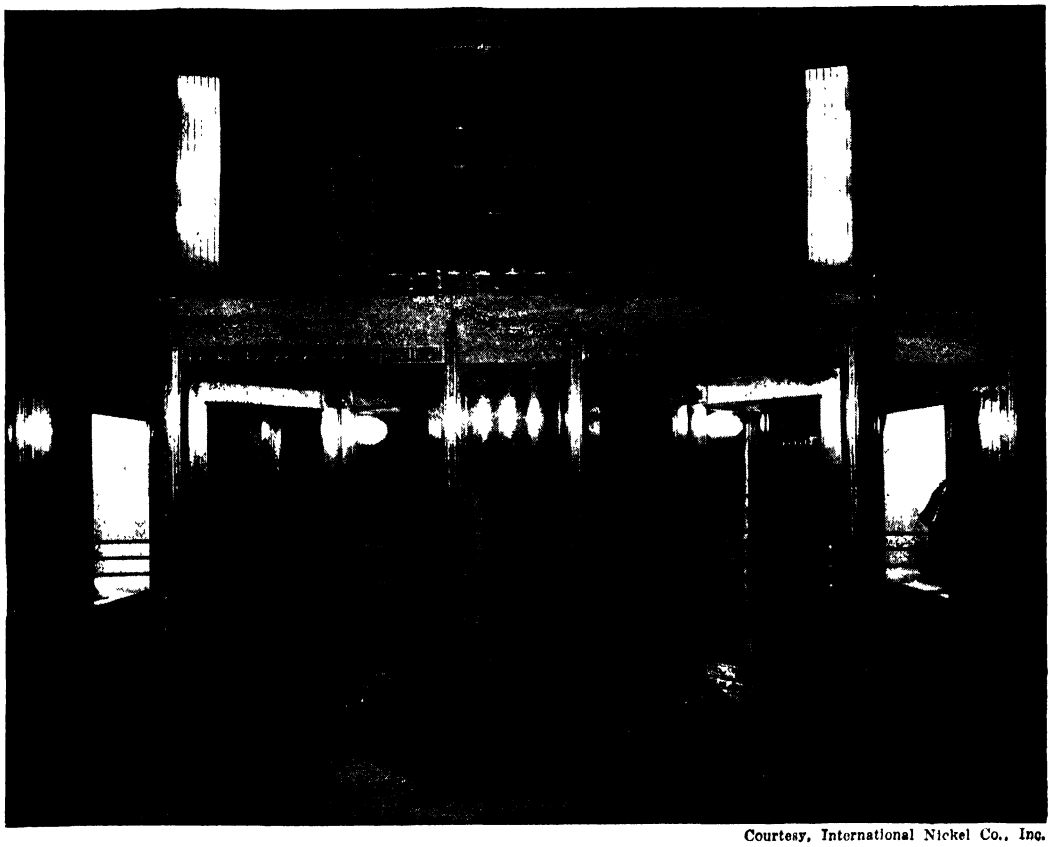
means more to our civilization than gold, silver, copper, tin and lead combined.

Iron, in nature, is extremely abundant, though seldom in a free form. It is the fourth most abundant element and about one-twentieth of the earth's crust is estimated to be iron. Just as our society depends on iron for its maintenance, so does our body depend on iron for its life, and some iron is found in all plants and animals. It is said that a man's body contains from a quarter to a half ounce of iron.

Modern smelting methods such as the blast furnace, the open hearth furnace, the Bessemer converter and the electric furnace, which have all developed out of the application of science to industrial problems, provide efficient means for separating iron from the greater part of the impurities with which it is combined.

The ferrous alloys, in which iron predominates, are the most commonly used. No strict agreement exists as to the exact proportions of iron and carbon which form steel, but we shall not go too far astray if we say that steel is an alloy of iron containing from 0.20 per cent to 1.7 per cent of carbon. Fairly pure iron, with the carbon amounting to less than 0.20 per cent and with slight impurities left from the smelting process, is wrought iron. Amounts of carbon greater than 1.7 per cent to about 4.5 per cent produce cast iron. In general, iron becomes harder and more brittle as the carbon in it is increased, hence cast iron will not withstand hammering nor can it be formed into desired shapes when cold without breaking.

In the manufacture of steel small amounts of other metals are often added to produce alloy steels with new and desirable properties. Manganese is a frequent addition. All steel contains small amounts of it. A little manganese will help remove oxygen from the steel, and when in excess of 1 per cent it increases the brittleness of the metal. However, a manganese steel containing approximately 13 per cent of manganese is exceptionally hard and ductile, a property of metals which allows them to be drawn out like taffy without breaking. So hard is this



Courtesy, International Nickel Co., Inc.

Bronze has for centuries been used for decoration. Here we see it on the entrance to a Toronto store.

steel alloy that it cannot be cut and must be forged, rolled or cast to practically the finished shape. Some finishing can be done by grinding. Because it cannot be drilled or cut, it is used for burglarproof safes, steam-shovel buckets, rock crusher jaws, airplane tail-skids, and for railroad curves and crossings.

Silicon is used in amounts of less than 1 per cent to reduce the oxygen content of steel to a lower level than can be accomplished with manganese. In amounts of about 2 per cent silicon in steel gives great strength and such an alloy with a small amount of manganese is sometimes used for automobile leaf springs.

NICKEL HELPS TO MAKE STAINLESS STEEL

Nickel is a common ingredient in steel alloys of great strength and toughness. Most of our nickel comes from Canada. The addition of nickel in amounts up to 5 per cent increases the strength and hardness without making the alloy materially more brittle. Nickel increases steel's resistance to corrosion and is a principal factor in "stainless steels." Nickel steels are often used for gears in an automobile's transmission and rear axle.

Chromium imparts to steel hardness, strength and resistance to wear and corrosion. It is often used in steel alloys together with nickel, molybdenum and vanadium. Chrome-nickel steels are frequently used in the gears and axles of automobiles because of their great strength. Steel with large amounts of silicon and chromium resists heat and corrosion well, and is used many times for exhaust and intake valves in engines which operate at red hot temperatures. Stainless steels contain large amounts of chromium and 8 per cent nickel. This alloy steels is the so-called 18-8 steel, which is composed of approximately 18 per cent chromium and 8 per cent nickel. This alloy steel resists corrosion and is practically non-magnetic. The rustless, shining metal tower of the Chrysler Building in New York City, much of the gleaming, metal trim on automobiles, acid-resisting kitchen cutlery and corrosion-resisting airplane bolts and fittings are made from stainless steels.

THE CUTTING EDGE OF TUNGSTEN STEEL

Tungsten steels even though heated red will retain their hardness. "High speed steel" is a combination of steel with about 14 to 18 per cent of tungsten and about 2 to 4 per cent chromium. This steel alloy takes an edge hard enough to cut other metals

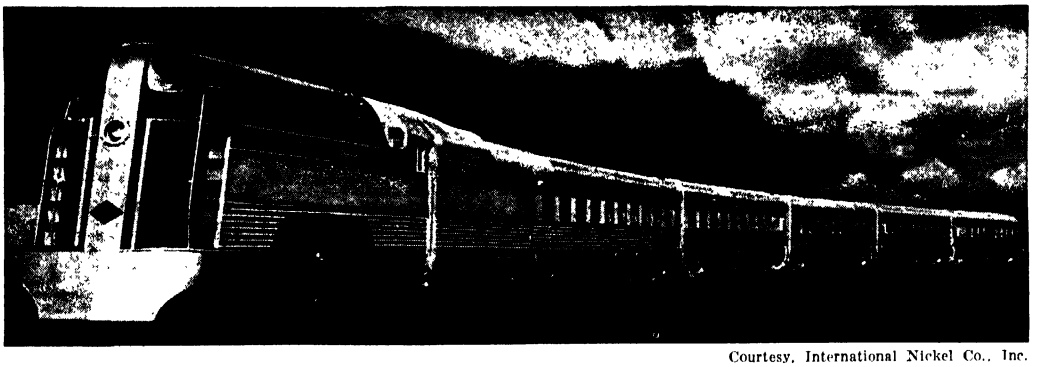


Courtesy, International Nickel Co., Inc.
Diver in "Monel" metal helmet, at Sydney, Australia.

even when it is heated red hot by the friction created by the fast cutting. It is used wherever metal has to be fashioned by cutting at high speeds.

Vanadium is the hardest of the metals and one of the most expensive. In steel alloys vanadium, in amounts seldom over 0.2 per cent, is used generally with chromium. Chrome-vanadium steel has high strength and good ductility. It is employed for ball bearings, leaf springs, transmission gears, rear axle gears and steering gear parts in automobiles. Molybdenum is used alone or with chromium and nickel to impart toughness and higher strength to steel.

Many alloys widely used are known to us by particular names. One of these, "Monel" metal, is perhaps familiar to you as the silvery metal used in restaurants, ice cream parlors, kitchens and laundries because it offers excellent resistance to corrosion, has high strength and is readily cleaned with a damp cloth. Monel metal is an alloy containing some 68 per cent of nickel, 29 per cent of copper, and the remainder made up of small amounts of iron, manganese, silicon and carbon. When used for spring wire Monel metal has a higher manganese content up to 2.5 per cent and when used for castings the silicon content may be increased up to 4 per cent. Slight variations in composition con-



Courtesy, International Nickel Co., Inc.

A light-weight stainless steel streamlined train that flashes back and forth between Philadelphia and New York.

siderably affect the magnetic properties.

"K Monel" is a nickel-copper-aluminum alloy with a high corrosion resistance, exceptional strength, and non-magnetic properties. In airplanes it is often used near compasses which would be affected by a magnetic material. "Inconel" is a nickel-chromium alloy which is classed as non-ferrous because the iron and carbon content is relatively small. It is resistant to tarnish and has good strength and workability.

Steels with a high nickel content expand relatively little when heated. Invar, a name coined from the word invariable, is such an alloy with a content of about 35.5 per cent of nickel. It is much used in measuring tapes and instruments where a constant length despite temperature changes is demanded.

Brass, a copper-zinc alloy, is readily drawn when the zinc content is about 30 to 35 per cent, and has a relatively high strength when the amount of zinc is increased to about 45 per cent. Copper-beryllium alloys have begun to attract great attention. The addition of 2.5 per cent of beryllium to copper produces an alloy of remarkable hardness and tensile strength which can be tempered until it has properties equal to those of spring steel. The electrical conductivity of this alloy is exceedingly good. Beryllium bronze spiral springs went through more than 3,000,000 vibrations without loss of tension, while a spring steel under the same conditions gave way after 2,000,000 vibrations. Leaf springs made of the best grade of steel fracture after 2,000,000 bendings, but beryllium bronze has withstood more than 15,000,000 bendings. Beryllium is a newcomer in the field of alloys. The tensile strength of copper is raised from 33,000 to 200,000 pounds when about 2 per cent of beryllium is added and the compound is treated by heat.

Pewter, used in ornaments and kitchen ware, was made by the ancient Chaldeans, Egyptians, Greeks and Romans. It is an alloy of tin and copper. The finest pewter combines 9 parts of tin with 1 of copper. An inferior grade of pewter is made of 75 per cent tin and 25 per cent lead.

Most metals and alloys shrink in volume when passing from the liquid to the solid state. This would be a distinct disadvantage in casting type for printing because the molten metal in the matrix or mold for forming the letter would shrink from the mold's sides upon solidifying and would not reproduce a sharp outline. Type metal is therefore designed to reduce shrinkage or even to bring about expansion when the liquid alloy solidifies. A common formula for type metal is 10 parts of antimony, 4 parts of lead and 2 of tin. Antimony serves the purpose of lowering the melting point of the alloy, increasing the hardness and causing it to expand when solid. Because it is easily cast, type metal is used for statuettes, candlesticks and other decorative objects.

Alloys with a low melting point are useful in fire sprinkling systems. Such alloys are generally composed of bismuth, lead and tin. A change in the proportions of these ingredients changes the temperature at which the alloy will melt. Various types of fuses are made from these alloys which melt and thus open a water or chemical sprinkling system when the temperature has increased above a determined point.

Tens of thousands of alloys are already known and new ones are daily being discovered. Each successful alloy marks a distinct advance because it permits us to do some job better, or faster, or cheaper, or more safely. Iron, nickel, lead, tin, aluminum and other common metals are finding, through change, a wider world of usefulness.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 1663.

Why Can We Hear Better When We Shut Our Eyes?

WE can not always hear better with our eyes closed; but there are times when this is true, and for a good reason. If we are listening to music, our enjoyment of it requires attention. We have to put together in our mind the sounds just heard and the sounds we are hearing at the moment and even the sounds we expect to hear. The fewer other things the brain is doing at the time, the better. We certainly enjoy the music more with our eyes closed.

Exceptions to this are when we are listening to music and at the same time reading the score, or watching a performance upon a stage, as in opera.

But it is very different when we are, for



instance, listening to a tiresome lecture in a stuffy room on a sleepy afternoon. Instead of hearing better when we close our eyes, we shall soon find that we are not hearing at all! The brain must be more or less awake in order to hear, and where it might otherwise sleep, light pouring into the eyes will help to keep it awake. If we make experiments with bright lights and sharp sounds, we find that either of them helps us to feel the other more intensely if they are going on at the same time.

WHY DOES EVERYTHING SPIN ROUND WHEN WE ARE DIZZY?

The feeling that things are spinning round is a part of dizziness. Dizziness may come from several causes. One is faintness, when not enough blood is going to the brain. There is a humming in the ears, and the eyes do not work properly; things seem to whirl around.

Another reason for dizziness has to do with three little canals and two sacs in the inner ear. These together make up our organ of balance. If this organ becomes diseased the person may constantly suffer from dizziness—the feeling that things are spinning around.

As every child knows, we can make ourselves dizzy by turning ourselves around several times in one direction. This disturbs the organ of balance about which we have been speaking, and the disturbance gives us the dizzy feeling. If you turn around the other way, you put things right by restoring the original state of affairs within the balancing organ. The name for the feeling that things are spinning round is *vertigo; vert* simply means "turn."



WHY ARE BLIND PEOPLE SO QUICK AT HEARING?

The simplest answer to this question would be to say that blind people listen more attentively to the sounds around them. An ordinary person who has all the senses of sight, smell, touch, hearing and taste receives a tremendous number of impressions from all sorts of sources, which are conveyed to his brain by special nerves and give him the ideas that he identifies with all those sensations. Now, if one of the organs of the senses, such as the eyes, can not receive impressions from the outside world, the brain has fewer messages to attend to, and so has more time for the rest.

Thus, in a blind person there are no means of his getting all the information that comes to an ordinary person through sight. If he wants to know how near he is approaching to somebody walking toward him, the best means he has of judging that is by listening to the sound of the other person's footstep. He can not see the distance that separates him and the other person. In this way he forms the habit of listening intensely for all the sounds around him; and so we find that blind people become extremely quick at hearing. In other words, their sense of hearing is very highly educated.

WHY DO OUR EARS SEEM TO RING AT TIMES?

The sounds we normally hear are caused by vibrations of the drum of the ear, set in motion by waves of air driven against it by other vibrating objects. The ringing sounds we sometimes hear in the ear are due to other causes. Often they are due to wax or some other substance in the canal of the ear rubbing against the drum. Sometimes they are due to abnormal pressure of air in what is called the Eustachian tube—the tube that runs between the throat and the middle ear. Sometimes they are due to spasms of a little muscle within the middle ear. Sometimes they are due to disease of the ear, or to other illness. If we have any sort of trouble with our ears, it should be looked after at once.

THE NEXT WONDER QUESTIONS ARE ON PAGE 1749.



Story Poems

Illustrated by Elinor Blaisdell

The Glove and the Lions

By LEIGH HUNT
(1784-1859)

KING Francis was a hearty king, and loved a royal sport,
And one day, as his lions fought, sat looking on the court;
The nobles filled the benches, and the ladies in their pride,
And 'mongst them sat the Count de Lorge, with one for whom he sighed;
And truly 'twas a gallant thing to see that crowning show—
Valor and love, and a king above, and the royal beasts below.

Ramped and roared the lions, with horrid, laughing jaws;
They bit, they glared, gave blows like beams, a wind went with their paws;
With wallowing might and stifled roar they rolled on one another,
Till all the pit, with sand and mane, was in a thunderous smother;
The bloody foam above the bars came whisking through the air;
Said Francis then, "Faith, gentlemen, we're better here than there!"

De Lorge's love o'erheard the king, a beauteous, lively dame,
With smiling lips, and sharp, bright eyes, which always seemed the same;
She thought, "The Count, my lover, is as brave as brave can be;
He surely would do wondrous things to show his love of me;
King, ladies, lovers, all look on; the occasion is divine;
I'll drop my glove to prove his love; great glory will be mine."

She dropped her glove to prove his love, then looked at him and smiled;
He bowed and in a moment leaped among the lions wild:
The leap was quick; return was quick; he has regained his place,
Then threw the glove, but not with love, right in the lady's face!
"By Heaven," said Francis, "rightly done!" and he rose from where he sat;
"No love," quoth he, "but vanity, sets love a task like that."

King Bruce and the Spider

By ELIZA COOK (1818-1889)

KING Bruce of Scotland flung himself down
In a lonely mood to think;
'Tis true he was monarch, and wore a crown,
But his heart was beginning to sink.

For he had been trying to do a great deed,
To make his people glad;
He had tried, and tried, but couldn't succeed;
And so he became quite sad.

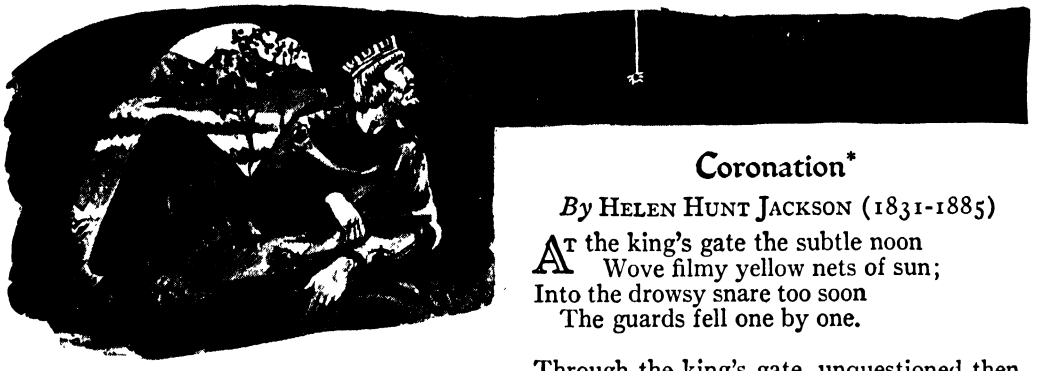
He flung himself down in low despair,
As grieved as man could be;
And after a while as he pondered there,
"I'll give it all up," said he.

Now just at that moment a spider dropped
With its silken cobweb clue;
And the King in the midst of his thinking stopped
To see what that spider would do.

'Twas a long way up to the ceiling dome,
And it hung by a rope so fine,
That how it would get to its cobweb home
King Bruce could not divine.

It soon began to cling and crawl
Straight up with strong endeavor;
But down it came with a slippery sprawl,
As near the ground as ever.

Up, up it ran, not a second it stayed
To utter the least complaint;
Till it fell still lower, and there it laid,
A little dizzy and faint.



Its head grew steady—again it went,
And traveled a half-yard higher;
'Twas a delicate thread it had to tread,
A road where its feet would tire.

Again it fell and swung below,
But again it quickly mounted;
Till up and down, now fast, now slow,
Nine brave attempts were counted.

"Sure," cried the King, "that foolish thing
Will strive no more to climb;
When it toils so hard to reach and cling,
And tumbles every time."

But up the insect went once more,
Ah, me! 'tis an anxious minute;
He's only a foot from his cobweb door,
Oh, say, will he lose or win it!

Steadily, steadily, inch by inch,
Higher and higher he got;
And a bold little run at the very last pinch
Put him into his native cot.

"Bravo, bravo!" the King cried out,
"All honor to those who *try;*
The spider up there defied despair,
He conquered, and why shouldn't I?"

And Bruce of Scotland braced his mind.
And gossips tell the tale,
That he tried once more as he tried before,
And that time did not fail.

Pay goodly heed, all ye who read,
And beware of saying, "*I can't.*"
'Tis a cowardly word, and apt to lead
To Idleness, Folly and Want.

Whenever you find your heart despair
Of doing some goodly thing,
Con over this strain, try bravely again,
And remember the Spider and King.

Coronation*

By HELEN HUNT JACKSON (1831-1885)

At the king's gate the subtle noon
Wove filmy yellow nets of sun;
Into the drowsy snare too soon
The guards fell one by one.

Through the king's gate, unquestioned then,
A beggar went, and laughed, "This brings
Me chance, at last, to see if men
Fare better, being kings."

The king sat bowed beneath his crown,
Propping his face with listless hand;
Watching the hour-glass sifting down
Too slow its shining sand.

"Poor man, what wouldst thou have of me?"
The beggar turned, and pitying,
Replied, like one in dream, "Of thee,
Nothing. I want the king."

Up rose the king, and from his head
Shook off the crown, and threw it by,
"O man, thou must have known," he said,
"A greater king than I."

Through all the gates, unquestioned then,
Went king and beggar hand in hand.
Whispered the king, "Shall I know when
Before *his* throne I stand?"

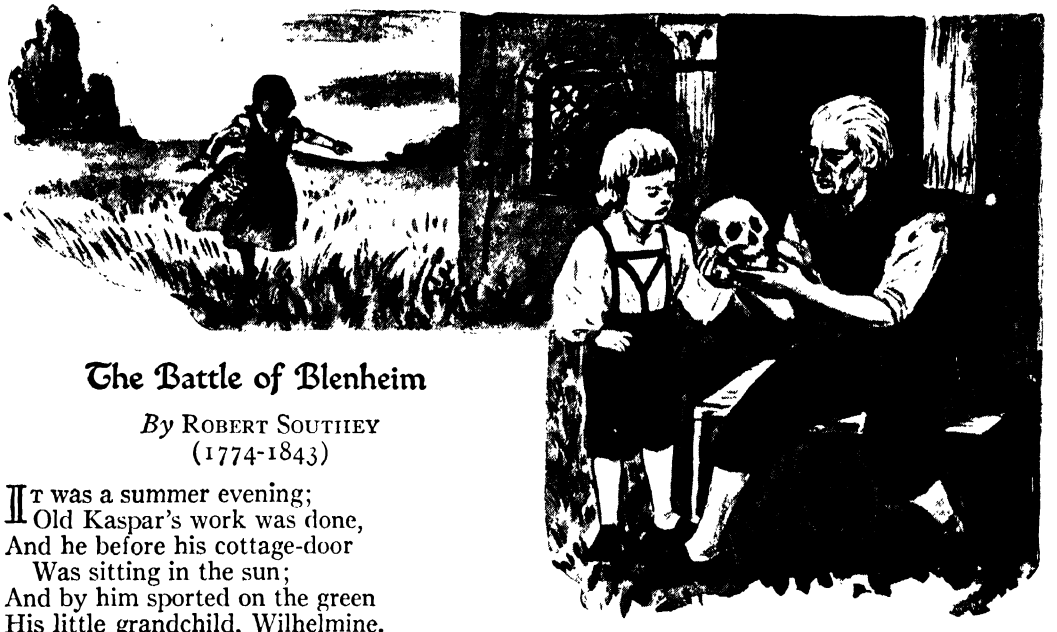
The beggar laughed. Free winds in haste
Were wiping from the king's hot brow
The crimson lines the crown had traced.
"This is his presence now."

At the king's gate the crafty noon
Unwove its yellow nets of sun;
Out of their sleep in terror soon
The guards waked one by one.

"Ho here! Ho there! Has no man seen
The king?" The cry ran to and fro;
Beggar and king, they laughed, I ween,
The laugh that free men know.

On the king's gate the moss grew gray;
The king came not. They called him dead;
And made his eldest son one day
Slave in his father's stead.

*By permission of the publishers, Little, Brown & Co.



The Battle of Blenheim

By ROBERT SOUTHEY
(1774-1843)

It was a summer evening;
Old Kaspar's work was done,
And he before his cottage-door
Was sitting in the sun;
And by him sported on the green
His little grandchild, Wilhelmine.

She saw her brother Peterkin
Roll something large and round,
That he beside the rivulet,
In playing there, had found:
She ran to ask what he had found,
That was so large and smooth and round.

Old Kaspar took it from the boy,
Who stood expectant by;
And then the old man shook his head,
And with a natural sigh,
" 'Tis some poor fellow's skull," said he
"Who fell in the great victory.

"I find them in my garden,
For there's many here about;
And often, when I go to plow,
The plowshare turns them out;
For many thousand men," said he,
"Were slain in that great victory."

"Now tell us what 'twas all about,"
Young Peterkin, he cries;
And little Wilhelmine looks up
With wonder-waiting eyes;
"Now tell us all about the war,
And what they fought each other for."

"It was the English," Kaspar cried,
"Who put the French to rout;
But what they fought each other for
I could not well make out;
But everybody said," quoth he,
"That 'twas a famous victory.

"My father lived at Blenheim then,
Yon little stream hard by;
They burned his dwelling to the ground,
And he was forced to fly;
So with his wife and child he fled,
Nor had he where to rest his head.

"With fire and sword the country round
Was wasted far and wide,
And many a childing mother then,
And new-born baby, died;
But things like that, you know, must be
At every famous victory.

"They say it was a shocking sight
After the field was won;
For many thousand bodies here
Lay rotting in the sun:
But things like that, you know, must be
After a famous victory.

"Great praise the Duke of Marlborough won
And our good Prince Eugene."
"Why, 'twas a very wicked thing!"
Said little Wilhelmine.
"Nay, nay, my little girl," quoth he,
"It was a famous victory.

"And everybody praised the Duke,
Who this great fight did win."
"But what good came of it at last?"
Quoth little Peterkin.
"Why, that I cannot tell," said he;
"But 'twas a famous victory."

How They Brought the Good News from Ghent to Aix

By ROBERT BROWNING (1812-1889)

I SPRANG to the stirrup, and Joris, and he;
I galloped, Dirck galloped, we galloped all three;
"Good speed!" cried the watch, as the gate-bolts undrew;
"Speed!" echoed the wall to us galloping through;
Behind shut the postern, the lights sank to rest,
And into the midnight we galloped abreast.

Not a word to each other; we kept the great pace
Neck by neck, stride by stride, never changing our place;
I turned in my saddle and made its girths tight,
Then shortened each stirrup, and set the pique right,
Rebuckled the cheek-strap, chained slacker the bit,
Nor galloped less steadily Roland a whit.

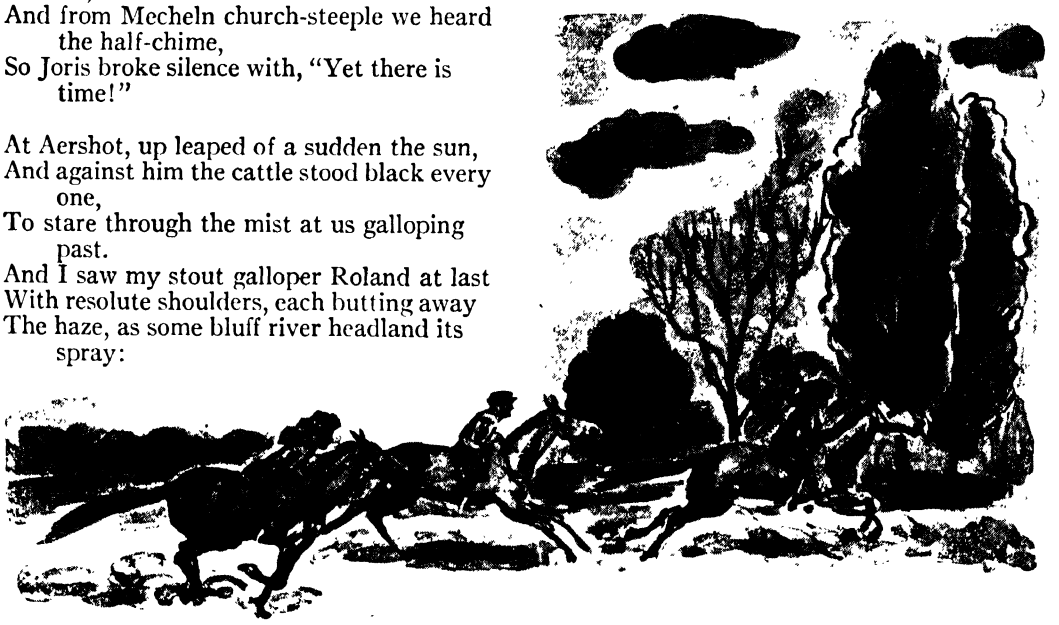
'Twas moonset at starting; but while we drew near
Lokeren, the cocks crew and twilight dawned clear;
At Boom, a great yellow star came out to see;
At Düffeld, 'twas morning as plain as could be;
And from Mecheln church-steeple we heard the half-chime,
So Joris broke silence with, "Yet there is time!"

At Aershot, up leaped of a sudden the sun,
And against him the cattle stood black every one,
To stare through the mist at us galloping past.
And I saw my stout galloper Roland at last
With resolute shoulders, each butting away
The haze, as some bluff river headland its spray:

And his low head and crest, just one sharp ear bent back
For my voice, and the other pricked out on his track;
And one eye's black intelligence,—ever that glance
O'er its white edge at me, his own master, askance!
And the thick heavy spume-flakes which aye and anon
His fierce lips shook upwards in galloping on.

By Hasselt, Dirck groaned; and cried Joris "Stay spur!
Your Roos galloped bravely, the fault's not in her,
We'll remember at Aix"—for one heard the quick wheeze
Of her chest, saw the stretched neck and staggering knees,
And sunk tail, and horrible heave of the flank,
As down on her haunches she shuddered and sank.

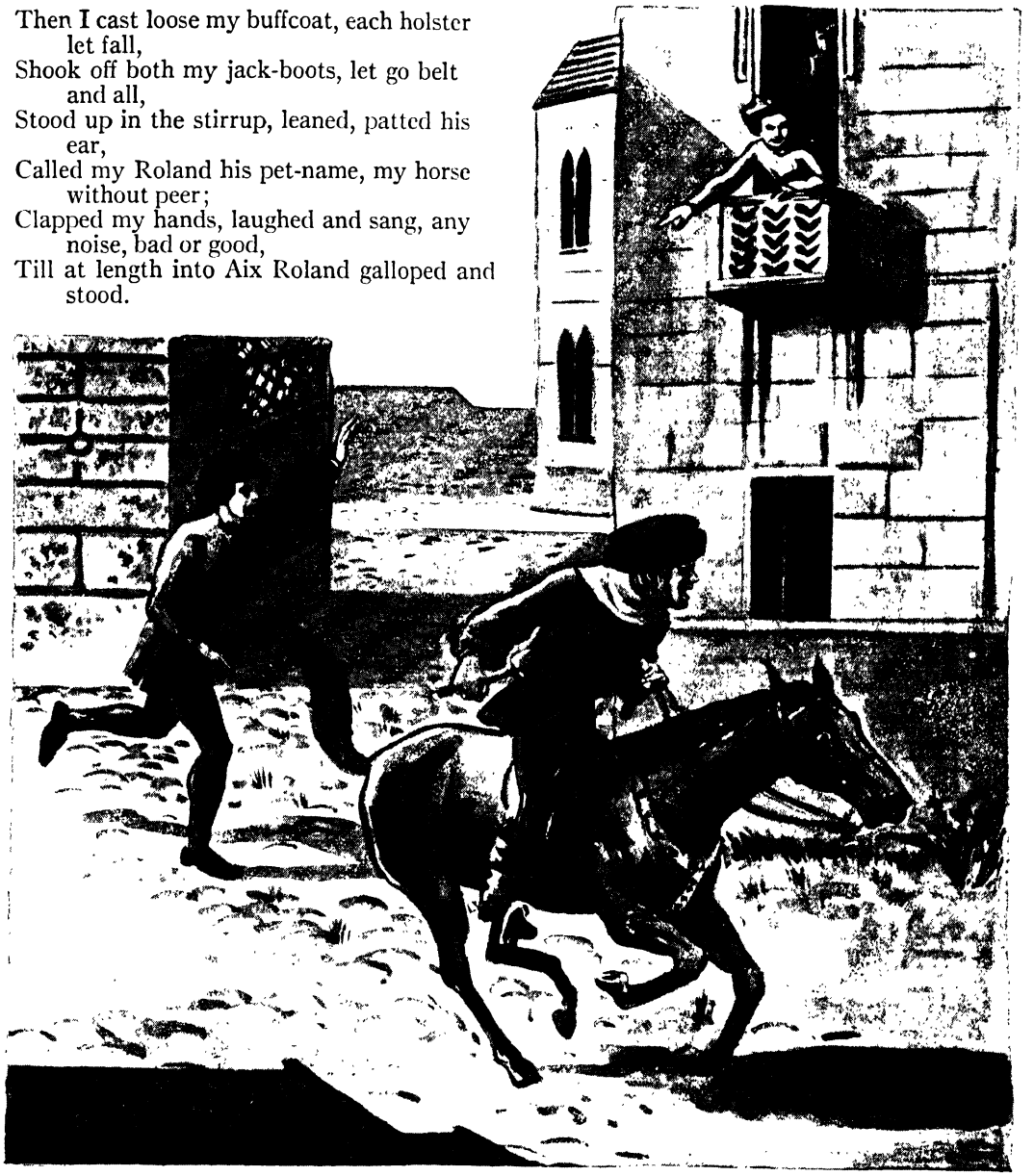
So, we were left galloping, Joris and I,
Past Looz and past Tongres, no cloud in the sky;
The broad sun above laughed a pitiless laugh,
'Neath our feet broke the brittle bright stubble like chaff;
Till over by Dalhem a dome-spire sprang white,
And "Gallop," gasped Joris, "for Aix is in sight!

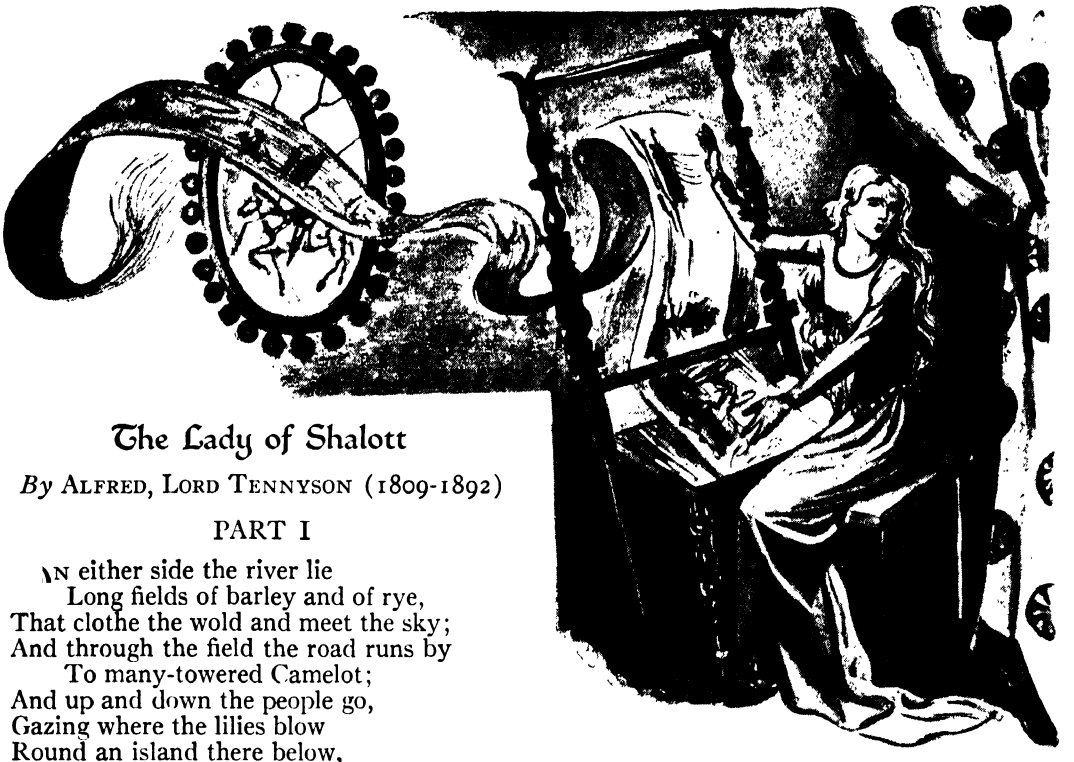


"How they'll greet us!"—and all in a moment his roan
Rolled neck and croup over, lay dead as a stone;
And there was my Roland to bear the whole weight
Of the news which alone could save Aix from her fate,
With his nostrils like pits full of blood to the brim,
And with circles of red for his eye-sockets' rim.

Then I cast loose my buffcoat, each holster let fall,
Shook off both my jack-boots, let go belt and all,
Stood up in the stirrup, leaned, patted his ear,
Called my Roland his pet-name, my horse without peer;
Clapped my hands, laughed and sang, any noise, bad or good,
Till at length into Aix Roland galloped and stood.

And all I remember is,—friends flocking round
As I sat with his head 'twixt my knees on the ground;
And no voice but was praising this Roland of mine,
As I poured down his throat our last measure of wine,
Which (the burgesses voted by common consent)
Was no more than his due who brought good news from Ghent.





The Lady of Shalott

By ALFRED, LORD TENNYSON (1809-1892)

PART I

ON either side the river lie
Long fields of barley and of rye,
That clothe the wold and meet the sky;
And through the field the road runs by
To many-towered Camelot;
And up and down the people go,
Gazing where the lilies blow
Round an island there below,
The island of Shalott.

Willows whiten, aspens quiver,
Little breezes dusk and shiver
Through the wave that runs for ever
By the island in the river
Flowing down to Camelot.
Four gray walls, and four gray towers,
Overlook a space of flowers,
And the silent isle embowers
The Lady of Shalott.

By the margin, willow-veiled,
Slide the heavy barges trailed
By slow horses; and unhailed
The shallop flitteth silken-sailed
Skimming down to Camelot:
But who hath seen her wave her hand?
Or at the casement seen her stand?
Or is she known in all the land,
The Lady of Shalott?

Only reapers, reaping early
In among the bearded barley,
Hear a song that echoes cheerly
From the river winding clearly,
Down to towered Camelot:
And by the moon the reaper weary,
Piling sheaves in uplands airy,
Listening, whispers "'Tis the fairy
Lady of Shalott."

PART II

There she weaves by night and day
A magic web with colors gay.
She has heard a whisper say,
A curse is on her if she stay
To look down to Camelot.
She knows not what the curse may be,
And so she weaveth steadily,
And little other care hath she,
The Lady of Shalott.

And moving through a mirror clear
That hangs before her all the year,
Shadows of the world appear.
There she sees the highway near
Winding down to Camelot:
There the river eddy whirls,
And there the surly village-churls,
And the red cloaks of market girls,
Pass onward from Shalott.

Sometimes a troop of damsels glad,
An abbot on an ambling pad,
Sometimes a curly shepherd-lad,
Or long-haired page in crimson clad,
Goes by to towered Camelot;
And sometimes through the mirror blue
The knights come riding two and two:
She hath no loyal knight and true,
The Lady of Shalott.

But in her web she still delights
To weave the mirror's magic sights,
For often through the silent nights
A funeral, with plumes and lights
And music, went to Camelot:
Or when the moon was overhead,
Came two young lovers lately wed;
"I am half sick of shadows," said
The Lady of Shalott.

PART III

A bow-shot from her bower-eaves,
He rode between the barley-sheaves,
The sun came dazzling through the leaves,
And flamed upon the brazen greaves
Of bold Sir Lancelot.
A red-cross knight for ever kneeled
To a lady on his shield,
That sparkled on the yellow field,
Beside remote Shalott.

The gemmy bridle glittered free,
Like to some branch of stars we see
Hung in the golden Galaxy.
The bridle bells rang merrily
As he rode down to Camelot;
And from his blazoned baldric slung
A mighty silver bugle hung,
And as he rode his armor rung,
Beside remote Shalott.

All in the blue unclouded weather
Thick-jeweled shone the saddle-leather,
The helmet and the helmet-feather
Burned like one burning flame together,
As he rode down to Camelot;
As often through the purple night,
Below the starry clusters bright,
Some bearded meteor, trailing light,
Moves over still Shalott.

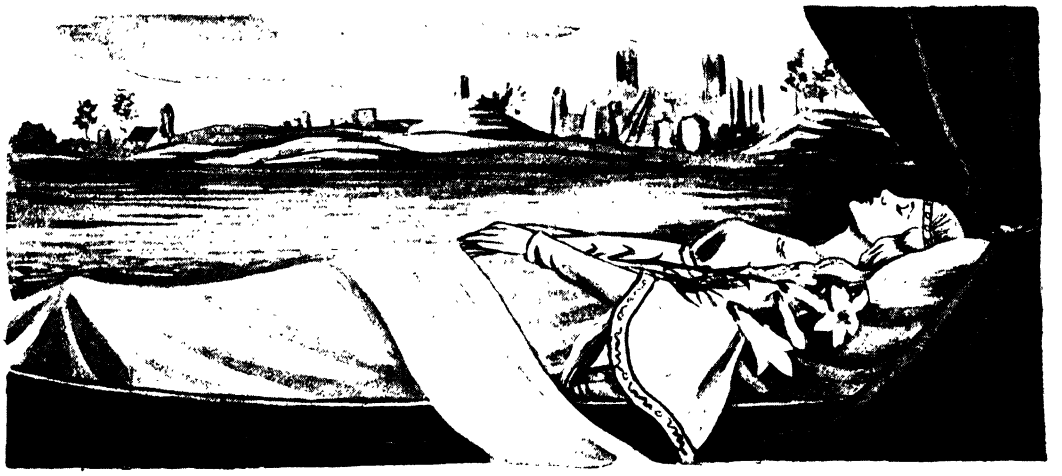
His broad clear brow in sunlight glowed;
On burnished hooves his war-horse trode;
From underneath his helmet flowed
His coal-black curls as on he rode,
As he rode down to Camelot.
From the bank and from the river
He flashed into the crystal mirror,
"Tirra lirra," by the river
Sang Sir Lancelot.

She left the web, she left the loom,
She made three paces through the room,
She saw the water-lily bloom,
She saw the helmet and the plume,
She looked down to Camelot.
Out flew the web and floated wide;
The mirror cracked from side to side;
"The curse is come upon me!" cried
The Lady of Shalott.

PART IV

In the stormy east-wind straining,
The pale yellow woods were waning,
The broad stream in his banks complaining,
Heavily the low sky raining
Over towered Camelot;
Down she came and found a boat
Beneath a willow left afloat,
And round about the prow she wrote
The Lady of Shalott.

And down the river's dim expanse—
Like some bold seer in a trance,
Seeing all his own mischance—
With a glassy countenance
Did she look to Camelot.
And at the closing of the day
She loosed the chain, and down she lay;
The broad stream bore her far away,
The Lady of Shalott.



Lying, robed in snowy white
That loosely flew to left and right—
The leaves upon her falling light—
Through the noises of the night
She floated down to Camelot:
And as the boat-head wound along
The willowy hills and fields among,
They heard her singing her last song,
The Lady of Shalott.

Heard a carol, mournful, holy,
Chanted loudly, chanted lowly,
Till her blood was frozen slowly,
And her eyes were darkened wholly,
Turned to towered Camelot;
For ere she reached upon the tide
The first house by the water-side,
Singing in her song she died,
The Lady of Shalott.

Under tower and balcony,
By garden-wall and gallery,
A gleaming shape she floated by,
Dead-pale between the houses high,
Silent into Camelot.
Out upon the wharfs they came,
Knight and burgher, lord and dame,
And round the prow they read her name,
The Lady of Shalott.

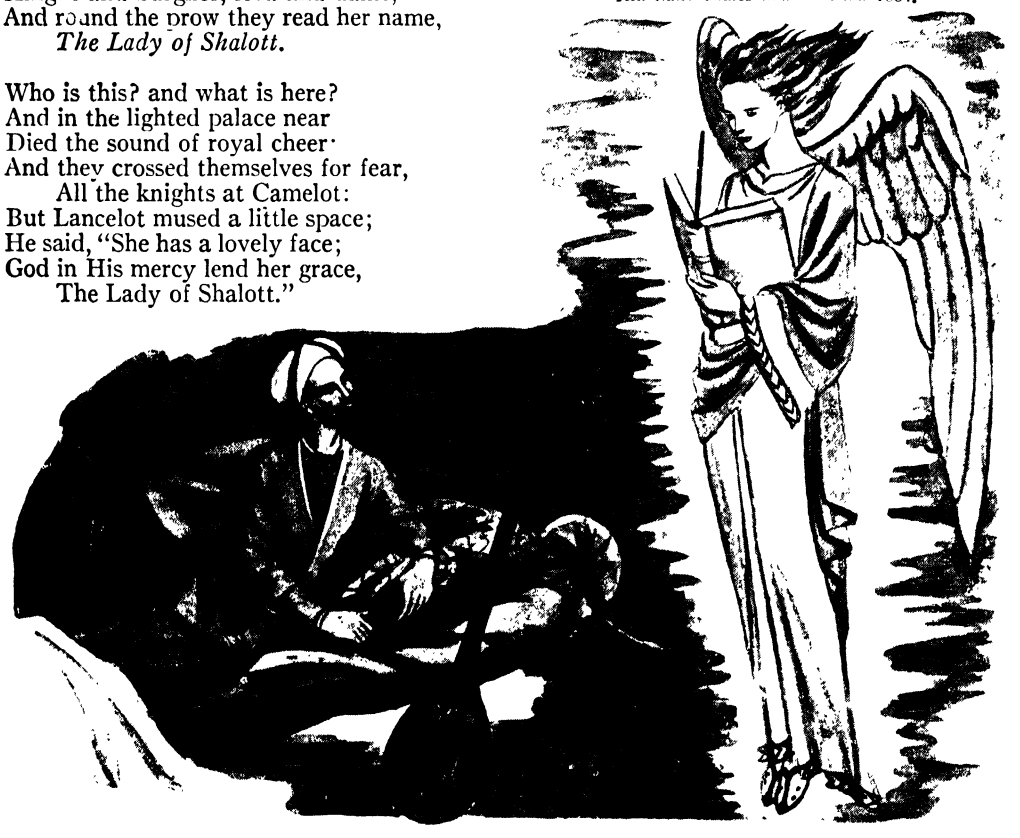
Who is this? and what is here?
And in the lighted palace near
Died the sound of royal cheer;
And they crossed themselves for fear,
All the knights at Camelot:
But Lancelot mused a little space;
He said, "She has a lovely face;
God in His mercy lend her grace,
The Lady of Shalott."

Abou Ben Adhem

By LEIGH HUNT *(1784-1859)*

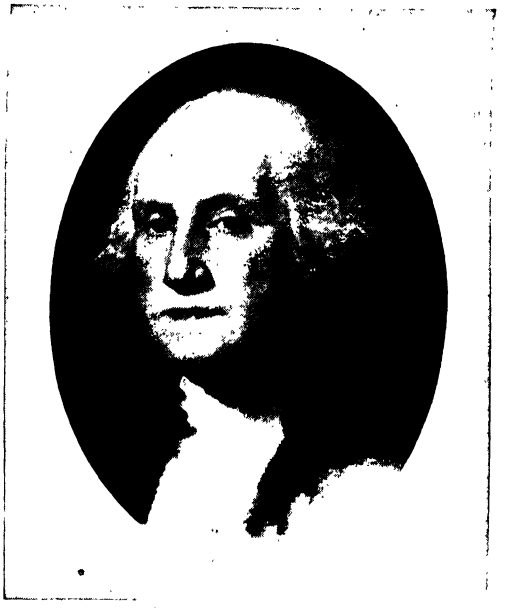
ABOU Ben Adhem (may his tribe increase!)
Awoke one night from a deep dream of peace,
And saw, within the moonlight in his room,
Making it rich, and like a lily in bloom,
An angel writing in a book of gold:—
Exceeding peace had made Ben Adhem bold,
And to the Presence in the room he said,
"What writest thou?"—The vision raised its head,
And with a look made of all sweet accord,
Answered, "The names of those who love the Lord."
"And is mine one?" said Abou. "Nay, not so,"
Replied the Angel. Abou spoke more low,
But cheerly still; and said, "I pray thee, then,
Write me as one that loves his fellow-men."
The Angel wrote, and vanished. The next night
It came again with a great wakening light,
And showed the names whom love of God had blessed,
And lo! Ben Adhem's name led all the rest.

THE NEXT POEMS ARE ON PAGE 1884.





Abraham Lincoln



Courtesy, Museum of Fine Arts, Boston
George Washington

TWO FAMOUS PRESIDENTS

THIRTY-TWO men have served as president of the United States since our government began in 1789. You will find something about every one of them in different places in our book, but here we shall tell you more about the two who stand at the top of our honor roll, George Washington and Abraham Lincoln.

On February 22, 1732, in a homestead in Westmoreland County, Virginia, a boy was born who was to alter the history of a nation. The name of that boy was George Washington. His father died when the boy was eleven years of age, and he spent much of his time at the home of his half-brother, Lawrence. Good schools were not common then, and the future president did not attend at all after he was eleven years old. His brother Lawrence, who was fourteen years his senior, had been fighting abroad, and had great influence upon his younger brother, whom he dearly loved. There is a story that Lawrence secured for his brother a commission in the British navy, but that his mother's tears prevented him from accepting. We know that he visited the West Indies with his brother.

When he was but sixteen, the real work of Washington's life began. He was placed in charge of the survey of the estate of Lord Fairfax in the Shenandoah Valley. With but one companion, another young lad by the name of George Fairfax, he started out on horseback to ride to the Shenandoah Valley, a distance of 100 miles through the forest. Upon their return to Mount Vernon, Lord Fairfax was so much pleased with Washington's work that he had him appointed a public surveyor. For the next few years the young man's life was spent largely in the forests. He was gaining self-reliance and a knowledge of the country that was to stand him in good stead in the days to come.

There soon came to Washington an opportunity to prove his pluck and perseverance. For years there had been a dispute between the French and the English as to the right of each nation to occupy the Ohio Valley. The French were invading the country that the English claimed belonged to them. It was decided to send a trusty messenger from Governor Dinwiddie, of Virginia, to the French commander to remonstrate with him for building forts upon English land. Washington willingly accepted the task. A journey of 1,000 miles through a trackless wilderness

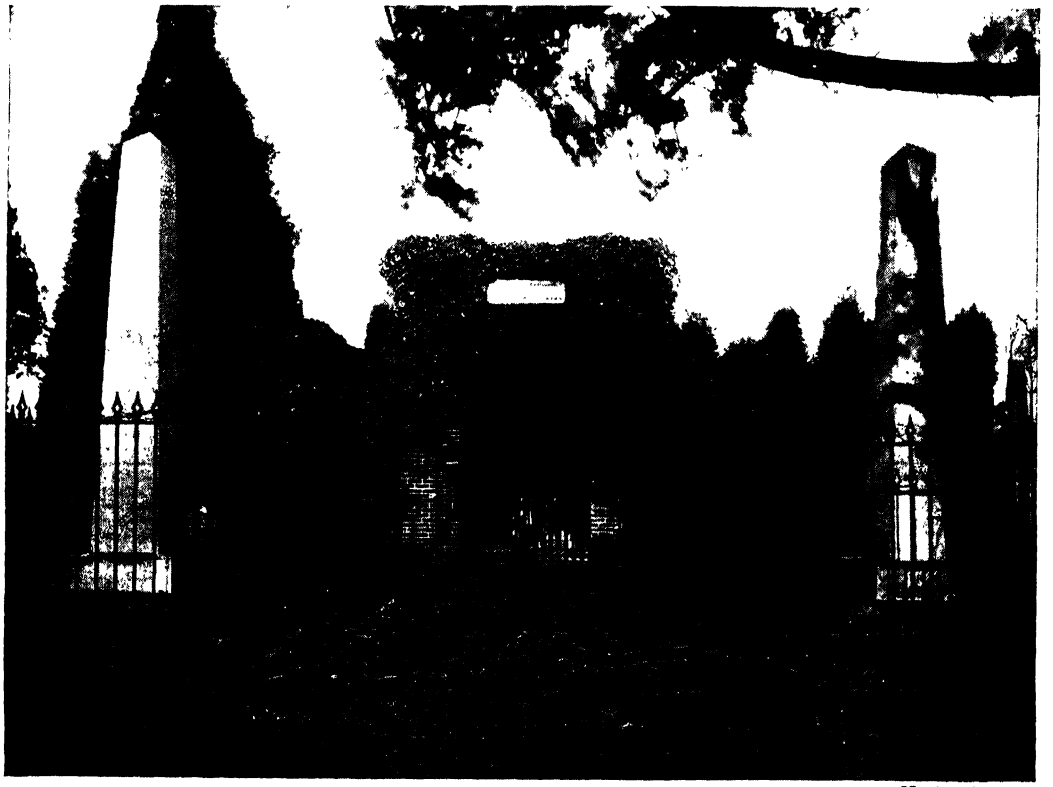
in the dead of winter was an undertaking to cool the ardor of the most courageous; but Washington with a little party boldly plunged on through dark forests, over steep snowbound mountains and swollen rivers, until the end of his journey was reached.

The French were very polite, but showed that they intended to stay where they were, and the little party turned homeward. The horses soon became too weak to stand, and leaving them behind, Washington pushed on ahead with a single companion—their packs strapped to their backs and their guns in their hands. Upon reaching the Allegheny River, which they had expected to cross on the ice, they found, to their dismay, that it was broken up and filled with whirling, grinding blocks of ice. With one hatchet between them Washington and his companion managed to build a rough raft. Desperately they struggled with the swirling current and the floating ice cakes. As they reached the middle of the stream, the raft suddenly heaved and Washington was hurled into the icy water. Instinctively he clutched a log, and by the greatest effort managed to reach a near-by island. Here the travelers tramped back and forth through the long darkness of night, their clothes stiffening to ice as the bitter wind searched them out.

When morning came, they crossed to the other shore, and from there they hurried on to Williamsburg, then the capital of Virginia, to deliver to Governor Dinwiddie the letter from the French commander. This courage was characteristic of Washington's whole life. In the French and Indian War that followed, he served bravely and well until the end of 1758, when the war in the South and West was over.

In 1759 he married an attractive young widow, Martha Custis, to whom he had lost his heart upon first sight. Years of married happiness were passed on his broad lands at Mount Vernon before the country again called him to the front.

After the French and Indian War the disputes with Great Britain grew more bitter, and Washington was chosen as a delegate to both the First and Second Continental Congress. After the battle of Lexington, Congress determined that an army must be or-



National Photo

At Mount Vernon, on the estate where he lived beside the Potomac River, George Washington, first of our presidents, is buried in a modest tomb. The great of many lands go there to pay homage to his memory.

ganized to defend the rights of the colonists. A leader was necessary, and on June 15, 1775, Washington was unanimously elected Commander-in-chief. On July 3, amid the shouting of the multitude and the roar of artillery, Washington took command of the men who had gathered around Boston.

These men had come from their farms at the news of trouble; they were without uniforms or camp equipment; their arms were their own rifles, and bullets which fitted the weapon of one man could not be used in that of his neighbor. They had not enlisted in an army; they had come to defend their country. It was Washington's task to make an army of this gathering and then lead it in battle.

THE SUFFERINGS OF HIS MEN AT VALLEY FORGE SORELY TRIED WASHINGTON'S HEART

The soldiers he commanded were brave and patriotic, but they were not disciplined. Yet they had to meet the deadly fire of the king's regulars, and it sorely tried their general's heart to see how dearly they must pay for their lack of experience and training. Ammunition and firearms were scarce; food and clothing were almost unobtainable. During the winter of 1777-78 at Valley Forge many of the soldiers went barefoot, leaving bloody tracks behind them in the snow. The piteous, uncomplaining courage of these poor fellows wrung tears from the man who had said of the battle's roar, "I heard the bullets whistle, and, believe me, there is something charming in the sound."

The American army, under its brave commander, spurred itself to remarkable deeds until, with the aid of France, the war ended in the surrender of Cornwallis. Soon America was free.

OUR FIRST PRESIDENT WAS INAUGURATED ON APRIL 30, 1789, IN NEW YORK

On December 28, 1783, Washington offered his resignation and retired once more to his home at Mount Vernon, but he was not to be allowed to remain in peaceful obscurity. He was chosen to preside over the convention which framed the Constitution. When the Constitution was adopted, a president of the newly formed nation was necessary. There was but one man who could fill the place. On April 30, 1789, Washington's inauguration took place. For eight years, two terms of office, he successfully guided the nation; and then, refusing a third term, he again retired to his old home at Mount Vernon to enjoy the rest he so well deserved.

One day when Washington had returned from a long ride around his plantation, he complained of a sore throat. The next day, December 14, 1799, the great man died.

Washington was not the greatest general that ever lived. Those of us who admire him most do not say that. He was more than a great general. He was a great man. He was a good soldier, a wise ruler, a true friend and an honest, unselfish man. He loved his country and was willing to make any sacrifice for it.

THE HUMBLE CHILDHOOD OF A GREAT PRESIDENT—ABRAHAM LINCOLN

Abraham Lincoln first saw the light February 12, 1809, in a little log cabin in Kentucky. The Lincoln family in some parts of the country was prominent, but this branch had come down in the world. The cabin was a ramshackle affair; the clearing in which it was built was rank with weeds; the few acres of corn that stretched away to the forest were choked with grass. The father, Thomas Lincoln, was a carpenter, but seems to have neglected his trade to wander through the woods, gun in hand and dog at heels. To the kind mother, Nancy Hanks Lincoln, was left almost the entire care of the little clearing, and to the wonderful energy and brave cheerfulness of this woman Lincoln owed the incentive of his life. "God bless my mother," he said in later years. "All that I am or ever hope to be, I owe to her."

When a log schoolhouse was opened in the neighborhood, Mrs. Lincoln sent young Abe and his sister to learn the alphabet and master the spelling book. "You must learn to read and write," she said wistfully, a gaunt, toil-worn hand upon each upturned little head. "You must get knowledge, so that when you grow up you will be wise and good."

THE TRAGEDY THAT CAME TO THE LITTLE PIONEER FAMILY

Lincoln's father was of a wandering disposition, and when Abraham was seven years old, the father moved his family to a farm in Indiana, then almost a wilderness. Here, in the late autumn, father and mother and little son all set to work with axes in their hands to make a clearing in the woods for their new home. Winter was almost upon them, and with more haste than care they built themselves "a half-faced camp" of logs.

In the autumn of 1818 a strange sickness broke out all over the countryside, killing men and cattle by the dozens. Mrs. Lincoln

was among the ones stricken. A week after she was taken ill, her husband and little son, with heavy hearts, built the rough pine coffin for the wife and mother who had loved them so well and served them so faithfully. A winter of dismal loneliness descended upon the Lincoln family. The children missed her piteously. Often their father was away for long hunting trips, leaving them alone in the cabin in the wilderness. Night would find the two huddled together, their ears straining for the sound of footsteps that did not come, and hearing only the dismal howling of the wild animals that prowled about in the darkness.

It was a happy day for them when their father brought home a new mother, with her son and two daughters. The new Mrs. Lincoln was a very capable woman and it was not long before she had the disorderly cabin spick and span. She brought with her some new furniture and a goodly array of bright pots and pans, and soon the place was fairly shining with a sweet wholesomeness and comfort it had never known before.

When Abraham was eleven years old, a schoolhouse was built not very far from their home, and the question again arose whether the boy should be allowed to attend. His father contended that a big, able-bodied boy like Abe was of more use on their little farm than he could ever be at school; but his new mother said, "No, the boy must be given an education." Abraham went to school, and this was the beginning of his love for books. His school life was irregular, for he was much needed on the farm. In all, he attended school hardly more than a year, but he never let an opportunity slip to read everything on which he could lay his hands. Many weary miles Abraham traveled to borrow books. After his day's work was ended he would read as long as it was light; then, lying on the floor in front of the fireplace, with the aid of the glowing coals, he would read on into the night, often writing his compositions on a wooden shovel with a piece of charcoal. When the surface was covered he was sometimes obliged to shave off the first part of his work to make room for the next part.

At nineteen, Lincoln made a trip in a flatboat down the Mississippi River to New Orleans. It was not long after this that the Lincoln family once more started on the trail. This time they moved to Illinois. There young Lincoln helped to build the log cabin, and to split rails to fence the fields. After another trip to New Orleans he took a position as clerk in charge of a store



Photograph, courtesy, Department of Public Works and Buildings, Illinois

Ann Rutledge read and studied with Lincoln and in 1835 they became engaged. In the same year she died, saddening her lover's life. Her grave is at Petersburg, near New Salem. The verse on the gravestone, by Edgar Lee Masters, begins "Out of me, unworthy and unknown, the vibrations of deathless music."



President Lincoln speaking at the exercises which dedicated the Gettysburg battleground as a national cemetery, on November 19, 1863, about four months after the great battle. The President's speech was the short, simple Gettysburg Address which is everywhere recognized as a perfect literary gem. It is given on page 1653.

in New Salem. When the Black Hawk War began in 1832, he was elected captain of a company, but he saw no hostile Indians. He then bought a little store but was not successful; and he did some land-surveying. For a time he served as postmaster in New Salem.

About this time he was a tall, gawky-looking fellow, wearing a wide-brimmed straw hat without a band, a homespun shirt and a claw-hammer coat, and tow trousers that did not meet his shoes by several inches." Strangers felt, when they looked at him, "this man is a clown." The moment he opened his mouth to speak, all consciousness of his uncouth appearance vanished from their minds. The people had so much confidence in him that they elected him to the legislature in 1834, and he was re-elected three times. Meanwhile he studied law, and was admitted to practice in 1836. In 1846 he was elected to Congress and served one term.

In 1842, when Lincoln was thirty-three years old, he had married Mary Todd, of whom you may read in Some Famous Ladies of the White House.

For several years after his return from Washington he devoted himself entirely to the practice of law; but in 1854, when the entire country was roused over the Kansas-Nebraska bill regarding the admission of slave states to the Union, Lincoln again came to the front and took an active part in public affairs. He protested that "slavery is founded on both injustice and bad policy." Then followed a number of famous debates between Lincoln and Stephen A. Douglas, the "Little Giant" of Western politics. Both were candidates for the United States Senate in 1858, and the debates caused much excitement. Douglas was elected, but Lincoln had gained a great reputation.

In 1860 Lincoln was nominated for the presidency by the Republican party, and was elected in November. Upon the news of his election the long-expected division of the nation upon the slave question occurred. South Carolina soon seceded, and others followed, until there were eleven states in the Confederacy.

In the beginning the new president did not even have the support of all in the North. Many were opposed to keeping states in the Union by force, and others dreaded the rule

of the new Republican party. Several leaders of the party were much better known than he, and some of them had expected to be named for the high office which had gone to the awkward, uneducated Westerner. They could not understand a man who told funny stories in such a time, for they did not see that every one of his stories had a point which illustrated the matter in hand. These people thought that the country was in the care of a man who could not save it.

The Civil War opened with the firing upon Fort Sumter by the Confederates, and the years that followed were full of trial and terror to the nation. Steadfast amid the clamor of his foes, Lincoln held to his purpose and policy to unite the North and South. But while the President toiled in the executive office, his heart was bleeding for his fellow-countrymen who were falling by the thousand on the field of battle. He had but one thought through all those dark years—the preservation of the Union.

On the first day of January, 1863, President Lincoln issued the Emancipation Proclamation, freeing all the slaves in the Confederate States of America. In 1864 he was re-elected to the presidency; and the war's end drew near.

With the sure hand of a leader of men he guided the nation into peace at last. General Lee surrendered at Appomattox, April 9, 1865. It was certain that there would be little more fighting. The President's purpose was accomplished, the Union was saved. The country went wild with joy. Bells were rung; and the people shouted the glad news to each other; while prayers of thanksgiving were offered up in the churches all over the land.

In the midst of rejoicing there came a great shock. While attending the theatre, in Washington, April 14, 1865, the President was shot in the head by an actor, John Wilkes Booth. He died the next morning. The nation was stunned by the news.

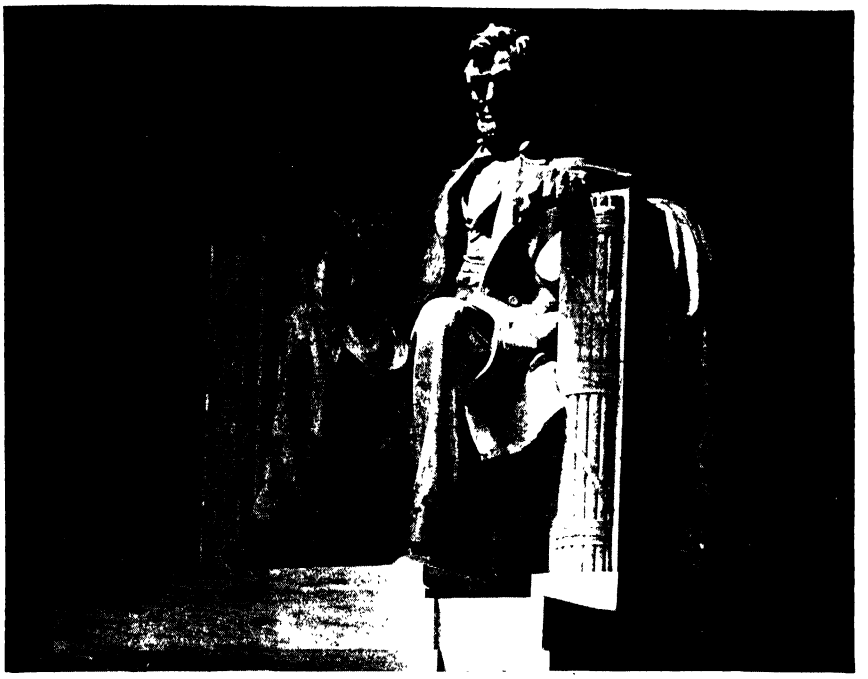
Of Abraham Lincoln, Robert Ingersoll wrote: "It is the glory of Lincoln that, having almost absolute power, he never abused it, except on the side of mercy. Wealth could not purchase, power could not awe, this divine, this loving man. He knew no fear except the fear of doing wrong. Hating slavery, pitying the master—seeking to conquer, not persons, but prejudices—he was the embodiment of self-denial, the courage, the hope and the nobility of a nation."

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 1694.



Photographs, courtesy Department of Public Works and Buildings, Illinois

William F. Berry and Abraham Lincoln bought three stores on credit and consolidated them, but the new firm soon failed. This is a reproduction of one of the stores where Lincoln also served as postmaster of the village.



This statue of Abraham Lincoln, which is in the Lincoln Memorial at Washington, D. C., is the work of Daniel Chester French. Photo, copyright, Harris & Ewing.

LINCOLN'S GETTYSBURG ADDRESS

Soon after the battle of Gettysburg, the field was dedicated as a national cemetery. On that occasion President Lincoln spoke the following words, which will endure forever as an expression of the spirit of the United States.

FOUR SCORE and seven years ago our fathers brought forth on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.

Now we are engaged in a great civil war; testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting-place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.

But, in a larger sense, we can not dedicate—we can not consecrate—we can not hallow—this ground. The brave men, living and dead, who struggled here have consecrated it, far above our poor power to add or detract. The world will little note, nor long remember what we say here, but it can never forget what they did here. It is for us the living, rather, to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us—that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion—that we here highly resolve that these dead shall not have died in vain—that this nation, under God, shall have a new birth of freedom—and that government of the people, by the people, for the people, shall not perish from the earth.

VIEWS IN CITY AND COUNTRY





One of the most important requirements for taking good pictures is the ability to "see" the picture before it is taken. These four views by an amateur photographer show imagination and considerable skill.







Figure 1. Two pictures on one film are sometimes amusing.

CAMERA FUN

TAKING pictures with a camera is one of the simplest and most delightful of pastimes. Few of us can make drawings of people and scenes, but with a camera we can obtain good pictures in a fraction of a second.

Picture making seems like magic, but there is nothing mysterious about a camera. In fact, your eye is a tiny camera that "takes a picture" whenever you look at something.

When your eye sees something, rays of light are reflected from the scene, through the lens of the eye, as you read in The Story of the Eye. Figure 2 shows what happens.

The camera also has a lens, which is like the lens of the eye except that it is made of curved glass. Some fine camera lenses are made of several thin pieces of glass, cemented together. Light passes through the camera lens when the shutter is opened, and an image is formed on the film at the back of the camera, as shown in figure 3.

It is interesting to note that the picture-images in both the eye and the camera are formed upside down. The brain turns the eye-picture right-side-up for us; and when we look at a picture made with a camera, we simply turn it until it is right-side-up in our hands.

To take pictures, we place a roll of photographic film in the camera. This film is coated on one side with a substance known as an *emulsion,* which is very sensitive to light. When an image or picture is flashed on this sensitive coating, by light passing through the lens, a chemical change takes place. An invisible picture known as a *latent image* has been formed. Now, if we place our film in a chemical solution called a *developer,* another change takes place and an image appears.

This film picture is called a *negative* because it is black wherever the scene was white. To obtain a *positive* picture, we place the film against a piece of sensitized paper and expose it to light. Then we *develop* the paper as if it were another piece of film, and the final result is a *print,* or finished picture.

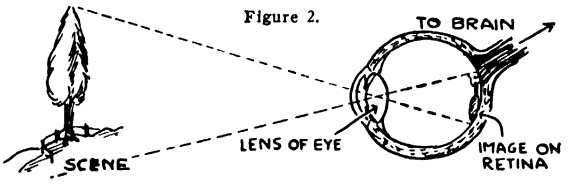


Figure 2.

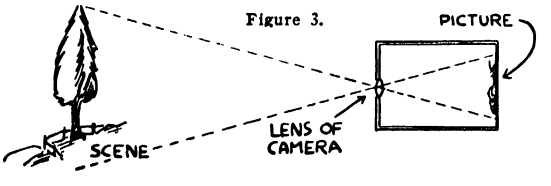


Figure 3.

There are many different kinds of cameras. Most of the inexpensive box or folding models are of the fixed focus or *universal*

focus type, and these are the easiest for the beginner to use. As you gain experience, you may want a folding camera with a choice of shutter speeds and a fast anastigmat lens. Such lenses are marked f.6.3, f.4.5, or even f.2. The smaller the number is, the faster the lens. These lenses make snapshots possible in weak light, and enable one to picture

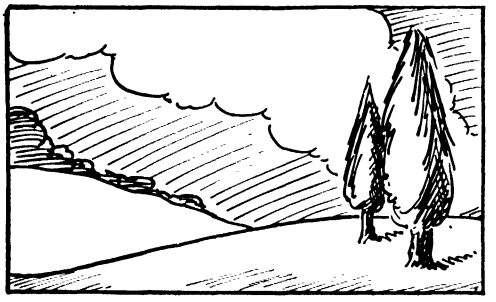


Figure 4.

rapid action. They also produce extremely sharp pictures, which make better enlargements.

Every camera is sold with an instruction booklet which the beginner should study carefully. You will have more fun with your camera if you learn all about it. It is better not to load the camera with film until you are familiar with all the adjustments. When you can operate the camera quickly and easily, you are ready to load it with film and begin making pictures.

Pictures may be made indoors or outdoors, on bright or dull days and even at night. For outdoor snapshots, or daylight pictures indoors, chrome type film is excellent. This is the kind of film to get for ordinary, everyday picture making. For pictures at night by artificial light use supersensitive pan film.

Outdoor pictures on bright days are easiest for the beginner, so we will make our first practice pictures under these conditions. If your camera is of the inexpensive box or folding type, the lens and shutter will require no special setting for these pictures. All you need to do is wind your film until the number 1 appears in the red window at the back of the camera. Then locate your subject in the view finder, and press the shutter lever. When the shutter clicks, the picture is made.

The view finder on your camera is your best guide to good pictures. The view finder does not take a picture, but it shows you in advance what the picture will be. This is because the camera lens and finder lens are adjusted to cover the same field of view.

Some cameras are equipped with two view finders—one on the side and one on the top. This makes it possible for you to see what you will get in either vertical or horizontal pictures. Figure 4 is a horizontal picture, with the camera held on its side; but for a view such as this, with tall trees and beautiful sky, the camera should be held so as to take a vertical picture. The dotted line in figure 5 shows what you would get if you held the camera on its side in this case.

Now, let us take some pictures. Check over the camera to make sure the film is wound, and the lens and shutter are set properly. The shutter should be set for a snapshot, not for a time exposure.

Let us first take a picture of the house. Select the sunny side, and stand back far enough so that the whole building shows in the view finder. Do not tilt the camera, or you may get a distorted view.

Press the shutter lever, holding the camera quite steady. When the shutter clicks, the picture is made. Now wind the film at once so that the number 2 shows in the red window. Always wind the film immediately after

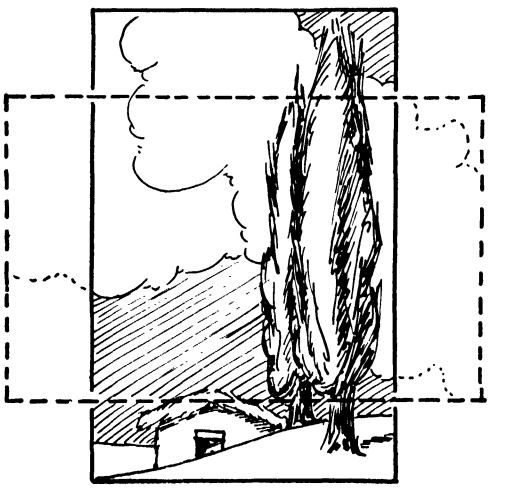


Figure 5.

taking a picture. If you should forget to wind it you would get two pictures on one film. These are known as *double exposures*, and spoil both pictures. See figure 1.

For the second picture, let us try a snapshot of the doorway. Of course you will have to move nearer to the house for the doorway picture, but instead of standing right in front of the door, step a little to one

side and see if that does not give a more pleasing view. Figure 6.

For our first pictures, we have chosen sunny subjects. Now let us try some in the shade. Since it is darker in the shade, there is less light to make a picture. That means the shutter of our box camera must stay open for a longer time, to let enough light in through the lens. Therefore, we set the shutter for a time exposure. We also must place the camera on a firm support, because if it should move during the time exposure the picture would be blurred.

Pictures of people in the shade are pleasing because there are no strong black shadows on the faces. For this picture, therefore, let us ask Mother to be the subject. If there is a flower bed on the shady side of the house, she can be plucking a flower, or pretending to loosen the earth with a trowel. The picture will be better if she is doing something, for then it tells a story.

Caution Mother not to move, for if she does the picture will be blurred. When everything is ready, gently press down the shutter release, to open the shutter. Then press the release again gently, without moving the camera, and the shutter will close. In open shade, with the sky clear and bright above the subject, the time exposure, that is, the time between opening and closing the shutter, can be quite short—about as fast as you can work the shutter. But under heavy shade trees or on a roofed porch, it is often necessary to make an exposure several seconds long. This is not difficult, but meanwhile, your subject must not move.

We have now taken three pictures on the first roll of film, and these illustrate most of the rules you will need to observe. Now you are ready to go ahead and select subjects of your own. You may try pictures of your dog peeping out of his kennel; pictures of your playmates or a snapshot of your sister giving a tea-party for her dolls on the lawn.

As a rule it is best not to have the subject exactly in the centre of the picture. It should be a bit away from the centre, and other things in the picture should guide the eye toward it. You should also avoid lines or objects which cut the picture into two parts.

The position of the sun is important in outdoor picture taking. It should never shine on the lens, because light then reflects inside the camera and causes streaks and *flare spots* on the pictures.

When shadows appear too black, especially in a picture of a person, you can soften

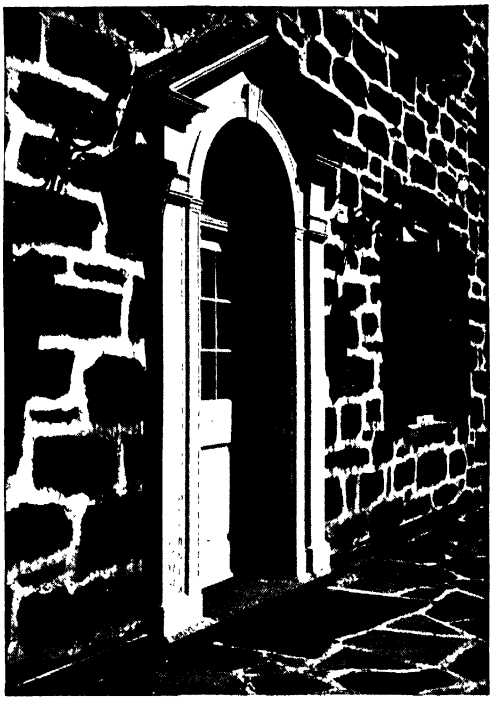


Figure 6.

them by placing a reflector near the subject. This reflector can be a sheet of white cardboard or newspaper—anything that will catch light and throw it back toward the subject. You may even have the person stand near a white wall, in such a position that light is reflected to his shaded side.

Snapshots indoors at night are easy after you have learned to take pictures outdoors. But you must provide plenty of light. The lights to use are electric bulbs called *photo-floods*. For a night snapshot with a box camera, two or three No. 2 photo-flood bulbs should be arranged in cardboard reflectors as shown in figure 7.

You will observe that the lights are fairly close to the subject. This is important. If you move the lights too far from the subject, you must make a time exposure instead of a snapshot. Another important point is to load the camera with supersensitive pan-chromatic film for night pictures, since this film is especially sensitive to artificial light.

In the beginning, you may make a few picture errors, but you will gain experience quickly and learn how to avoid these. Inspect your prints, observe any mistakes and try to correct them in the future. Here are a few common errors that may show up in the first prints that you make. These are

errors which most novices in photography make at some time or other:

If your box-camera pictures look blurred or fuzzy, you may have been too close to the subject. If you used a focusing camera, a blurred picture may mean that the distance mark was not set properly. Blurred pictures also occur if the subject moves quickly, or if you fail to hold the camera steady.

If your picture has no detail in the shadows, it is *underexposed,* which means that the light was too weak. If the picture has no detail in the bright parts, it is *overexposed.*

If trees or buildings or people seem to lean back or sidewise, it means you tilted the camera. Sometimes a photographer will do so purposely in order to secure an unusual effect. If you are not trying to secure an effect of this sort, you should keep your camera as level as possible.

While you can take acceptable snapshots from the start, it is always possible to improve the quality of your pictures by selecting snapshots that are most pleasing to the eye and also by choosing the viewpoint that presents them most interestingly.

Try to have each picture tell a story. For a picture to tell a story, the subject should be busy. For example, if your mother is the subject, you might show her reading or knitting. This makes a far more interesting snapshot than if she just sat and looked at the camera. Ask you subjects not to look at you, or, if possible, catch them before they know that you are snapping pictures. Good photographers like to take snapshots of this sort.

As we mentioned before, you must always bear in mind the position of the sun in taking outdoor snapshots. Various positions of the sun will produce entirely different shadow effects. There will be short, dark shadows at noon and long slanting shadows in early morning or late afternoon. These differently shaped shadows sometimes completely change the appearance of a scene.

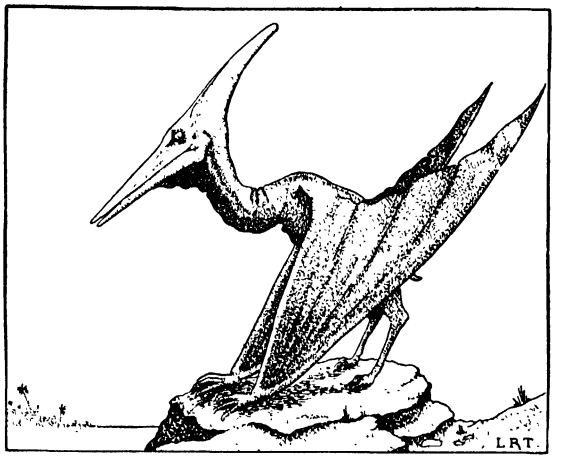
Article and Illustrations furnished by The Eastman Kodak Company.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 1765.



Figure 7. An interesting indoor snapshot.

THE CRETACEOUS PERIOD



Pteranodon, a Cretaceous pterodactyl, had a wing-spread of from fifteen to twenty feet.

THE Cretaceous period receives its name from the great deposits of chalk which are exposed on either side of the English Channel. It was here in southern England and northern France that these formations were first studied. However, it must be understood that chalk is the exception and not the rule in this period.

The Cretaceous was a long period and is divided into an Upper, or Later, and a Lower Cretaceous. During some of the period, a great part of North America was under water. The Gulf of Mexico overflowed and covered most of the southern United States, Cuba and Mexico. Texas, Oklahoma, Kansas and Wyoming gradually sank, and the waters crept across Canada and Alaska to join the Arctic Ocean. This great inland waterway known as the Colorado Sea, was more than a thousand miles across at its widest point, between Idaho and Wisconsin. Eastern Canada and the northeastern United States remained above sea level.

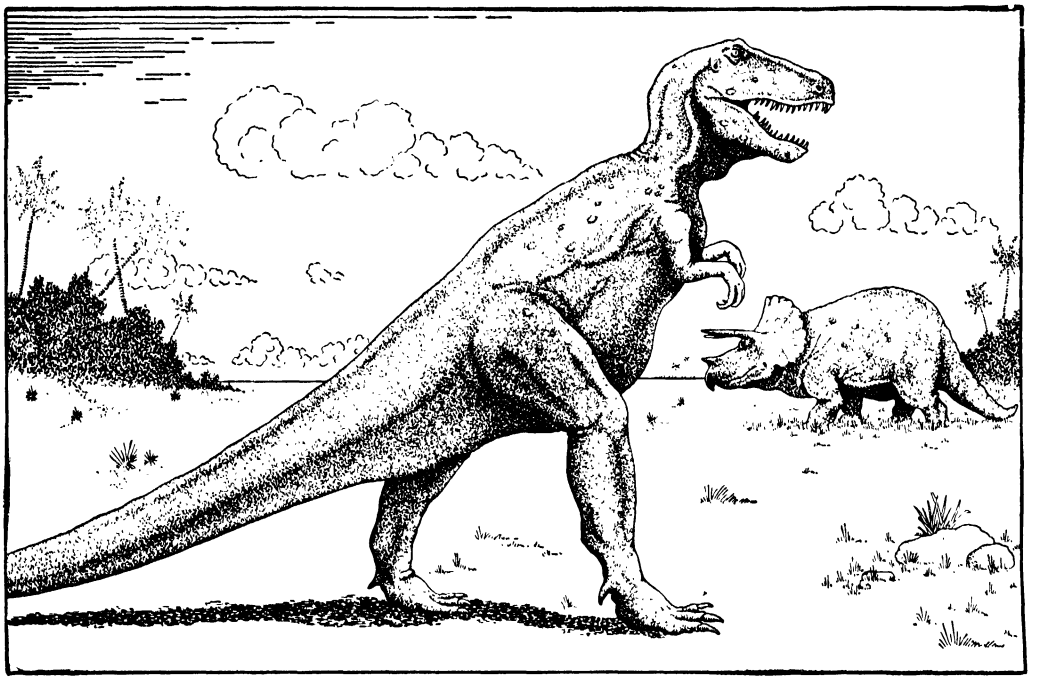
During the Cretaceous period, most of Europe was under water, and in the water the rocks were being deposited either as sandstone, clay or chalk, so that we find Cretaceous rocks in detached areas over most of the continent, giving a record of the seas, lakes and rivers of the period. A map of Europe at that time would show the greater part of Spain, Italy, and the whole of Belgium, Holland, Prussia, Hungary, Switzerland, Rumania and north Russia as an almost continuous sheet of water. According to geologists this flooding of the land during the Cretaceous was probably the most marked spreading of the oceans that has ever occurred.

Cretaceous rocks are found not only in Europe but all over the world—in the Arctic regions, India, Japan, North America, South America, Australia and New Zealand. In California there are strata of Cretaceous rock as thick as thirty thousand feet. During parts of the period, the seas were very shallow, and some of them became fresh. The rich coal beds of Alberta were laid down during this period.

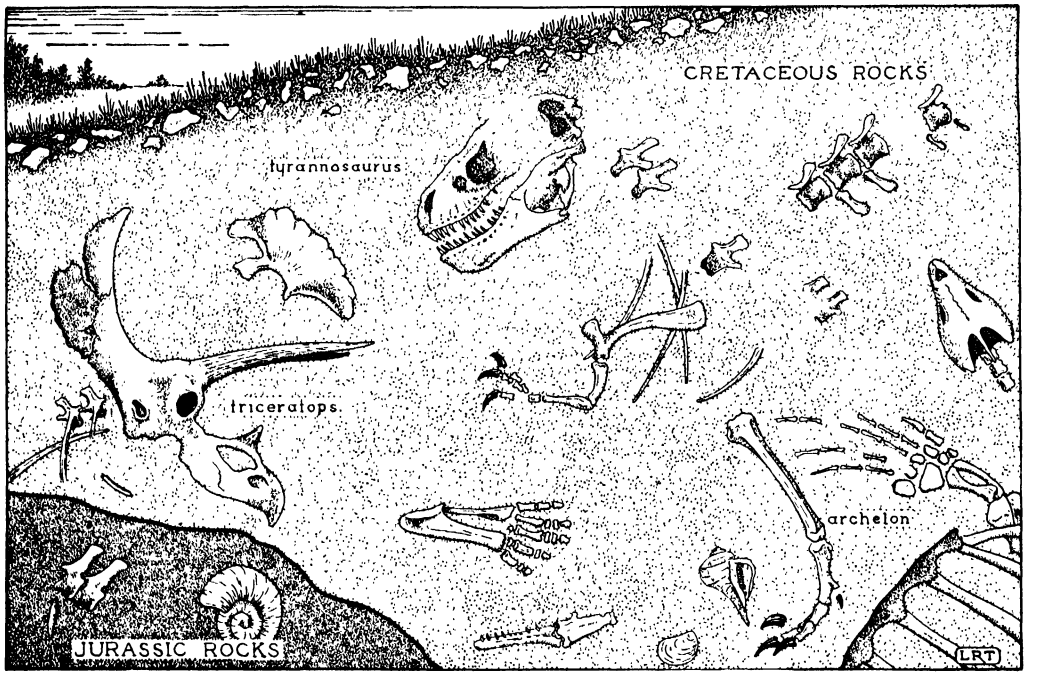
The chalk rocks, like most other limy rocks, are composed of the limy shells of myriads of microscopic sea creatures. If a little chalk is ground up with water, it will be found to be full of these tiny shells (foraminifera), so small that about two thousand placed end to end stretch only about an inch. A cubic inch of this chalk will contain thousands of millions of shells. The seas of the period must have been swarming with these tiny sea creatures, and in the course of ages they accumulated on the floor of the sea and formed the white cliffs of Dover and all the other chalky rocks that we see now in the Cretaceous System. Because chalk beds formed during any period other than the Cretaceous are seldom found, this period is often known as the Age of Chalk.

The vegetation of the Cretaceous period is of special interest, for it was in the middle of this period that the first flowering plants appeared. These plants quickly spread throughout the world and took the place of the horsetails, ferns and cycads as rulers of the plant kingdom. The Cretaceous forests must have been very much like the forests we know to-day, although much richer and more luxuriant. Magnolias, myrtles, tulip trees, sassafras, oaks, beeches, elms, willows, palms and many other modern trees flourished in the warm, moist climate. When

LIFE AND REMAINS OF THE CRETACEOUS



Here are two of the monster lizards that roamed the plains of the western United States during the Cretaceous period. In the foreground is tyrannosaurus, the fiercest creature that ever lived. Behind him stands triceratops, the three-horned dinosaur, who was one of the last of the great reptiles to die out.



This is a section through the Cretaceous rocks, showing the remains of some of the great beasts that lived then. The skull of tyrannosaurus is over four feet long and that of triceratops may have been as long as almost eight feet. In the right hand corner are the remains of archelon, the giant turtle of Cretaceous seas.

they died, they left impressions in the deposits of the Cretaceous period so that we have a record of them today. The Cretaceous rocks of northern Greenland have yielded up nearly two hundred species of plants, among them the breadfruit tree, which now grows only in tropical regions. More than a thousand Cretaceous plants have been discovered in North America. Because the flowering plants spread over the world so rapidly, the plants of Europe during this period were about the same as those growing in Greenland and North America.

The Cretaceous seas swarmed with life. In addition to the foraminifera, sponges, star-fish, sea-urchins, corals, polyzoa and crustaceans abounded. Sharks were quite common. Probably the largest fish was portheus, which reached a length of from eighteen to twenty feet and had a jaw a yard long, every inch of which was lined with long, sharp teeth.

SOME STRANGE REPTILES OF THE CRETACEOUS SEAS

Like the Jurassic, the Cretaceous period was an age of great lizards. One of the most interesting of these was the mosasaurus, which, when first discovered at Maestricht in Holland in 1780, was a great puzzle to the naturalists. At various times it was considered a fish, a whale and a crocodile. It was left for the genius of Cuvier to identify it as a reptile. The mosasaurus first found was only twenty-four feet long, but specimens have since been discovered about fifty feet long. These great creatures had fin-like paddles with which they propelled themselves through the sea. Like snakes, they had sharply pointed teeth on their upper jaws which were enormous and jointed in such a way as to allow them to gape horribly and to swallow tremendous morsels. They must have been very formidable creatures. At the close of the Cretaceous they completely disappeared.

An amazing creature, too, was the elasmosaurus, which has been found in the chalk deposits of Kansas. It was sometimes fifty feet long, twenty feet forming a slender neck. It has been said that it probably often swam many feet below the surface "raising the head to the distant air for a breath, then withdrawing it and exploring the depths forty feet below without altering the position of its body."

Another sea-dweller of the Cretaceous period, the turtle, has left a great number of descendants. The largest Cretaceous turtle is called archelon. It was twelve feet long and almost as wide. It swam by means of large flippers half as long as the body.

The iguanodon may perhaps be considered one of the most characteristic land reptiles of the period. It was first discovered in the Cretaceous rocks of Sussex; but no less than twenty-nine of them were found in a Belgian coal-mine. It was a herbivorous, or plant-eating animal, thirty or more feet long from nose to tip of tail, had a duck-like bill, and walked on its hind legs like a kangaroo. In the Royal Museum in Brussels nine skeletons of these strange creatures are mounted in one room. A North American relative of the iguanodon was the trachodon, a reptile that was as common during the Cretaceous period as deer were a few years ago. There is on exhibit at the American Museum of Natural History in New York the mummified remains of a trachodon. When he died millions of years ago, this animal must have lain exposed to the hot sun in a dry climate until his body was completely dried out and mummified. Then it was covered over by wind-blown sand which eventually became solidified into rock and preserved this unusual specimen. The trachodon skin was not so very different from the skin of some of our modern lizards.

THE MOST TERRIBLE CREATURE THAT EVER WALKED THE EARTH

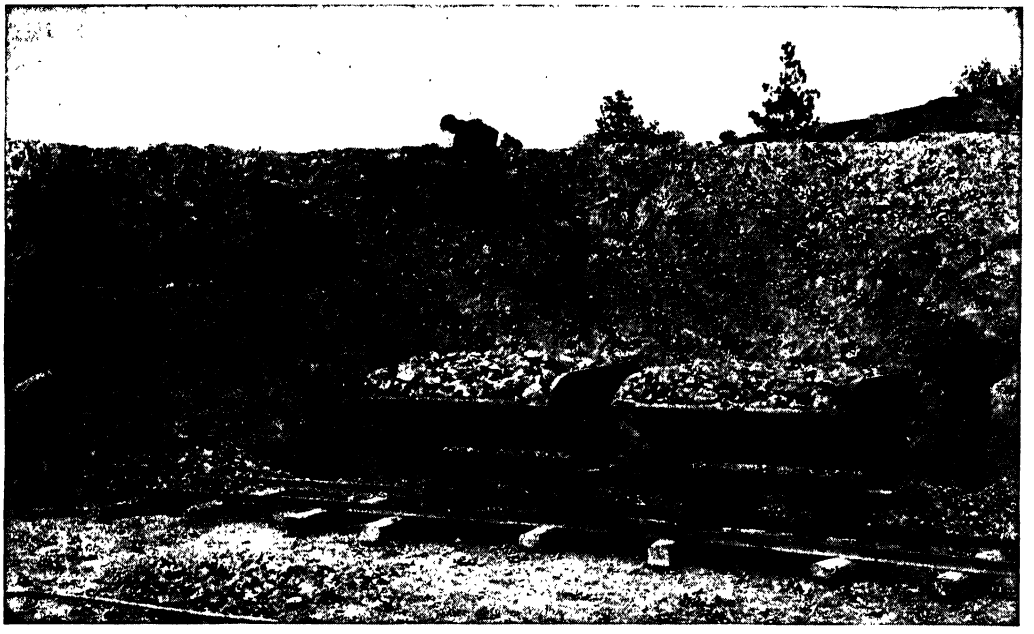
Another Cretaceous dinosaur, tyrannosaurus rex, "King of the Tyrant Reptiles," has been described as the most destructive life engine that ever lived. He roamed the ancient plains of Montana and Wyoming. His head towered from eighteen to twenty feet above the ground and his entire body was almost fifty feet long. His jaws were armed with curved, pointed, and double-edged teeth, the longest of which was six inches. Great claws enabled him to rend the flesh of his victims.

One of the most curious dinosaurs of the Cretaceous was the triceratops, a creature with a skull eight feet long and armed with three horns. Two of these horns were above his eyes and another grew from the middle of his snout. His skull projected backward over his neck to form a great bony collar that must have furnished an excellent protection against the attacks of such fierce animals as tyrannosaurus.

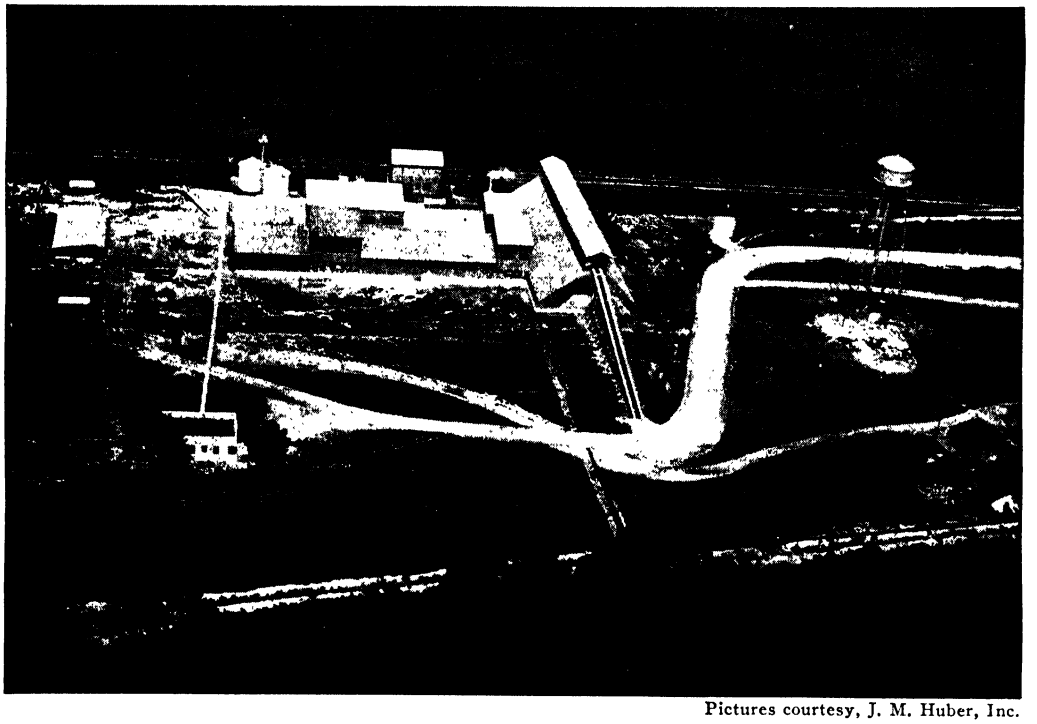
Besides the pterodactyls of the Jurassic, there were a few true birds, some with teeth. Mammals were not yet plentiful.

THE NEXT STORY OF THE EARTH IS ON PAGE 1783.

WHERE CHINA CLAY COMES FROM



Here we see kaolin, or china clay, being mined in Georgia, where it is found in large quantities. Other states which produce a great deal of china clay include North Carolina, Delaware and Pennsylvania. The crude clay is loaded on cars and taken to the plant, a few miles off, to be purified and made ready for the potteries.



Pictures courtesy, J. M. Huber, Inc.

This is an air view of a large clay refining plant. The crude clay is brought from the mines in trucks, which carry it up the trestle in the centre foreground and dump it in the long air drying shed. This is designed for air circulation and the clay remains in it for several weeks. It then goes through an elaborate process in which it is washed and all grit is removed, then it is filtered, dried and stored for shipping.

HOW CHINA CUPS AND SAUCERS ARE MADE



Metropolitan Museum of Art, N. Y.

A painting from an Egyptian tomb (about 2,000 B.C.). At the left is a kiln. At the right a potter turns his wheel.

CUPS and saucers, dinner plates and all of the other useful and beautiful articles of chinaware which we use in our homes are so familiar to us that we do not realize the knowledge, art and skill that have gone into their making. The art of making them and the materials of which they are made have had a long, romantic history.

Chinaware, or porcelain, pottery, bricks and tiles, drain pipes and flower pots are all made of clay, shaped and then fired or burned, but they are otherwise quite different from one another, both in substance and in the way they are made. Dishes, in which we are particularly interested, are of three general kinds: vitreous, semi-vitreous and earthenware or pottery.

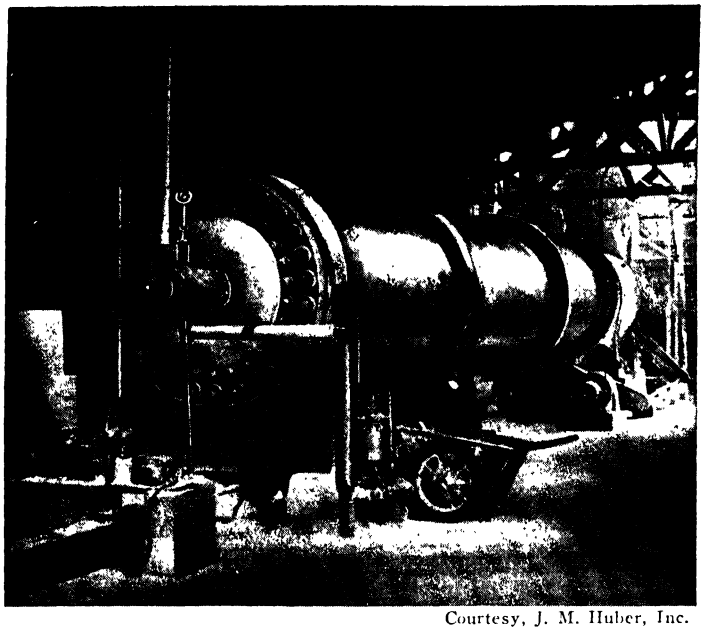
The word "vitreous," which means "glassy," is used to identify true porcelain, of which the finest dishes are made. It is extremely hard, because of the high temperature at which it is fired. It is translucent, which means that if you hold a piece of it up to a strong light, the light will show through the thinner parts. Also, if you tap the edge of a porcelain dish with a pencil it will give forth a clear, ringing sound.

Semi-vitreous dishes are much used by restaurants, and for ordinary daily use at home. They are not so hard as vitreous dishes, light will not show through them, and they make a duller sound when you strike them. Both kinds of dishes come in pretty shapes and designs, but you can always tell which kind a dish is by holding it up to the light and by tapping it to see if it rings clearly. Many manufacturers have the word "vitreous," or "semi-vitreous" printed on the under side of each dish.

Earthenware is coarser than semi-vitreous ware, and much more brittle. It is quite opaque, that is, it will not let the light through, and if you tap it the sound will be dull and flat. Earthenware comes in several different grades. Many attractive pieces are made of it, including vases, jars, bowls, breakfast, tea and dinner sets.

The making of pottery is one of the oldest arts known to man. It is so ancient that no one knows what people first learned to make vessels of clay. In our great museums we may find well shaped bowls and vases which were buried in the graves of the Egyptians perhaps six thousand years ago, and which have helped us to learn something of the state of civilization in Egypt long before the time of Moses. The ancient Cretans and the Greeks made wonderfully beautiful jars and vases thousands of years ago. The Assyrians and Persians were noted for skill in this work, and Roman pottery has been found everywhere within the limits of that great empire. The Egyptians knew how to make a beautiful glaze for their pottery thousands of years ago. Some students think that they were the first people to learn the art of glazing, and that it was taught by them to the Babylonians and Assyrians. The Greeks also probably learned the art from the Egyptians.

As we have learned, the civilization of Greece and Rome was almost swamped for a time by the rush of barbarian peoples from the north. These peoples knew little about the making of pottery, and the potter's work that was done in Europe in medieval times was very crude. The knowledge which had been gained during centuries by the Egyptians, the Greeks, the Assyrians and Persians lingered on in Egypt and Syria. After the



Courtesy, J. M. Huber, Inc.

One way of reducing the moisture in the crude clay is to pass it through a rotary dryer of the kind shown in this picture.

Moslem conquests the art was revived, and beautiful pottery was made by some of the Moslem peoples.

When the Moors overran Spain they brought with them skilled workers in various crafts, among whom were potters. Knowledge of the art of these Moorish potters soon spread through Europe. Potters of other nations were quick to learn it and improve upon it, and soon potteries sprang up in other countries. Many beautiful things were made, especially in Italy, but they were made from heavy clay.

Long before this time the Chinese, working by themselves, had learned to make fine pottery. In their search for fine clay they found a kind of clay which, when mixed with other ingredients and fired, became what we now know as porcelain, or china. The Chinese named this clay kaolin, from the Kao Ling Hills where it was first discovered. The name "porcelain" came from the Italians, who called the Chinese ware *porcellana* because its satiny surface was like a *porcelana,* or cowrie shell. It is amusing to know that this shell got its name from the word *porcella,* "little pig," because of its shape.

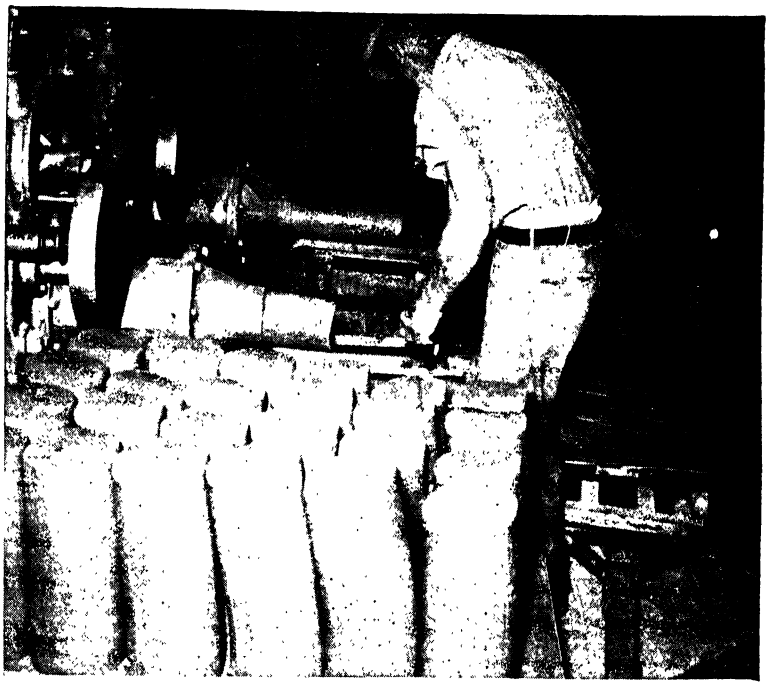
Just when porcelain was first made is not known. Some people believe that it was being made in China before the Christian era, but the earliest known pieces date from about the tenth and eleventh centuries, A.D. Thus we know that, while Leif Ericson was exploring the coast of North America, and while William the Norman was conquering England, Chinese artist-craftsmen were producing fine porcelain. By the time that Chaucer made his journey to Canterbury with the pilgrims, Chinese potters were supplying the Ming emperors with porcelain that is today worth a king's ransom.

The Chinese taught the art to the Japanese, and for centuries no other people was able to imitate the ware of these two countries. Traders and travelers brought examples of this porcelain to western Asia and northern Africa, and some of it was brought to Europe from Cairo as early as the twelfth century. European potters tried hard to discover what clay it was that gave the Chinese porcelain its hardness and whiteness, and many experiments were made.

Some of what we now call "soft paste" porcelain is said to have been made in Venice in 1470, by an alchemist, Maestro Antonio, and what is known as the Medici porcelain was made at Florence in the last years of the seventeenth century. This was very beautiful ware, but it lacked some of the qualities that the kaolin gave to the Chinese porcelain. It was not until 1709 that kaolin was discovered to be the long-sought clay. The discoverer was a chemist named Böttger, and he is said to have found it in the clay used to whiten his wig. Böttger lived at Dresden, but he moved to Meissen, where he made the famous Dresden china. He tried to keep his discovery secret, but in vain. In a few years porcelain was made in other countries of Europe, and French, Italian and Austrian porcelain also became famous. It received its common name of china because it was first made in that country.

While clay has always been the chief ingredient of porcelain, other materials are used with it. Among these are feldspar, ground quartz, calcium carbonate in the form of chalk, and sometimes calcium phosphate in the form of bone ash. The kaolin,

THE CLAY IS MIXED AND MOLDED



The clay is mixed with other ingredients, such as quartz, feldspar and whiting, and is made into the sausage-shaped "puggings" shown at the right. Then it is ready to be made into china.

Courtesy, Onondaga Pottery Co.



Courtesy, Lenox Incorporated

In casting, the clay is made into a creamy liquid called "slip," and poured into porous molds. The water is absorbed and the clay forms a smooth deposit on the inside of the mold. This hardens in the desired shape.



Courtesy, Lenox Incorporated

Round pieces of ware, such as plates, saucers and bowls, are usually made by the "jiggering" process shown in this picture. The jigger is in adaptation of the traditional potter's wheel. Here the clay is pressed into a mold which shapes the outside of the dish. The mold is then placed in the machine, and as it whirls around, the man shapes the inside of the dish with the arm of the jigger. When the piece is shaped it is taken to a drying room.

or china clay, does not melt and become transparent, but some of the other things, such as the feldspar, do. If you were to look at a piece of porcelain through a microscope, you would see a glassy substance packed full of opaque sticks of kaolin. When the light rays try to find their way through the glassy part of porcelain, they are reflected back and forth among these sticks, and it is this that gives fine porcelain its soft translucence.

Early in the eighteenth century lovely china began to be made at Sevres, Chantilly and Vincennes in France, and at Stratford-le-Bow, Chelsea and Derby in England and in many other places in these and other countries. Each manufacturer developed his own formula for making the paste. There were three general types of porcelain made, "hard paste," "soft paste" and "bone paste." Soft paste porcelain is very lovely, but is slightly porous. Most modern china is made of some variety of hard paste or bone paste. It was the development of bone paste that first brought about quantity production of fine china. The English potters, sometime about the middle of the eighteenth century, found that a fine, hard china could be made at a low cost by adding bone ash to the mixture.

China and earthenware were brought to America in the colonial period and in the early years of the Republic by ship-loads. Most of this ware was English, and so important was the American market that some of the potteries made a specialty of china and fine earthenware with American patriotic and scenic designs. These are now eagerly sought by collectors. A factory for making bone china was started in Philadelphia in 1769 by two men, George Anthony Morris and Gousse Bonnin. Bonnin is believed to have learned his trade at Bow. The business was closed three years later for lack of money to carry it on, though these unfortunate pioneers had tried in many ways to raise the necessary funds. In 1771 they had appealed to the Pennsylvania Assembly for a loan, and later they had set up a lottery, but they could not get enough money to carry on. Another Philadelphia pioneer in the making of china was more successful. William Ellis Tucker, a Quaker, opened a factory in 1825 for the manufacture of hard paste chinaware. This business flourished for more than twenty years. To-day much fine china is made in the United States, besides semi-vitreous ware and clay products of every imaginable kind.

Many things happen to the clay after it has been taken out of the ground, before it is ready to make a dainty cup and saucer,

a graceful vase, or any of the numerous other things that are made of china. To take out any sand that may be in the clay after it is quarried, it is mixed with water and strained through a fine sieve into a tank, where it is allowed to settle, and the water is drawn off. The clay is then put into filters, the water is pressed out, and the clay is ready to be shipped to the pottery. It is not yet ready for the potter, however, and the processes through which it has to go depend upon how it is to be used.

To make fine china, the kaolin is mixed with other materials and water is added. After it is thoroughly mixed it is freed of any remaining impurities by straining and by means of electric magnets to remove particles of iron. When it has been mixed to a thick, creamy paste that can be molded into any shape, it may either be used at once, or it may be filtered and pressed again, and folded away in a dark place for later use. Some potters put it through still another mill to press out any air that may be in it.

Valuable vases, and many other things, are still made on the potter's, or throwing, wheel. This is a contrivance which was probably used in Egypt six thousand years ago and has been very little altered in principle since. The potters of Babylon and Nineveh used wheels very much like it, even before the Bible was written. The throwing-wheel is a disk which revolves horizontally in a pan. The pace at which it moves is fixed by a brake which the potter controls. The wheel is still sometimes worked by the potter's foot, but most of the wheels used in large potteries are worked by electricity.

As the throwing-wheel spins round on its axle, the potter throws the clay, which sticks to the wheel and goes round with it. Then the art of the potter comes into play. As the wheel spins he presses, and pulls, and molds it with his skillful hands or with tools made for the purpose. He works from the base upward, shaping the walls, making them the right height and thickness, and gradually the clay takes on the desired shape. When it is finished, the vessel is set aside to dry, so that it can be fixed on a lathe, and turned and smoothed. Plates, bowls, cups and other round pieces are made on a wheel that is shaped to mold the face of the article, while a steel tool is held so as to shape the back of the article. This process is often called "jiggering."

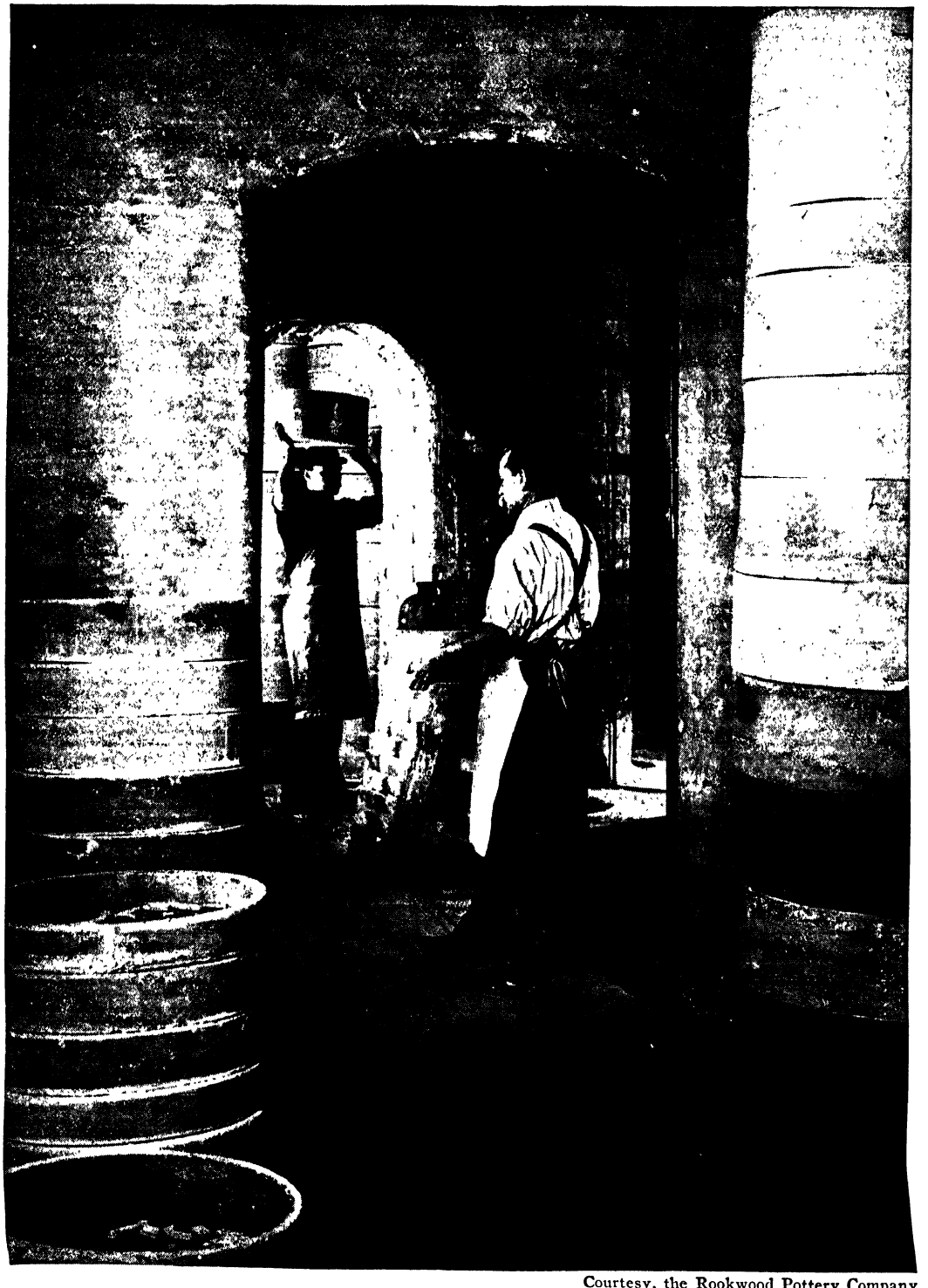
Many articles, such as teapots, handles and oddly shaped pieces, cannot be made on the wheel, but are "cast" in a plaster of Paris mold. A thin, cream-like mixture of clay called "slip" is poured into the mold and allowed to stand. The water in the slip



Courtesy, Onondaga Pottery Company

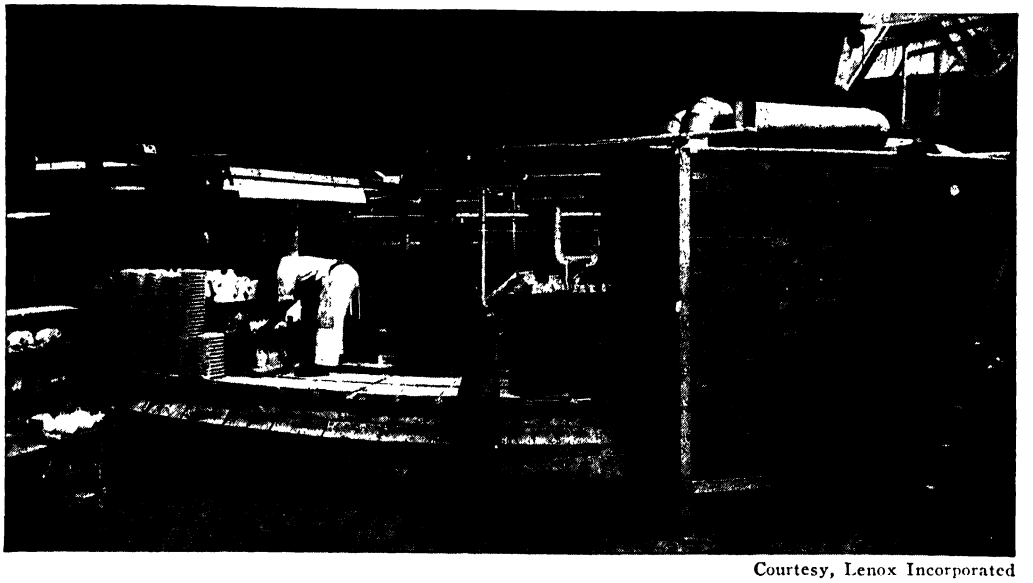
When the dishes are sufficiently dry they are taken to the finishing room. Each piece is examined, rough lines or scraps of clay are smoothed away, and it is dusted with fine clay to prevent sticking in the kiln.

THE BISCUIT KILN IS PREPARED



Courtesy, the Rookwood Pottery Company

Here we see a large kiln in which fine pottery is to be fired. The pieces are placed in the clay saggers in such a way that they will not touch one another, and the saggers are stacked up until the kiln is full. The firing may take as long as thirty hours, and the kiln must be slowly cooled before it is opened again.



Courtesy, Lenox Incorporated

Here we see plates, jugs, sugar bowls and other pieces being placed in the kiln for the firing that will "bake" them into biscuit. Note how carefully the plates in the tall stacks or "bungs" are kept from touching.

is absorbed by the plaster of Paris, leaving the clay on the inside of the mold. The longer it stands, the thicker the clay will be. When it has reached the desired thickness, the remaining water is poured off and the cast is allowed to dry. Then it is taken from the mold, trimmed and smoothed. Cup-handles, spouts for teapots and other things of the sort are made in separate molds and stuck on with a little of the slip. There is a third method called "pressing," in which the clay is placed on a one-piece mold and hammered into shape with a hand batter. All of these methods require skill and experience, and though machinery is used as an aid to the potters, eighty percent of the work in a pottery is hand work.

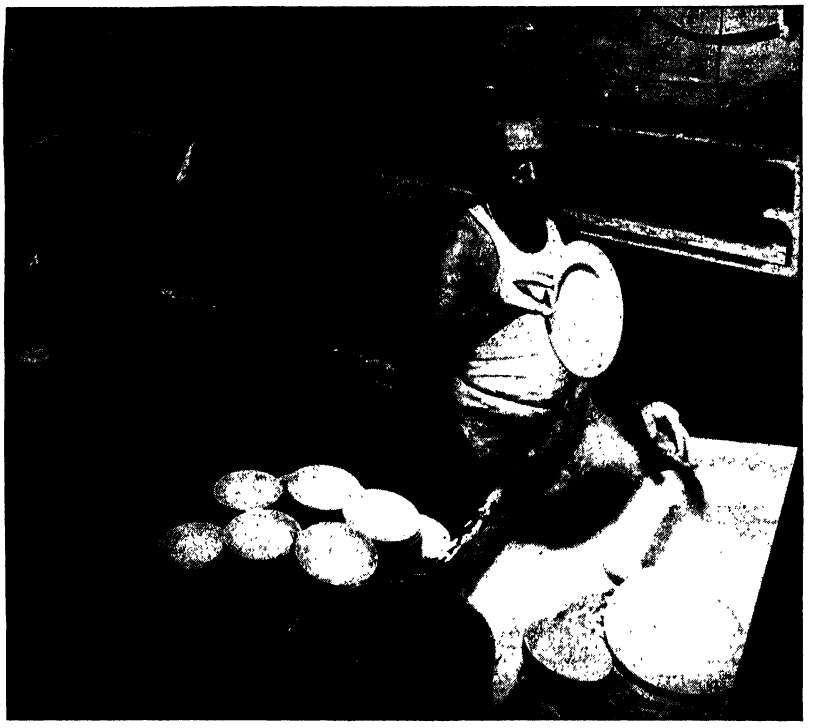
After the clay has been shaped, the vessels are put in a drying room, and then comes the delicate and difficult process of baking, or firing, the clay to make it into porcelain. For this purpose the china is packed into closed earthenware boxes called saggers, in such a way that they will not touch one another. The saggers are packed into a kiln (pronounced kill), which is a kind of furnace, and heated until the temperature has reached as high as 1,500 degrees Centigrade. The kiln is kept at this temperature for about ten hours, and is then allowed to cool so gradually that it is three or four days from the time they are put in before the saggers are opened and the "biscuit," as it is now called, is taken out.

The dishes are now ready for glazing. The pieces are dipped in a kind of liquid glass called "glaze slip," which leaves a thin, even coating all over the biscuit. Then they are put into another kiln and fired at a temperature hot enough to fuse the glaze and the biscuit and give the china a softly shining surface.

Some china is decorated before the glaze is put on, and this we call "underglaze" decoration. There are various ways of applying it to the biscuit. One method is to make the design in one color, by means of copper-plate printing. "Overglaze" decoration is more elaborate, and may be painted by hand or by decalcomania. In this latter process, the design is lithographed on a special paper which is pressed on the china in such a way that the whole design is transferred to it. If gold is used, it is usually applied to the smooth surface of the glaze, just as the colors are. Etched, or encrusted, gold decorations are made by cutting the design in the glaze with acid, and then covering it with gold. When the gold has been burnished the high parts of the design are bright against the duller sheen of the low parts, giving a very rich effect. After the colors and gold have been applied, they are set, or fused with the china by another firing. Quite lovely raised designs are sometimes made by pressing or building them on the clay before it is fired.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 2021.

CHINA BEING GLAZED



When the firing process is finished, the biscuit, as it is now called, is dipped in a liquid glaze, and made ready for a second firing.

Courtesy, Lenox Incorporated



Courtesy, Onondaga Pottery Company

The man in this picture is placing glost (glazed) ware in saggers before it is sent to the glost kiln. In the foreground are a biscuit sagger (left) and a glost sagger (right), cut in half so that we can see how the dishes are placed. Note that the glazed pieces are carefully separated to keep the glaze from sticking.

THIS IS HOW A VASE IS MADE



Under the skillful fingers of the potter the shapeless clay on the wheel becomes a thing of beauty.



Spinning his wheel and working the clay up and down, pressing inside and out, he forms a cylinder.



Gradually he draws upward and outward the revolving mass till it begins to take the shape of a ewer.



The wheel spins again, and under the nimble fingers and the artist's eye, the lump of clay is transformed.

CHINA TAKES ON GLOWING COLORS



Some pieces are decorated by hand. Here we see an artist painting the design on a vase. When it is finished it will be fired in a special kiln to fix the colors. This is fired at a much lower temperature than the other kilns.

Courtesy, Rookwood Pottery Co.



Courtesy, Ovington's, New York

When we see lovely chinaware we seldom realize what a triumph it is of human knowledge, art and skill. Besides the gold and colors, which were put on over the glaze, this set has a raised border made of the clay itself.



Harold M. Lambert, from Frederic Lewis

THE MUSCLES and THEIR MASTERS

THE muscles make up a very great part of the whole bulk of the body. Another word for muscle is flesh. The whole body would be useless without the muscles, for they carry out its orders. Without our muscles we could not move our bodies. Even the life of the body depends upon some of the muscles; for instance, those which you and I and every other human being on the earth are using for breathing at this moment.

Many special muscles help us in the process of digesting our food. We can not open our eyes in the morning without the help of tiny muscles in our eyelids; and muscles of the eyeball adjust the eye's lens so that we can see both distant objects and near objects.

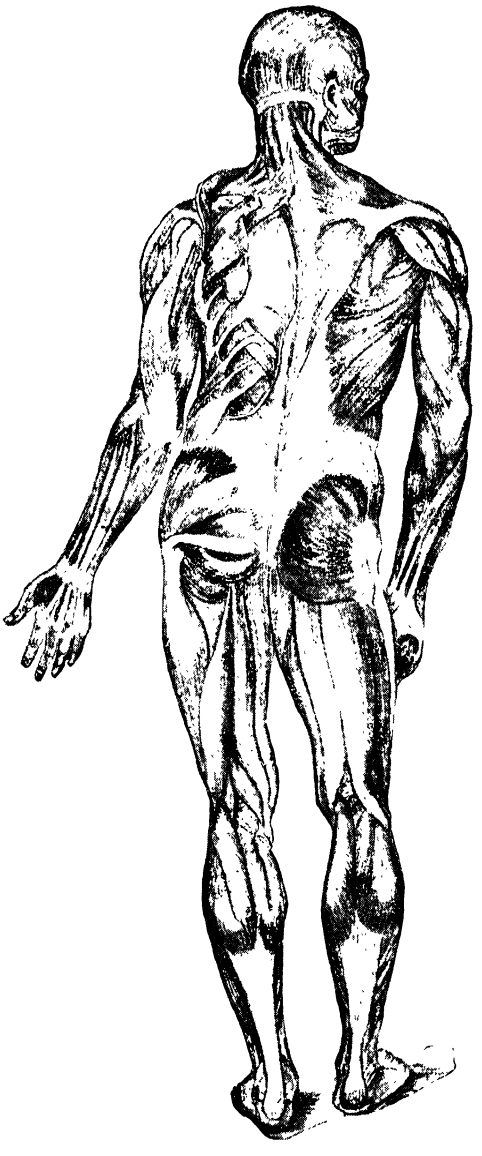
Muscles cover almost the entire body. Our knuckles and our shin-bones seem to have little or no muscle on them, but these spots are exceptions. Muscles vary in shape, according to the work they have to do. Some are thin and flat sheets; others are long and narrow, and so on. The most usual kind of muscle ends in a sort of rope that runs to the bone which the particular muscle controls. If you look at the front of your wrist, or if you feel at the back of your knee, you will find some of these strong ropes. The proper name for them is *tendons;* sometimes they are called *sinews.* Sometimes people confuse tendons with ligaments. A tendon is part of a muscle. A ligament is a rope of tissue binding a joint together.

In the picture on page 1676 we see that a muscle has a body, which is the red flesh, the really living part of the muscle; and a whitish rope, the tendon, by which the muscle pulls on the bone. The picture shows us the biceps muscle of the arm. It has two heads, or starting-places; these join and form the body of the muscle; then comes the great tendon, which ends in one of the bones of the forearm. The word biceps comes from the Latin words for two and head.

THE FOLDS OF MUSCLE INSIDE THE SKIN



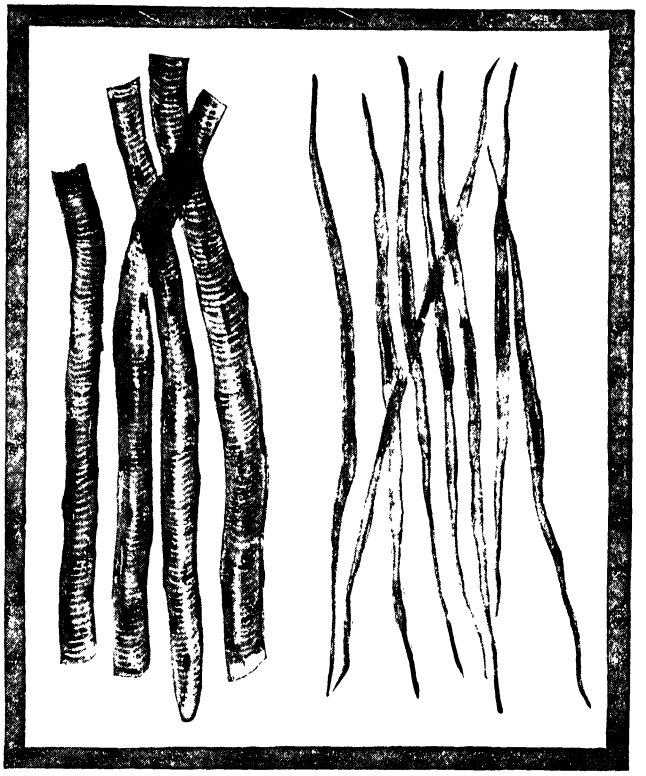
Front view of the chief muscles of the body. They wrap the skeleton in an intricate arrangement of overlapping layers, which thin out to tendons at the joints, where the muscles are attached to the bones.



This back view of the muscles shows, for instance, that the knee must bend when the calf and thigh muscles contract. Notice the ropes of tendon running to the heels and girdling the wrists.

You can see the two heads in the picture, at the shoulder. This is one of the large muscles.

When the biceps or any other muscle contracts, or acts, its fleshy part shortens and swells, and so the two ends of the muscle approach each other. Every boy knows how the body of his biceps muscle swells when he bends his elbow, for this is the great lifting muscle of the arm. When a muscle contracts and moves things, it does work and spends power. We must find where the power comes from.



Of the two principal kinds of muscle fibers, the striped ones, on the left, are the kind attached to the skeleton, and contain many nuclei. The unstriped fibers contain one nucleus each.

All muscles are richly supplied with blood. This helps to give them their red color, though most muscles also have in them a red coloring matter, or pigment, which is peculiar to muscles and not found in blood. It is the blood that supplies muscles with the power by which they act. The blood carries to them the food they must have.

Every machine—and a muscle is a living machine—turns some of the energy supplied to it into heat, not all into work. The more work it gives and the less heat, the better is the machine, for we generally want work and not heat. Any muscle is better in this respect than any machine ever made by man; and, further, the heat it *does* make *is* wanted.

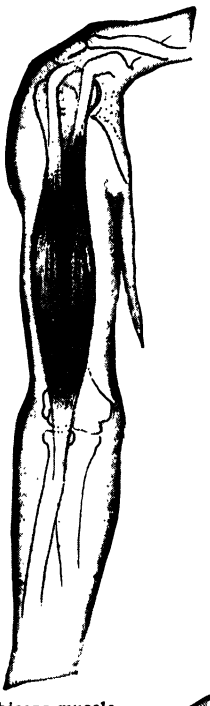
When we examine the red fleshy part of a muscle we find that this consists of millions of living cells that have grown into the form of narrow fibers, or threads, and are beautifully bound in bundles. The mystery of the contraction of a living muscle lies inside the protoplasm of the muscle cells. The muscles of the skeleton, such as the biceps, differ from those which cover, let us say, the stomach. The first kind, which are under the control of the will, show tiny cross striping when seen under the microscope; the other kind, those which act apart from the will, show no such striping. So the two kinds of muscles are called *voluntary* or *striped*, and *involuntary* or *unstriped*. *Voluntas* is Latin for "will" and *in*, or *un*, means "not." We show you some examples of both unstriped and striped muscle at the left.

We can watch the development of a muscle from muscle cells, which at first are round and small. When one of the striped, voluntary muscles grows by exercise, certain muscle cells which have never developed into active muscle fibers are made to develop. When they are all used up, the muscle will grow no bigger, however long or well it is exercised. Different people differ widely in the number of cells out of which they can make muscle fibers by exercise.

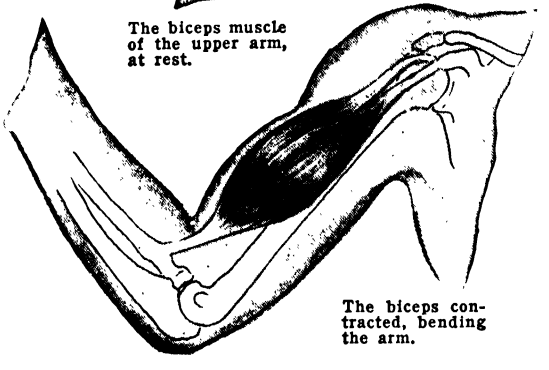
The size of the muscular system is important in a few cases, as where a man is doing hard physical labor. But it has nothing at all to do with strength of life. People often confuse strength of muscles with strength of life, or vitality. Women are, in general, much less muscular than men, but they have more vitality. Strength of muscle is not the most important thing for human beings, who have conquered the world, and live in it,

not by strength, but by skill. We should take care of our muscles, however.

If we are to learn to take proper care of our muscles, we must find out what happens when our muscles carry out our orders. Running into every muscle of the body we find at least one round whitish cord which is called a nerve. One of these, called the ulnar nerve, runs down to give itself to several of the muscles of the forearm, and passes behind the elbow for a short distance, between the skin outside it and the hard bone underneath it. If hit, it makes us uncomfortable and we call it the "funny-bone," though it is no bone. This nerve is what is called a *mixed* nerve. It has in it nerve-fibers running to muscles and making them move, and others running from the skin up to the brain for purposes of feeling. These two sorts of nerve-fibers are called *motor* and *sensory*. The motor nerve-fibers carry the message from the brain which tells the muscle to act, that is, to contract. The message travels so quickly that will and action seem to come together.



The biceps muscle of the upper arm, at rest.



The biceps contracted, bending the arm.

The article on The Nervous System will tell you more about both types of nerve-fibers. Here also we must consider them briefly because they are the masters of our muscles.

When the "funny-bone" nerve is hit, we feel a tingling sensation in the little finger and on the side of the finger next to the little one. That is because the "funny-bone" nerve sends a message down the fibers to these fingers.

Now we must consider the motor fibers. Especially we must see what we mean when we say that every muscle has motor nerve-fibers running into it. Suppose that by an accident the motor nerve of a muscle is cut; or suppose that the nerve-fibers become diseased and die. Two things always result. The first is that the muscle can not be used: it is paralyzed and lies still, however eagerly we try to use it; for it is motor nerves that are the motors and the masters of muscles. The second result is that the muscle always begins to waste and grow soft, flabby and small. So we know that the motor nerve is not merely the master of the muscle, but a master that takes good care of his servant. Some kind of influence runs down all motor nerves to the muscles which they supply, and keeps those muscles in health.

Muscles, then, are the servants of nerves; and there is a special way of putting this which is so good that we ought to learn it. The word "organ" means "instrument." We say that the eye or ear is the *end organ*—the instrument at the end—of the eye-nerve or the ear-nerve, just as the telephone on the desk might be called the end organ of the telephone wire. And now students of this subject have taught us that we ought to look upon muscles as the end organs of motor nerves—the instruments which carry out the orders of the motor nerves. Paralysis results whenever the nerve messages are interfered with. This causes the crippling in infantile paralysis.

It is quite easy to separate from the leg of a dead frog the muscle of its calf and the nerve that is the muscle's master. If this muscle is kept warm and free of germs and moistened with water containing a little salt, it will live for quite a long time. If we pinch the muscle or put chemicals on it, or if we even apply certain kinds of electricity to it, nothing happens; but if we do these things to the nerve, the muscle contracts as long as nerve and muscle are alive.

The nerve is a fiber or a group of fibers running from a nerve-cell or from nerve-cells. The master is the nerve-cell in the brain or in the spinal cord. For every muscle in the body we know the exact group of nerve-cells in the brain or the spinal cord. If anything destroys them, the muscle is paralyzed and withers.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 1803.

USING MUSCLES BUILDS STRONG BODIES



Harold M. Lambert, from Frederic Lewis

These two boys are having fun testing the strength of their growing young muscles. With right legs braced and right hands clasped, they struggle to see which one can topple over the other, using only one arm.

THE FIRST ENGLISH PRINCE OF WALES



Edward I asking the Welsh nobles to swear allegiance to his infant son as Prince of Wales.

1678



Queen Philippa begs Edward III to spare the six men of Calais, doomed to die so that their city may be saved.

THE STORY OF ENGLAND

II. EDWARD I TO THE CORONATION OF HENRY VII

HENRY III died in 1272 and two years later his son, returned from the Crusade, was crowned Edward I (1239-1307). Edward was very English in his interests and proceeded to develop a strong national government.

From 1215, when the Great Charter was signed, Parliament had been growing in power. Originally this body had consisted only of nobles and bishops; then, in 1265, Simon de Montfort had called in representatives of the towns. Edward I felt that the government would be much more successful if he could gain the co-operation of all the people, and that taxes could be collected more easily if the wealthy merchants and farmers who had to pay taxes were represented in Parliament where the taxes were decided upon. In 1295, when Edward I called a meeting of Parliament, he instructed each town and each county to send two representatives. This meeting is known as the Model Parliament because it was the beginning of the kind of Parliament England has today.

From this Model Parliament there developed two groups, the nobles and the common people. Since the representatives of the towns and counties discussed each problem among themselves, they were called "the commons." After a while the lords and bishops met in one place and came to be known as the House of Lords, and "the commons" met in a separate place and became known as the House of Commons. This system of having two separate groups to represent the people in the national government has been copied by the United States and other democracies.

Like so many of the kings before him, Edward spent part of his reign in wars. The Welsh had never willingly been a part of England. As you read in the chapter beginning on page 1564, the ancient Britons had found shelter in the hills of Wales, from the Romans and from the Saxons, and their children's children defied all attempts of the Saxon-English and the Norman-English to bring Wales into subjection. In time of war they frequently aided England's enemies, and English property along the border was continually being raided by the Welsh. Edward decided to beat these unwilling subjects into submission and he proceeded to do so. He organized the government of Wales and introduced English laws and customs. When the Welsh nobles came to pay homage to Edward, he promised to give them a prince as ruler, born in Wales, who could speak neither French nor English. He then brought out to them his little son, born at Carnarvon Castle a few days before. Ever since, the king's eldest son has been Prince of Wales.



Edward II.



Edward III.

Edward tried to bring Scotland also under English rule. But the Scots under William Wallace defeated the English at the Battle of Stirling Bridge, in 1297.

Edward I died in 1307 and was succeeded by his son, Edward II (1284-1327), who reigned for twenty years. He, like his father, tried to conquer Scotland, but the Scottish king, Robert Bruce, inflicted a terrible, bloody defeat on the English at the Battle of Bannockburn. Edward II's men left so much treasure upon the field when they fled that the Scots said they became rich as well as free as a result of this famous battle.



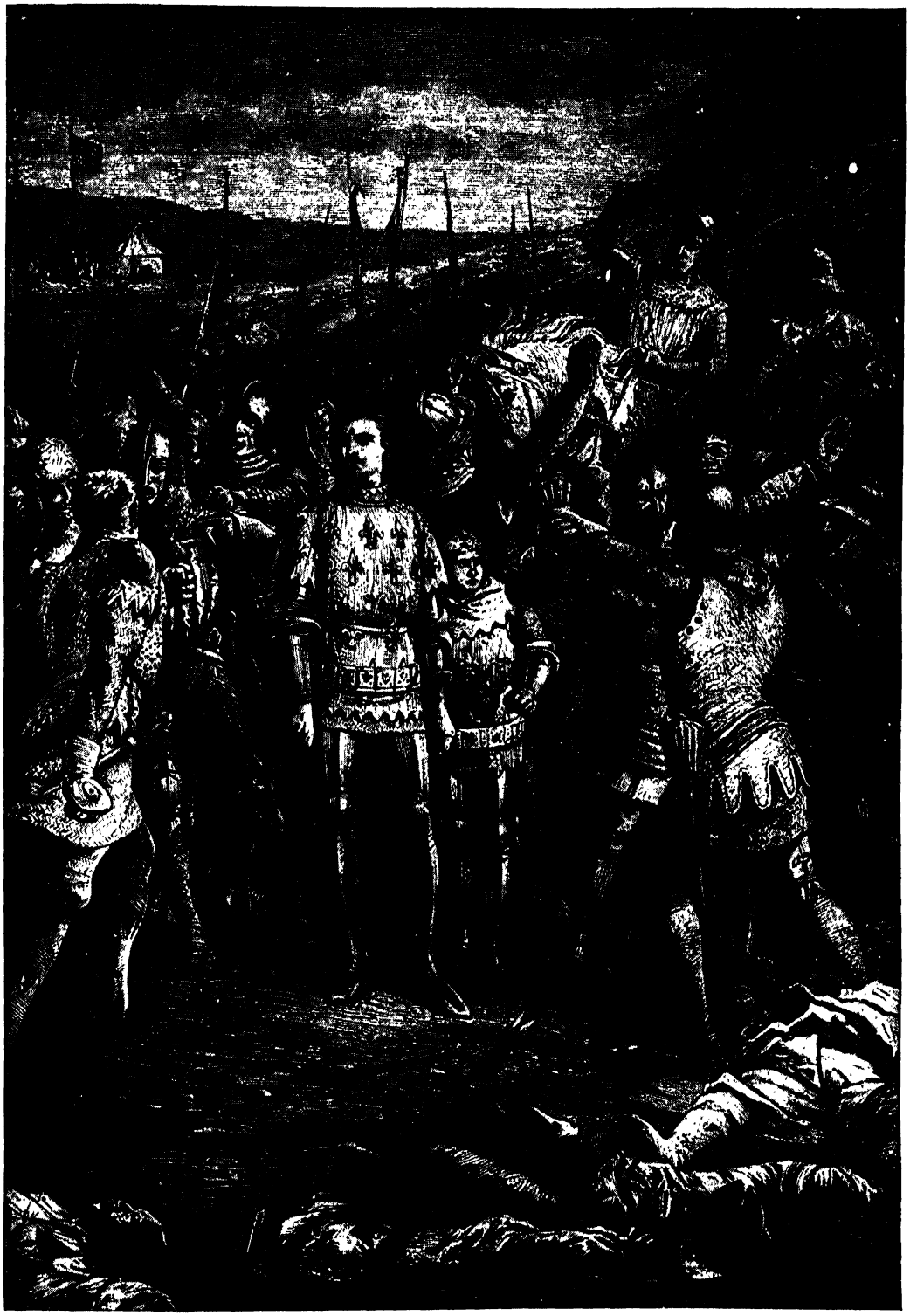
Philippa, wife of Edward III.

Most of Edward's time at home was spent in trying to quell his rebellious barons. He ruled badly, and in 1327 the barons said they had had enough of him. They forced him to give up his crown and they put him in prison. He was murdered the same year.

Edward's fifteen-year-old son was made king, as Edward III (1312-1377). This Edward ruled for fifty years. Early in his reign he determined to succeed where his father and his grandfather had failed, that is, to force the Scottish king to do homage to him. He invaded Scotland again and again, and made some headway, until France began to interfere by sending aid to the Scots.

There was at this time serious friction between England and France. Ever since the time of William the Conqueror the English kings had been overlords of portions of France. Sometimes they gained domains by inheritance, sometimes by marriage to French women. The French people hated, more and more, as the years went on, to pay homage to any Englishman. Another cause of trouble was French interference with the rich wool trade which England was carrying on with Flanders. Then Edward turned his thoughts to the very crown of France. He said he had a right to it. His grandfather had been Philip IV of France, and Edward was the only living grandson. But the French wanted a French king, so their assembly ignored Edward's claim and chose a cousin of Philip IV. That marked the beginning of a war between the French and the English which continued for more than a century,

A ROYAL CAPTIVE ON A FAMOUS FIELD



King John II of France and his son, taken prisoner by English troops in the Battle of Poitiers in 1356.



The Battle of Crécy, in 1346, in which the English utterly defeated the French. The English archers, with their deadly long-bows (right) proved to be far more effective than the French cross-bowmen (left). The English are said to have used cannon in the battle, but this weapon did not play an important part in the victory.

and is called the Hundred Years' War (1337-1453).

The English were at first victorious, on sea and on land. Edward III was a brave and able leader, and he had the help of his young son, the Black Prince (so called because of the color of his armor). The English armies, though much smaller than the French, were better trained and better equipped. The favorite weapon of the English foot-soldiers, the long-bow, was more effective than anything the French possessed. Two important English victories in this period were the Battle of Crécy in 1346 and the Battle of Poitiers in 1356, when the Black Prince took the French king prisoner.

Crécy was fought amidst thunder and lightning and torrents of rain and an eclipse of the sun. The English are said to have had four cannon—this was probably the first time gunpowder was used in battle. The Black Prince, barely sixteen, led in the fight, and won the spurs of a knight that day.

Then for nearly a year Edward tried to take the town of Calais, the door into France. Little wooden houses were built all round the town for the soldiers, and no one could pass food through. At last the people were starving and had to give in to the English.

Edward said that six of the men of Calais must come and give their lives, and then he would let the rest go free. So, one brave man after another offered to go, and the six came to Edward with ropes round their necks. Can you fancy how the wives and children of these men felt as they saw them go to the English camp? Then Edward's Queen Philippa herself knelt before her husband, and begged him to have mercy, and Edward's heart softened and he put the ropes of the six citizens of Calais into her hands; and she sent the men home. But the unhappy war went on.

While the war continued in France, the people of England suffered from an epidemic of a disease called the Black Death. The disease killed about half the people in England; and as a result, labor was scarce. The serfs, who had no civil rights and had to work for three days a week for the lord who owned their land, found that they could get better terms now, because each lord was afraid his serfs might run away and work for someone else. So the Black Death helped the peasants in England to become more independent. Many were freed of serfdom and allowed to rent the land they farmed.

The Black Prince died in 1376, and Edward III died in 1377. The crown passed to the ten-year-old son of the Black Prince, who became Richard II (1367-1400). An old poem describing the times says "Woe to the land when a child is king." Before Richard II was old enough to act as king, the country was controlled by a group of powerful nobles. Advised by these men, Parliament passed a poll tax which required the payment of a sum of money for every person in every household over the age of twelve. This tax was so resented by the poverty-stricken peasants that they rebelled. Led by Wat Tyler, they went to London and seized the city. The young king (he was now fifteen) met the peasants and agreed to their demands. However, he did not mean to keep his promises, and soon Wat Tyler was murdered, the peasants were defeated by the soldiers and the rebellion collapsed.

There were other reasons for discontent among the peasants. John Wyclif, a preacher, went about saying that the nobles had no right to property and power unless they led good lives. Followers of Wyclif, called Lollards, also told the people that they were being treated unjustly, which was certainly the truth. Wyclif translated the BIBLE into English and circulated it so that common



Death of Wat Tyler, leader of the peasants in the Great Revolt of 1381. The young king, Richard II, first agreed to the demands of the peasants. But after Tyler had been treacherously slain by Walworthe, the lord mayor of London, the King refused to keep his promises. The revolt was suppressed and many peasants were put to death.

people had their first chance to hear the BIBLE in their own language.

The increased use of the English language (replacing Latin or French) resulted in the development of English literature. Popular poems began to be written in the language of the people. The best known of these was PIERS PLOWMAN, at least partly written by William Langland. In this period England produced the first of her great poets, Geoffrey Chaucer. We tell you about him and his works elsewhere in our book. See the General Index.



Prince Henry at the deathbed of Henry IV. After the King's death the prince became King Henry V. He accomplished much in his short reign (1413-1422).

Richard II ruled harshly. He made his people very angry by trying to govern without Parliament, and at last, after many troubles, he was forced to resign his crown, in 1399. It was a sad ending to a brilliant beginning. When he was born his father was a great and powerful soldier and heir to the English throne, and the news of the boy's birth was received with shouts of joy from the soldiers assembled in the Great Hall of the Black Prince at Bordeaux. When Richard died, he had lost all his inheritance and was in prison alone.

A distant cousin became king after him—Henry IV (1367-1413). As Henry IV had no real right to the throne, he was constantly in dread of losing it and found it very difficult to keep order in England and Wales. Scotland was afraid to do much against him, because their Prince James—afterward James I—was a prisoner in England. This is how it happened. When James was about nine years old, his father sent him to France to be educated and to be out of harm's way. His ship fell into the hands of Henry IV, who said: "His father should have sent him to me. I can teach him French as well as the king of France."

All the years that the lad spent in England he used for study. He was particularly fond of Chaucer and later wrote very interesting



The Battle of Agincourt, 1415, in which the English army of King Henry V defeated a much larger French force. The long-bows of the English archers greeted the enemy's cavalry with such a shower of arrows that the ranks of the French were thrown into confusion. The English cavalry then made a fierce charge and carried all before it.



Culver Service

A typical fifteenth-century tournament, held in a large public square of London.

poetry himself. Henry IV little thought that James, before he returned to his own land and kingdom, would act as chief mourner at the funeral of Henry's son, Henry V (1387-1422).

Full of life and mischief was Prince Hal, as he was often called in his father's lifetime, and he got into many scrapes, yet as soon as he became king, his great ambition showed itself: he wanted to be king of France as well as of England. He had no real right to be so; but he gathered a large force and crossed the Channel, and in the face of great difficulties won a victory at Agincourt.

In the end it was arranged that Henry should marry Katherine, the French princess, and that when the poor, mad old king, her father, died, his son should be passed over, and Henry should reign with Katherine. Things were in a bad way in France, where there were endless quarrelings among the nobles and no one to keep them in order, or this arrangement could never have been made.

But all Henry's plans came to a sudden end. He was a good soldier, he was wise and seemed born to do great things; but he died when only thirty-five, leaving a little son of nine months as his heir. The babe was crowned Henry VI on his mother's lap, with her bracelet, it is said, as a crown for his baby head.

Henry VI (1421-1471) had a long reign, but an unfortunate one. First his uncles governed for him, and during this time the English lost what hold they had on France. This was chiefly through the efforts of a young girl called Joan of Arc, who was bitterly sorry for the miseries of her country and longed to drive the English out and to see her own king upon his throne. So she dressed herself in shining armor and rode at the head of an army with a great white banner, cheering on the soldiers and making them brave like herself. At last she succeeded in leading them to victory. She was afterward betrayed into the hands of the English, who cruelly



Bettmann Archive

A young squire being accepted into the order of knighthood.



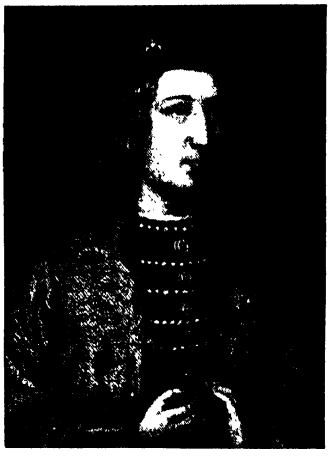
Joan of Arc leading the French forces at the Battle of Orleans. The English had besieged the town, which was on the point of surrender. But Joan came to the rescue with a French army, and the English were forced to give up the siege. This brave girl, who saved her native land, was burned at the stake in 1431 as a sorceress.

burned her to death. All the efforts made to regain France were useless, though the struggle lasted many years. The English lost every bit of France except Calais. There followed a sad period of strife at home.

During the childhood of Henry VI, the barons plotted and struggled for control of the kingdom. When Henry became king these plots continued because he was weak and easily influenced. The plots finally led to a civil war known as the War of the Roses. The leader of the opposition to Henry VI was Richard of York, and his family emblem was a white rose. Henry VI was a member of the House of Lancaster and his supporters adopted a red rose as their emblem. Richard of York planned to make himself king, but he was defeated and killed in battle.

Richard's son Edward (1441-1483) defeated the King's army, forced the King to flee to Scotland, and was crowned Edward IV. The civil war lasted a while longer, but Edward won and remained king. Henry was imprisoned in the Tower of London, and there he died. Henry was too weak to control others and to govern in such troubled times, but he was fond of scholars and teachers and books and pictures of all kinds. He founded the great school at Eton and King's College at Cambridge.

One of the disturbances in Henry VI's reign was Jack Cade's Rebellion. Cade was an Irish rebel who went to England and pretended to be a relative of the Duke of York. About 20,000 men flocked to his banner, and he marched to London at their head, defeating the King's army. Cade's forces, contrary to his orders, proceeded to loot the city,





Edward IV and his queen, Elizabeth Woodville. Edward was of the House of York, whose emblem was a white rose.

which turned honest citizens against them. The looters were defeated and dispersed. Cade fled but was overtaken, wounded and died.

Edward IV had a successful and prosperous reign. The civil war did not have a great deal of effect upon the common people. It was chiefly the nobles and their followers who were involved. During this time English towns developed. Many markets, better houses and churches were built; the docks and harbors were improved; the main streets were paved; and wealthy men established schools and other public benefits. Trade and manufacturing increased, and many foreigners came to England with new goods and new ideas. In 1476 William Caxton brought the first printing press to England and with the permission of Edward IV used a room in Westminster Abbey to print books. Soon more printing presses were brought in, more books were printed and gradually more people learned to read them, though education was not widespread among the common people.

When Edward IV died, in 1483, his thirteen-year-old son was nominally king, Edward V (1470-1483). But Edward V never was crowned and never reigned. His uncle, the Duke of Gloucester, had himself appointed Protector of the Realm, and he placed young Edward and Edward's little brother in the Tower of London. The two boys were never seen again. It is supposed that they were murdered by orders of their uncle, who mounted the throne as King Richard III (1452-1485).

Richard's reign was short. He tried to please the people by calling Parliament together and setting many things in order. He also did a good deal for trade and made it easier for people to produce books. But many were so horrified at the disappearance of the little princes that they turned against Richard. Civil war flared up, and in the Battle of Bosworth Field, Richard was killed; and Henry Tudor, of the family of Lancaster, was made king as Henry VII (1457-1509). He reigned from 1485 to 1509.



Richard III and the Duke of Buckingham plotting the murder of the two sons of the former king, Edward IV. Buckingham later turned against Richard and led a revolt against the King. This revolt collapsed and Buckingham was executed.



The hall of Moat House in the Kentish town of Ichtham. This building is still standing; it is 600 years old.

He married the eldest daughter of Edward IV, and so the two houses of York and Lancaster were united at last, the red and white roses mingling in one double flower, the Tudor rose.

The long War of the Roses was costly for England in this way. Most of the nobles had lined up in the fight, on one side or the other, and a great many of them had been killed, either in battle or by execution. The Commons were not strong enough to demand a hearing, and so there was now no check upon the power of the king. The Tudor sovereigns, and the Stuarts after them, came to believe that they had a divine right to rule as they wished. Thus hundreds of years were to pass before England achieved a democratic government.

By FLORENCE V. GEEHR.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 1812.

EDWARD I AND HIS DESCENDANTS

(Note: r. stands for reigned; m., for married.)

EDWARD I (r. 1272-1307)
m. Eleanor, daughter of Ferdinand III of Castile

EDWARD II (r. 1307-1327)
m. Isabel, daughter of Philip IV of France

EDWARD III (r. 1327-1377)
m. Philippa, daughter of William III of Hainault

Edward, the Black Prince
m. Joan of Kent

RICHARD II (r. 1377-1399)

Lionel, Duke of Clarence

Philippa, m. Edward Mortimer

Roger Mortimer

Anne Mortimer
m. Richard, Earl of Cambridge

Richard, Duke of York

EDWARD IV (r. 1461-1483)

EDWARD V (r. 1483)

John of Gaunt, Duke of Lancaster

HENRY IV (r. 1399-1413)

HENRY V (r. 1413-1422)

HENRY VI (r. 1422-1461)

RICHARD III (r. 1483-1485)

Hans Brinker, or The Silver Skates*

ADAPTED FROM THE STORY *by* MARY MAPES DODGE

ONE cold December morning, a merry troop of girls and boys came skimming down a canal in Holland. There was the rich burgomaster's daughter, Hilda van Gleck, with her costly furs and loose-fitting velvet sacque; and, near by, a pretty peasant girl, Annie Bouman, jauntily attired in a coarse scarlet jacket and a blue skirt just short enough to display the gray homespun hose to advantage. Then there was the proud Rychie Korbes, whose father, Mynheer van Korbes, was one of the leading men of Amsterdam; and Carl Schummel, Peter and Ludwig van Holp, Jacob Poot, and a very small boy rejoicing in the tremendous name of Voostenwalkbert Schimmelpenninck. There were nearly twenty other boys and girls in the party, and one and all seemed full of excitement.

Before long our merry boys and girls were almost lost in the confusion of bright colors, the ceaseless motion, and the gleaming of skates flashing back the sunlight. We might have known no more of them had not the whole party suddenly come to a standstill and, grouping themselves out of the way of the passers-by, all talked at once to a pretty little maiden, whom they all had drawn from the tide of people flowing toward the town.

"Oh, Katrinka!" they cried, in a breath, "have you heard of it? The race—we want you to join!"

"What race?" asked Katrinka, laughing. "Don't all talk at once, please, I can't understand."

Everyone panted and looked at Rychie Korbes, who was their acknowledged spokeswoman.

"Why," said Rychie, "we are to have a grand skating match on the twentieth, on Mevrouw van Gleck's birthday. It's all Hilda's work. They are going to give a splendid prize to the best skater."

"Yes," chimed in half-a-dozen voices, "a beautiful pair of silver skates—perfectly magnificent! with, oh! such straps and silver bells and buckles!"

"Who said they had bells?" put in the small voice of the boy with the big name.

"I say so, Master Voost," cried Rychie.

"So they have—" "No, I'm sure they haven't,—" "Oh, how can you say so?—" "It's an arrow—" "And Mynheer van Korbes told my mother they had bells—" came from sundry of the excited group.

"Oh! oh!" and the chorus of conflicting opinion broke forth again.

"The girls' pair are to have bells," interposed Hilda, quietly, "but there is to be another pair for the boys with an arrow engraved upon the sides."

"There! I told you so!" cried nearly all the youngsters in a breath. . . .

"There's a pretty pair just coming upon the ice!" Carl Schummel said mockingly. "The little rag-pickers! Their skates must have been a present from the king!"

"They are patient creatures," said Hilda, gently. "It must have been hard to learn to skate upon such queer affairs. They are very poor peasants, you see. The boy probably made the skates himself."

Presently Hilda left her group of friends and sailed up to Gretel and Hans Brinker, the two poor children.

"I only wished to speak to you about the grand race," she said in some embarrassment. "Why do you not join it? You can both skate well and the ranks are free. Anyone may enter for the prize."

Gretel looked wistfully at Hans, who tugging at his cap, answered respectfully:

"Oh, jufvrouw, even if we could enter, we could skate only a few strokes with the rest. Our skates are hard wood, you see" (holding up the sole of his foot), "but they soon become damp, and then they stick and trip us."

Hilda wished from her heart that she had not spent so much of her monthly allowance on lace and finery. She had but eight kwartjes left. Looking down with a sigh at the two pair of feet so very different in size, she asked:

*From PROSE AND POETRY Journeys. Used by permission of The L. W. Singer Co., Publishers.



"Which of you is the better skater?"

"Gretel," replied Hans, promptly.

"Hans," answered Gretel, in the same breath.

Hilda smiled.

"I cannot buy you each a pair of skates, or even one good pair; but here are eight kwartjes. Decide between you which stands the best chance of winning the race, and buy the skates accordingly." And with a nod and a smile Hilda, after handing the money to the electrified Hans, glided swiftly away.

"Jufvrouw, jufvrouw van Gleck!" called Hans in a loud tone, stumbling after her as well as he could, for one of his skate-strings was untied.

Hilda turned, and with one hand raised to shield her eyes from the sun, seemed to him to be floating through the air, nearer and nearer.

"We cannot take this money," panted Hans, "though we know your goodness in giving it. We have not earned it."

Hilda was quick-witted. She had seen a pretty wooden chain upon Gretel's neck.

"Carve me a chain, Hans, like the one your sister wears. That sum will be but a poor price for the chain," and off she darted, outstripping the fleetest among the skaters. . . .

On the following day, there was not a prouder nor a happier boy in all Holland than Hans Brinker, as he watched his sister, with many a dexterous sweep, flying in and out among the skaters who at sundown thronged the canal. As the little creature darted backward and forward, flushed with enjoyment, she felt that the shining runners beneath her feet had suddenly turned the earth into fairyland, while "Hans, dear Hans!" echoed itself over and over again in her grateful heart.

"By den donder!" exclaimed Peter van Holp to Carl Schummel, "but that little one in the red jacket and patched petticoat skates well. Gunst! she has toes on her heels, and eyes in the back of her head! See her! It will be a joke if she wins the race!"

"Hush! not so loud!" returned Carl, rather sneeringly. "That little lady in rags is the special pet of Hilda van Gleck. Those shining skates are her gift, if I make no mistake."

"So! so!" exclaimed Peter, with a radiant smile, for Hilda was his best friend. "She has been at her good work there, too!" And Mynheer van Holp, after cutting a double 8 on the ice, to say nothing of a huge P, then a jump, and an H, glided onward until he found himself beside Hilda. Hand in hand, they skated together, laughingly at first, then staidly talking in a low tone. Strange to say, Peter van Holp soon arrived at a sudden conviction that his little sister needed a wooden chain just like Hilda's.

Two days afterward, on St. Nicholas Eve, Hans, having burned three candle-ends, and cut his thumb into the bargain, stood in the market-place at Amsterdam, buying another pair of skates. . . .

The twentieth of December came at last,

bringing with it the perfection of winter weather. All over the landscape lay the warm sunlight. It tried its power on lake, canal and river; but the ice flashed defiance and showed no sign of melting. The very weather-cocks and the windmills stood still to enjoy the sight.

There was an end to grinding, crushing and sawing for that day. It was a good thing for the millers near Broek. Long before noon, they concluded to take in their sails and go to the race. Everybody would be there. Already the north side of the frozen Y was bordered with eager spectators: the news of the great skating-match had traveled far and wide. Men, women and children, in holiday attire, were flocking toward the spot. Some wore furs, and wintry cloaks or shawls; but many, consulting their feelings rather than the almanac, were dressed as for an October day.

The site selected for the race was a faultless plain of ice near Amsterdam, on a great arm of the Zuider Zee. The townspeople turned out in large numbers. Strangers in the city deemed it a fine chance to see what was to be seen. Many a peasant from the northward had wisely chosen the twentieth as the day for the next city-trading. It seemed that everybody, young and old, who had wheels, skates or feet, had hastened to the scene.

The music has commenced. How melody seems to enjoy itself in the open air! The fiddles have forgotten their agony and everything is harmonious. Until you look at the blue tent, it seems that the music springs from the sunshine, it is so boundless, so joyous. Only the musicians are solemn.

The racers are assembled together near the white columns. It is a beautiful sight. Forty boys and girls in picturesque attire darting with electric swiftness in and out among each other, or sailing in pairs or triplets.

A few careful ones are soberly tightening their straps; others halting on one leg with flushed, eager faces suddenly cross the suspected skate over their knee, give it an examining shake, and dart off again. One and all are possessed with the spirit of motion. They cannot stand still. Their skates are a part of them, and every runner seems bewitched.

Twenty boys and twenty girls. The latter by this time are standing in front, for they are to have the first "run."

The Crier stands between the columns and the first judges' stand. He reads the rules in a loud voice:

"THE GIRLS AND BOYS ARE TO RACE IN TURN, UNTIL ONE GIRL AND ONE BOY HAS BEATEN TWICE. THEY ARE TO START IN A LINE FROM THE UNITED COLUMNS—SKATE TO THE FLAGSTAFF LINE, TURN, AND THEN COME BACK TO THE STARTING-POINT; THUS MAKING A MILE AT EACH RUN."

A flag is waved from the judges' stand. Madame van Gleck rises in her pavilion. She leans forward with a white handkerchief in her hand. When she drops it, a bugler is to give the signal to start.

The handkerchief is fluttering to the ground. Hark! They are off!

No. Back again. Their line was not true in passing the judges' stand.

The signal is repeated.

Off again. No mistake this time. Whew! how fast they go!

The multitude is quiet for an instant, absorbed in eager, breathless watching.

Cheers spring up along the line of spectators. Huzza! five girls are ahead. Who comes flying back from the boundary mark? We cannot tell, something red, that is all. There is a blue spot flitting near it, and a dash of yellow nearer still.

Now we can see! Katrinka is ahead! She passes the van Holp pavilion. The next is Madame van Gleck's. That leaning figure gazing from it is a magnet. Hilda shoots past Katrinka, waving her hand to her mother as she passes. Two others are close now, whizzing on like arrows. What is that flash of red and brown? Hurrah, it is Gretel! Soon Katrinka, with a quick merry laugh, shoots past Hilda. The girl in yellow is gaining now. She passes them all, all except Gretel. The judges lean forward. Cheer after cheer fills the air.

"GRETEL BRINKER — ONE MILE!" — shouts the Crier.

While the girls are resting—some crowding eagerly around our frightened little Gretel, some standing aside in high disdain—the boys form in a line. Ludwig, Peter, Carl and Hans are there, cool and in good skating order.

Mynheer van Gleck drops the handkerchief this time. The buglers give a vigorous blast! The boys have started.

Half-way already! Did ever you see the



like! Three hundred legs flashing by in an instant. But there are only twenty boys. No matter, there were hundreds of legs, I am sure! Where are they now? There is such a noise one gets bewildered. What are the people laughing at? Oh, at that fat boy in the rear. See him go! See him! He'll be down in an instant, no, he won't. I wonder if he knows he is all alone; the other boys are nearly at the boundary line. Yes, he knows it. He stops! He wipes his hot face. He takes off his cap and looks about him. Better to give up with a good grace. He has made many friends by that hearty, astonished laugh. Good Jacob Poot!

A cloud of feathery ice flies from the heels of the skaters as they "bring to" and turn at the flag-staffs.

Something black is coming now, one of the boys—it is all we know. Now they come nearer—we can see the red cap. There's Carl —there's Peter—there's Hans!

Hans is ahead! Young Madame van Gend, Peter's married sister, almost crushes the flowers in her hand; she had been quite sure that Peter would be first. Carl Schummel is next, then the youth with the red cap. The others are pressing close. A tall figure darts from among them. He passes the red cap, then Carl. Now it is an even race between him and Hans. Madame van Gend catches her breath.

It is Peter! He is ahead! Hans shoots past him. Hilda's eyes fill with tears, Peter *must* beat! Gretel gazes with clasped hands—four strokes more will take her brother to the columns.

He is there! Yes, but so was young Schummel just a second before. At the last instant, Carl, gathering his powers, had whizzed by them and passed the goal.

"CARL SCHUMMEL! ONE MILE!" shouts the Crier.

Soon Madame van Gleck rises again. The falling handkerchief starts the bugle; and the bugle, using its voice as a bowstring, shoots off twenty girls like so many arrows.

It is a beautiful sight, but one has not long to look; before we can fairly distinguish them they are far in the distance. This time they are close upon one another; it is hard to say as they come speeding back from the flag-staff which will reach the columns first. There are new faces among the foremost—eager, glowing faces, unnoticed before. Katrinka is there, and Hilda, but Gretel and Rychie are in the rear. Gretel is wavering, but when Rychie passes her, she starts forward afresh. Now they are nearly beside Katrinka. Hilda is still in advance, she is almost "home." She has not faltered since the bugle note sent her flying; like an arrow still she is speeding toward the goal. Cheer after cheer rises in the air. Peter is silent but his eyes shine like stars. "Huzza!"

The Crier's voice is heard again.

"HILDA VAN GLECK, ONE MILE!"

A loud murmur of approval runs through the crowd, catching the music in its course,

till all seems one sound, with a glad rhythmic throbbing in its depths. When the flag waves all is still.

Once more the bugle blows a terrific blast. It sends off the boys like chaff before the wind—dark chaff I admit, and in big pieces. It is whisked around at the flag-staff, driven faster yet by the cheers and shouts along the line. There are three boys in advance this time, and all abreast. Hans, Peter and Ludwig. Carl soon breaks the ranks, rushing through with a whiff! Fly Hans, fly Peter, don't let Carl beat again. Carl the bitter, Carl the insolent. Hans and Peter, Peter and Hans; which is foremost? We love them both. We scarcely care which is the fleeter.

Hilda, Annie and Gretel, seated upon the long crimson bench, can remain quiet no longer. They spring to their feet—so different, and yet one in eagerness. Hilda instantly reseats herself; none shall know how interested she is, none shall know how anxious, how filled with one hope. Shut your eyes then, Hilda—hide your face rippling with joy. Peter has beaten.

"PETER VAN HOLP, ONE MILE!" calls the Crier.

The girls are to skate their third mile.

How resolute the little maidens look as they stand in a line! This third mile may decide the race. Still, if neither Gretel nor Hilda win, there is yet a chance among the rest for the Silver Skates.

The bugle thrills through them again. With quivering eagerness they spring forward, bending, but in perfect balance. Now they are skimming off in the distance. Again the eager straining of eyes—again the shouts and cheering, again the thrill of excitement, as, after a few moments, four or five, in advance of the rest, come speeding back.

Who is first? Not Rychie, Katrinka, Annie, nor Hilda, nor the girl in yellow—but Gretel —Gretel, the fleetest sprite of a girl that ever skated. She was but playing in the earlier race, now she is in earnest, or rather, something within her has determined to win. That lithe little form makes no effort; but it cannot stop—not until the goal is passed!

In vain the Crier lifts his voice—he cannot be heard. He has no news to tell—it is already ringing through the crowd. *Gretel has won the Silver Skates!* Goose-girl or not, Gretel stands acknowledged Queen of the Skaters!

With natural pride Hans turns to see if Peter van Holp is witnessing his sister's triumph. Peter is not looking toward them at all. He is kneeling, bending his troubled face low, and working hastily at his skate-strap. Hans is by him at once.

"Are you in trouble, mynheer?"

"Ah, Hans! that you? Yes, my fun is over. I tried to tighten my strap—to make a new hole—and this botheration of a knife has cut it nearly in two."

"Mynheer," said Hans, pulling off a skate —"you must use my strap!"

"Not I, indeed, Hans Brinker," cried Peter, looking up, "though I thank you warmly. Go to your post, my friend, the bugle will sound in a minute."

"Mynheer," pleaded Hans in a husky voice. "You have called me your friend. Take this strap—quick! There is not an instant to lose. I shall not skate this time—indeed I am out of practice. Mynheer, you *must* take it,"— Hans, blind and deaf to any remonstrance, slipped his strap into Peter's skate.

"Come, Peter!" they called from the line, "we are waiting for you."

"For madame's sake," pleaded Hans, "be quick. She is motioning to you to join the racers. There, the skate is almost on; quickly, mynheer, fasten it!"

"You are a noble fellow, Hans!" cried Peter yielding at last. He sprang to his post just as the white handkerchief fell to the ground. The bugle sends forth its blast, loud, clear and ringing.

Off go the boys! They are winged Mercuries every one of them. What mad errand are they on? Ah, I know; they are hunting Peter van Holp. He is some fleet-footed runaway from Olympus. Mercury and his troop are in full chase. They will catch him! Now Carl is the runaway—the pursuit grows furious!

The chase turns in a cloud of mist. It is coming this way. Who is hunted now? It is Peter, Peter van Holp; fly, Peter—Hans is watching you. He is sending all his fleetness, all his strength into your feet. Your mother and sister are pale with eagerness. Hilda is trembling and dare not look up. Fly, Peter! the crowd has not gone deranged, it is only cheering. The pursuers are close upon you! Touch the white column! It beckons—it is reeling before you——

Huzza! Huzza! Peter has won the Silver Skates!

"PETER VAN HOLP!" shouted the Crier.

THE NEXT STORIES ARE ON PAGE 1841.



Painting by Ezra Winter, Juley photo

George Washington taking the oath of office as president, on the open balcony of Federal Hall, New York, in 1789.

BUILDING THE NEW NATION

WE have already told how the whole army of the British general, Lord Cornwallis, was surrendered to the French and American armies at Yorktown on October 19, 1781. After that it seemed that almost everyone in England except King George III felt that the colonies must have their independence. However, King George and some of his advisers were stubborn, and peace was delayed. Even after it was pointed out to the King that the colonies could not be conquered now that they were getting help from France, he did not want to give up. He declared that at least the state of Georgia and the cities of New York and Charleston, which were still held by British troops, must be kept. Soon, however, General Anthony Wayne drove the British army out of Georgia, the Spanish took Florida, and the stubborn King was forced to agree that it was time to make peace with the Americans.

It took quite a while to decide on peace terms that satisfied everyone. The wishes of France and Spain had to be considered, because France had helped the Americans win the war, and France was at that time friendly with Spain. One of the reasons why France had helped the colonies was to cut down some of Britain's power; but the French Government did not want the new American nation to become too powerful. Spain controlled all of the country west of the Mississippi River, and also the land east of the Mississippi along the Gulf of Mexico, and the Spanish did not want the Americans too near to their territory. So the chief minister of Spain suggested that all of the country between the upper Mississippi and the Ohio rivers—now Ohio, Indiana, Illinois and the states north of them—should remain an English possession. The country south of the Ohio and east of the Mississippi—now the states of Kentucky, Tennessee, Alabama and Mississippi—should be Indian territory, a part of it under the protection of the United States and a part under Spain. This plan would have given the thirteen states no room in which to grow.

The Americans who had been sent to Paris to make peace, Benjamin Franklin, John Jay and John Adams, would not agree to such a plan, and other suggestions were made. On November 30, 1782, a treaty was agreed upon. It was signed on September 3, 1783.

This treaty gave to the United States all territory held by England east of the Mississippi, and gave Americans the privilege of catching fish on the coast of Newfoundland. On the other hand, the United States agreed that all debts owed to British merchants must be paid, and the Congress would ask the states not to pass harsh laws against those Tories who had not actually done any harm to the American cause. On the whole, the Americans had gained a great deal—really more than they had hoped to get.

MANY TORIES LEAVE THE COLONIES AND SETTLE IN CANADA AND OTHER LANDS

The states did not pay much attention to the recommendations of Congress about the Tories, or Loyalists, and many of these people left their homes and sailed away in the ships with the British troops. Many others were forced to go later, and some historians say that about 100,000 in all left the colonies. Some of them went to England, some to the West Indies, but more went to Canada, where they had a hard time at first. While it is true that a number of the Tories had carried on what we now might call Fifth-Column activities against the cause of independence, many others had simply gone about their own business and troubled nobody. The colonies needed population so badly that it seems a great pity that the good as well as the bad Loyalists were forced to leave.

As soon as it was certain that peace had been made, the army which had been in camp near Newburgh, New York, was disbanded. This was on November 3, 1783. On December 4, Washington met his officers at Fraunces' Tavern in New York. Fraunces' Tavern is now preserved as a historical shrine, and visitors may see the room where the meeting took place. After bidding an affectionate farewell to his officers, Washington was rowed across the Hudson River to New Jersey and started on his journey southward.

A COMMANDER-IN-CHIEF WHO REFUSED TO ACCEPT PAY FOR HIS SERVICES

When he reached Philadelphia, he handed to the proper officer a statement of the money he had spent out of his own pocket from the time when he took command of the army in Cambridge more than eight years before. The amount was $64,315. In addition to spending his own money, Washington had refused to take any pay for his services as commanding general of the army.

From Philadelphia he went to Annapolis, Maryland, where the Congress was then sitting, to resign his commission as commander. Then he hurried away to spend Christmas at Mount Vernon. He had seen his home but once during the whole eight and a half years, and he was looking forward to devoting his time to his family, his slaves and his lands. We shall see, however, that his countrymen did not allow him to remain long at the home he loved so much.

THE ARTICLES OF CONFEDERATION, ADOPTED BY THE THIRTEEN STATES IN 1781

Now that the colonies had become independent states, what sort of government did they have? You remember that in the beginning of the Revolution, delegates from the colonies met and called themselves the Continental Congress. This body raised an army, issued paper money, borrowed more money and carried on the war; but no one could say how many or how few its rights were. Soon people began to feel the need for a closer union of the states. A committee of the Congress drew up a paper called the Articles of Confederation. The Congress adopted them in November, 1777, and sent them to the states to be adopted or rejected. The states were very slow, and not until March, 1781—when the Revolution was almost over—did all the states agree to accept the Articles.

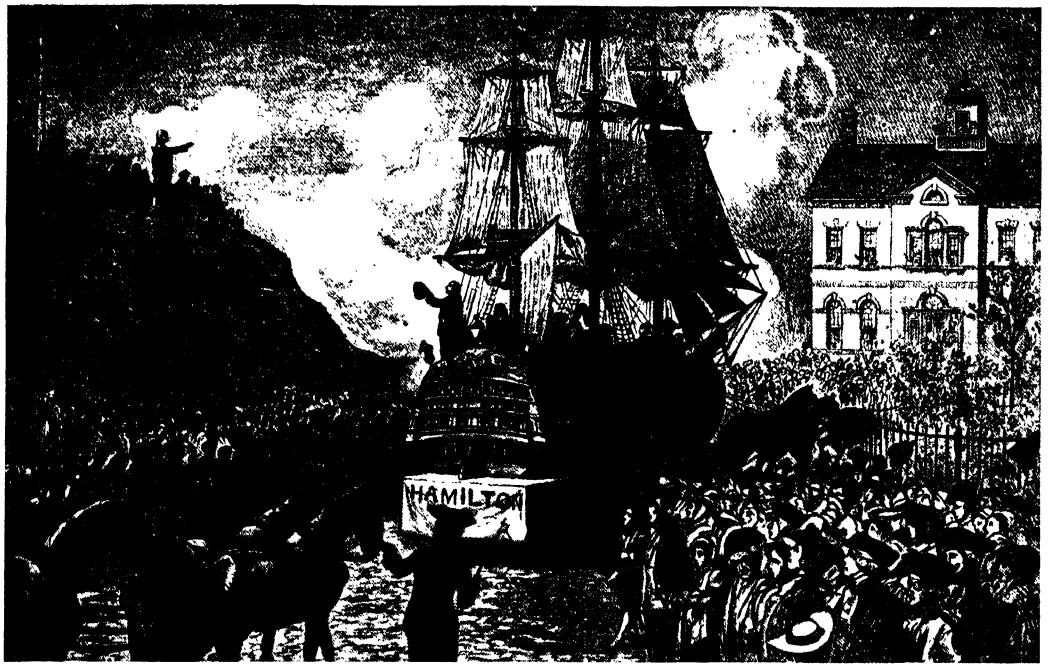
In order to understand the government the United States has today, we must understand what sort of government they had under the Articles of Confederation. Under these articles the states kept nearly all of the power and the Confederation had very little. There was no president of the United States. Each state sent not less than two and not more than seven delegates to Congress, and each state, whether large or small, had one vote.

HOW THE STATES VOTED UPON LAWS UNDER THE ARTICLES OF CONFEDERATION

These delegates were officers of the states, not of the United States. They were paid by the state that sent them, and they might be called back home at any time. No state could vote unless it had at least two delegates present. If a state had two, four or six delegates present, and half were on one side of a question and half on the other, the state's vote could not be counted. No law could be made unless at least nine of the thirteen states voted in favor of it, and so very few laws were made. No change could be made in the Articles unless every state agreed, and it was almost impossible to get all of the states to agree on any one thing.

Congress was given the right to establish a government, to make treaties, to establish post offices, to raise an army and to build a navy, but it was not given the power to raise money to pay for them. It could only recommend that each state pay its share of whatever money was needed. The states were jealous of one another. Quite often a state would refuse to pay what was asked, saying that the amount was more than its share. When this happened there was nothing that Congress could do to make the state pay. The states had fought the Revolution because of taxation, and had come to hate taxes of any sort. However, a government which has not the power to raise money is almost the same as no government at all.

Nowadays, every state and every city is glad to get as much trade as possible. In those days, many people had quite different ideas about trade. The people in New York thought that people from Connecticut and New Jersey who sold wood and food in New York City were enemies who carried off the money from the city. Therefore New York put heavy taxes on everything that was brought in from Connecticut and New Jersey, and those states, in revenge, refused to trade with New York at all. Several of the states quarreled about boundary lines, just as they had done when they were colonies. Then, too, the territory west of the Allegheny Mountains was claimed by several states and this gave rise to trouble. Other states quarreled about other matters, and some of them actually threatened to fight.



New York ratified the Constitution (agreed to it) in July, 1788. Parades and bonfires celebrated the event.

After peace was made conditions grew worse. During the war the need to work and fight together against the foe had kept the states from too much disagreement among themselves. Now that the war was over they quarreled most of the time. The army that had fought for freedom was not paid, and some of the officers, disgusted with the weakness of the Confederation, wanted to make Washington king. The Congress could not even get money enough to pay the interest on the money that had been borrowed from Europe to help carry on the war.

Within the individual states matters were not much better. There was a great deal of lawlessness and discontent. In some states people refused to obey the state laws, and in Massachusetts there was a little war known as Shays' Rebellion, from the name of the leader, Daniel Shays. When we consider all these things it is not surprising that some of the wisest men began to fear that the infant nation would not live to grow up. There was danger that civil war would break out, and

then, one by one, the states might be brought under the power of England or of Spain. The Spanish were hoping to join Georgia and South Carolina to Florida; and the Spanish governor at New Orleans had refused to allow American boats to float down the Mississippi into the Gulf of Mexico. Spain hoped that the people in what is now Kentucky and Tennessee would join her in order to get the right to use the Mississippi.

ONLY FIVE STATES SEND DELEGATES TO THE ANNAPOLIS CONVENTION, HELD IN 1786

It soon became clear to almost everyone that the Confederation was not working, and that a stronger, more efficient kind of central government must be found. In 1785 a meeting was held at Mount Vernon to discuss certain problems that had arisen between Maryland and Virginia. This meeting led to another, held at Annapolis the following year, to which all of the states were invited to send delegates. Only five of the states did so, and the Annapolis Convention was not a great success. It did, however, lead the way for the Congress to call a convention.

This convention met in May, 1787, in Philadelphia, in the same room in which the Declaration of Independence had been signed. Many great men were members, and George Washington was chosen to preside over the meetings. Some of the other members were James Madison, Benjamin Franklin and Alexander Hamilton.

WHY THE CONGRESS OF THE UNITED STATES IS MADE UP OF TWO HOUSES

From the beginning the different and often conflicting interests of the states made it hard to decide many of the questions that arose. For example, when it came to deciding how the states would be represented in the proposed new government, the large states and the small states disagreed. Virginia then had the largest population, and she felt that she should have more votes than a small state such as Delaware or New Hampshire. The small states, on the other hand, feared that the large states would have too much power if the votes were apportioned according to the number of people in a state. The small states wanted to keep the old plan of one vote to each state. After much discussion, it was agreed that the new Congress should be made up of two houses, or branches. In the one, called the Senate, each state, whether large or small, was to have two members. In the other, called the House of Representatives, the states were to have members according to their population.

Then the delegates disputed about the powers that the Congress was to have. Some did not want a strong central government; others wished a monarchy, or something very much like it. One man said that the old state lines ought to be wiped out and thirteen new states of equal size ought to be made. The farming states wanted one thing; the shipbuilding states another. The slave-holding states had one idea; the states where there were few or no slaves had another. Different opinions were also held about the head of the proposed government. Some wished a president to hold office for life; others wished the head of the government to be a committee of seven men.

THE CONSTITUTION IS ADOPTED AND IS SENT TO THE STATES TO BE VOTED UPON

There were many other matters on which the delegates from the different states found it hard to agree. In the end, however, these disputed points were settled, and after four months of discussion, the Constitution was adopted and sent by Congress to the states to be voted upon. The Convention had decided that the new government would begin when nine states had ratified, that is, agreed to accept, the Constitution. Any states that refused to join this majority were to be left out.

You may read more about the Constitution in the chapter beginning on page 7584 of Volume 20. It is a wonderful document, and the most remarkable thing about it is the fact that men with conflicting interests and needs were willing to compromise with one another; each sacrificing something in order to benefit everyone. It is such a spirit of compromise that makes democracy really work. It is said that Benjamin Franklin, when the Convention ended, pointed to a picture of the sun in the hall and said: "As I have been sitting here all these weeks, I have often wondered whether yonder sun is rising or setting. But now I know that it is a rising sun."

A NUMBER OF PROMINENT AMERICAN LEADERS OPPOSE THE NEW CONSTITUTION

When the Constitution was sent to the states, many prominent men tried to get the different states to vote against it. Patrick Henry in Virginia, and Samuel Adams in Massachusetts, who had done so much to bring on the War of Independence, worked against the Constitution because they were afraid it took too much power away from the states. Samuel Adams at last agreed not to oppose the new plan, but many other pa-



Culver Service

Life was gracious and leisurely on the big plantations of the South in the early days of the Republic. The great houses were filled with beautiful furniture; and in the stables were fine horses and elegant carriages.

triots held out in opposition. They feared that the president would become a tyrant.

Many others did not like some things about the new plan, but they felt that if they did not accept it there would be no government at all. These men, together with those who were friendly toward the new form of government, were too strong for the opponents. The Constitution was approved first by Delaware, then by Pennsylvania, New Jersey, Georgia, Connecticut, Massachusetts, Maryland, South Carolina, New Hampshire, Virginia and New York. North Carolina and Rhode Island did not join the new union until the government was well begun.

When the time came to elect a president, there was only one choice for the head of the new nation. George Washington was again called from Mount Vernon to serve his country. Ten states voted. North Carolina and Rhode Island were not members of the Union, and New York did not get ready in time.

Washington was supposed to be inaugurated on the first Wednesday in March, 1789, but not until April 30 was everything ready. On that day he took the oath of office on the balcony of Federal Hall in New York City. The building was long ago torn down, but today, almost on the exact spot on Wall Street, you may see a bronze statue of the "Father of his Country," and in the City Hall there is some of the furniture used by the first officers of our government. John Adams of Massachusetts was chosen vice-president.

We are proud of the size, the wealth and the population of our country today, but it was a very poor and weak nation then. The population was about 4,000,000, hardly as many people as now live in the city of Chicago. Not more than 100,000 lived west of the Allegheny Mountains, where the Indians roamed the woods and often attacked the scattered pioneers. Most of the people got their living by farming or fishing, though cotton-manufacturing was beginning, and there were a few iron foundries. There were only a few small cities. Molasses brought from the West Indies was made into rum, and on every farm there was a spinning-wheel and a loom for weaving. Small ships were built in New England and along the middle Atlantic coast, to be used for fishing or for trading with the West Indies. For the most part, the young nation depended upon Europe for its manufactured articles.

Railroads, telegraphs, telephones, gas, electric lights and matches were unknown. People traveled from place to place on horseback, in carriages or wagons, by boat or by stagecoach. The stagecoaches took a week

to go from Boston to New York, if they did not stick in the mud. We can now travel the distance in less than five hours by train, and less than two hours by plane. Candles were generally used for lighting at this time, and even much later. Fire was usually made by striking a flint stone with a piece of steel. Often if the fire went out during the night a child was sent next morning to a neighbor's house to bring back some burning embers in a bucket. Coal was very little used.

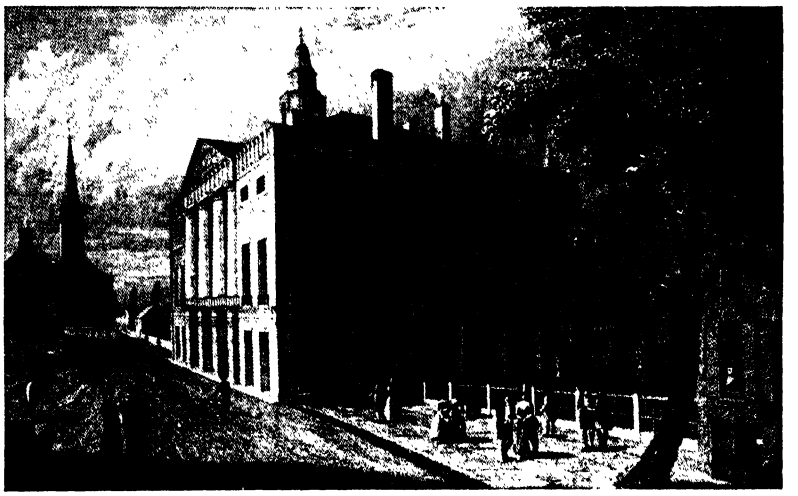
Only four or five towns deserved the name of city at all. Boston and New York were unpaved, unlighted towns, with cattle and pigs roaming around the streets. Philadelphia was the largest town, and was noted for its paved sidewalks and its fine houses. Charleston was an important port, and ships from England came there to get rice and indigo, bringing with them manufactured goods of every kind. Baltimore was smaller, but prosperous, and it had one fine street, of which the people were very proud.

The life of the farmer and of the farmer's wife was hard. There was no machinery to save labor, such as we now have on almost every farm. Everything was done by hand. Often the father tanned the hides of the cattle and made the family shoes from the leather. He often had to be a carpenter, a butcher and a blacksmith, as well as a farmer. The farmer's wife took care of the house, spun yarn, wove cloth and made the clothes for the family, knit stockings, made soap and candles, looked after the milk and butter, cured the meat, made sausages and did hundreds of other things, helped by her daughters. The sons helped the father on the farm.

There were few newspapers, and we would think them very poor. They were small, badly printed, and had few readers. Books were scarce and high in price. Even doctors and teachers and lawyers had very few books. Mails were slow and seldom arrived on time. Often a letter took weeks to make a trip now made in hours. The people in one state knew little about those in another, and sometimes people in different parts of the same state were entire strangers. We know now more about what happens in Australia or India than the Georgian knew about what happened in Connecticut.

Very little attention was given to music, literature, art or architecture, though there were some fine private houses filled with furniture, silver and china brought from Europe. The houses were heated by big fireplaces, and had none of our modern conveniences, such as running water, bathtubs, gas and electric stoves and washing machines.

Many of our common vegetables, such as the tomato, the cauliflower and the eggplant, were unknown. Apples and pears were small and not very good, while the only strawberries or raspberries were those which grew wild. Ice was kept only by the well-to-do, who built their own ice-storage houses. Our modern way of preserving fruit and vegetables by putting them in tin or glass was not used then, but they were dried in the sun. Berries were put down in sugar.



Federal Hall, New York, where Washington was inaugurated in April, 1789. The building was torn down in 1836 and the Subtreasury Building was erected on its site.

Such was the country of which George Washington was chosen president. His work was not easy. A government had to be organized and officers appointed. The Congress had borrowed much money which it could not pay, and no one would trust the new government. Money had to be raised to pay off these debts and to pay the officers of the government. The people did not believe in keeping an army in peacetime, but all knew

that they must have a small force to protect the frontier regions against the Indians. A navy was also necessary, but armies and navies can not be kept without money.

Washington chose as Secretary of the Treasury the young Alexander Hamilton about whom you have read in the chapter about the American Revolution. Hamilton was a good business man and put the nation's finances in much better shape. He got Congress to lay a small tax on goods brought into the country. The colonists had been against such taxes when they were laid by Britain, but now they made no objection, and soon the Treasury had money enough to carry on the government and to begin to pay debts.



John Adams.

Such a tax is called a tariff, or an import duty. It is called an indirect tax because people pay it without knowing it. The merchant who brought in the foreign goods paid the tax first. Then he added the tax and his profit to the price of the goods. The people who bought the goods could not know how much of the price that they paid was the cost of the manufacturing, how much was the cost of bringing it from abroad, how much was profit, and how much was tax. So most people did not object to this kind of tax.

If Hamilton had persuaded Congress to tax every house, every farm and all other property, that would have been a direct tax, because it would have been collected directly from the owner of the property. Some states might have forbidden their citizens to pay such a tax to the government, and the Union might have been broken up. He did cause a small direct tax to be placed on whiskey, and some people in Pennsylvania refused to pay it. But the President called out a large body of troops and the people gave in and agreed to pay the tax.

In another part of your BOOK OF KNOWLEDGE you may read about the French Revolution, which began in 1789. Many of our citizens sympathized with France. They said that the French had helped us in our Revolution, that they had established a republic like ours, and because of this they were at war with England. They said, too, that England was still our enemy, for she still kept soldiers in some forts on American soil, and her warships stopped American vessels to look for English sailors who had deserted their own ships. For these reasons, the friends of France said that we ought to help France, even if it brought on another war with England.

Washington knew that we were not yet strong enough to fight England again, and, besides, he felt that in France the Revolution was going too far. So he declared, in 1793, that the United States would remain neutral, which meant that we would take neither side. We made no friends by this plan, for France was very angry because we did not join her, and England captured our ships if they were sailing to France. It took all of Washington's strength to keep Congress from declaring war against England, but he succeeded. He knew that we were growing stronger every year, but that we needed all our energies for peaceful development. If we fought with England again, we could get no help from Europe, and we would be almost sure to lose our independence. Instead of going to war, Washington sent John Jay to England to make a treaty. The Jay Treaty, as it is called, was not very favorable to the United States, and many people did not like it, but even so, it was better than having another war.



Thomas Jefferson.

During Washington's first term there had been no political parties in the country, but during his second term, which began in 1793, the people began to divide. One party, led by Hamilton and John Adams, wished to have a very strong central government. They did not believe in the rule of the people, but thought that only the well-to-do and well-

educated could be trusted to rule. The other party, of which Thomas Jefferson was the leader, believed that the best government was that which governed least, and that all the people were more likely to be right than a few, no matter how well-educated and rich the few might be. The followers of Hamilton were called Federalists. Jefferson's followers were first called Republicans, but later were called Democrats.

Washington tried hard to keep the peace between these parties, but found it hard work. He was beginning to grow old and he wished very much to go back to Mount Vernon. When his second term was almost over, he announced that he would not serve a third term, though a great many people wanted him to continue in office. At the election the vote between Adams and Jefferson was very close, but Adams was elected.

Adams was not popular in France, and that country did not like his election. Then, too, the French were angry because we had not helped them, and because we had made a treaty with England instead of fighting. So the French began to capture our ships, and when we objected, our representatives in France were told privately that if we would bribe some French ministers, our vessels would not be captured. When this outrageous offer became known in the United States, it was reported that Charles C. Pinckney, one of our representatives in France, had replied, "Millions for defense, but not one cent for tribute!" The people were very much excited, an army was raised, Washington was made commander and some warships were built, which captured some French vessels. War was not regularly declared, but when France found that the United States would fight, she was willing to make peace.

THE ALIEN AND SEDITION LAWS CAUSE THE ADAMS ADMINISTRATION TO LOSE FAVOR

The remainder of Adams' administration was full of trouble. During the trouble with France some rather severe laws had been passed. One law gave the president power to send any foreigner out of the country without a trial, or else to put him in prison. Another law punished anyone who opposed the government, or who published anything which was thought to be unfavorable to the government officials. These laws were called the Alien and Sedition Laws. They were very unpopular and Adams was blamed for them. When he tried to be elected for a second term he lost, and Jefferson was elected president instead.

The most important event during the eight years Jefferson was president was the purchase of Louisiana. In 1762 France had given to Spain all the territory France claimed west of the Mississippi. In 1801 France took it back again, for Napoleon had a dream of founding a new French nation in the New World. He had great trouble in the West Indies, however, and soon saw that the British fleet could destroy any colony that he might plant, and, besides, he needed all his money for his wars. So he sold to the United States the whole territory, which was greater in size than the United States at that time, for $15,000,000. This was called the Louisiana Purchase. From it thirteen states, or parts of states, have been made. Some of these are now among the richest and most highly developed states of the Union.

THE LOUISIANA PURCHASE PROVES TO BE A VERY PROFITABLE INVESTMENT

There were only about 40,000 people in this great territory, and many prominent men thought that it would be hundreds of years before it would have many settlers. Many people said that the money of the old states would be wasted in buying the territory. There was a great deal of opposition to the purchase in New England, some men going so far as to advise the New England states to leave the Union if the purchase was made. And yet, only nine years later (1812) a small part of the territory was admitted to the Union as the state of Louisiana, and in 1821 another part became the state of Missouri. A hundred years after the purchase, the population of the whole region was more than 15,000,000, and the value of the crops raised and the goods manufactured every year was more than two hundred times as much as the price paid for the territory.

Little was then known of the Pacific coast. In 1792 Captain Robert Gray had sailed into a great river, which he called Columbia after his ship, and the country around was generally called Oregon, but very little was known about it. President Jefferson decided to send William Clark and Meriwether Lewis to explore this country. Before they started, the Louisiana territory had been bought.

The Lewis and Clark expedition left St. Louis in 1804, went 1,600 miles up the Missouri River before winter set in, and the next spring went on until the river grew so small that a man could step across it. They then crossed the Rocky Mountains and found another river. They followed this to its mouth and it turned out to be the Columbia, which



Brown Brothers

Scene at New Orleans as Louisiana, formerly a French possession, was formally transferred to the United States.

had been discovered by Captain Gray. No white man had ever made this trip before them, and their exploration helped the United States to claim Oregon when the dispute with Britain over this territory arose many years afterward.

During the years of Jefferson's administration Britain was trying to crush Napoleon, who had conquered most of Europe. The British declared all seaports in Napoleon's power to be blockaded: that is, closed against vessels from any other nation. Napoleon answered by declaring all British ports blockaded. The United States had many merchant ships which traded with Europe, and both France and England began to capture any of our ships that they caught sailing to each other's ports. In 1807, 194 of our ships were seized by the English, and many by the French. Besides this, English warships would stop our vessels to look for sailors that had deserted, and sometimes took men who had become citizens of the United States, and even men born in this country. At that time the European nations did not agree that a man could change his nationality.

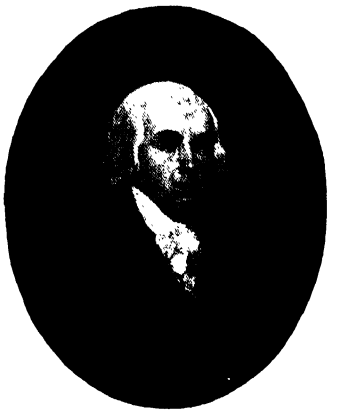
All of these things had been done in Adams' administration, and the people of the United States were becoming more and more angry about them. President Jefferson tried hard to avoid war, for he felt that we were not yet strong enough to wage a successful war. He tried to punish both countries by getting Congress to pass laws forbidding our ships to trade with either country. While these laws hurt France and England, they hurt our own country much more, and caused Jefferson to lose some of his popularity. Nevertheless, a majority of the people wanted him to serve a third term, but he followed the example of Washington and refused. From that time until 1940 it was the custom to elect no president for more than two terms of four years each.

During Jefferson's administration the country grew rapidly in population and wealth. In 1807 Robert Fulton, of whom you may read in another chapter of your BOOK OF KNOWLEDGE, ran his steamboat, the Clermont, on the Hudson River, and soon there were steamboats on all our rivers. A sad event was the death of Alexander Hamilton, who was killed in a duel in 1804 by Aaron Burr, then the vice-president. Later Burr had a plan to set up a separate country in the Southwest. The plan failed, however, and Burr, who had been the second highest officer of our government, was arrested and

tried for plotting against his country. He was finally acquitted.

Our next president, James Madison, was, like Washington and Jefferson, a Virginian. In fact, during the first thirty-six years of our government, Virginia furnished the presidents for thirty-two years, and so came to be called the "Mother of Presidents." Madison was one of the ablest and best men that have ever been president, but he came into office at a difficult time. Both England and France were capturing our ships, and the Indians west of the Alleghenies were murdering the settlers who were moving westward in large numbers.

Though Madison loved peace as much as had Washington or Jefferson, the idea of war had become popular. Some people wished to fight England, some wished to fight France, and a few would have fought both countries. England, however, had captured more of our ships than France had done, so that feeling was strongest against the English. Then, too, many of the Western people hoped to capture Canada and add it to the Union. Many Indian raiding parties came down from Canada and brought death and destruction to the settlers in the West, and these people felt certain that the British authorities encouraged the raiders.



James Madison.

War was declared by Congress on June 18, 1812. Four reasons for declaring war were given: (1) England had stirred up the Indians in the West. (2) She had captured 900 of our merchant ships in ten years. (3) She had blockaded our coasts. (4) She stopped our ships and impressed, that is, took off by force, our seamen, pretending they were British deserters. In the Constitution we declared that a foreigner could become an American citizen after a term of years. England said, "Once an Englishman, always an Englishman." She claimed, therefore, that a man born in England was a British subject, though he might have lived in the United States twenty years, and might be a citizen, or even an office-holder.

We had then about 8,000,000 people; England had 20,000,000. We had a few ships with 4,000 sailors and 1,500 marines; England had hundreds of ships and 150,000 sailors. Two hundred and thirty of her ships were larger than any of ours. Our army was small, while England had many trained soldiers. Most of them, however, were occupied fighting against Napoleon at this time, which was perhaps fortunate for us. Worse than all our other weaknesses was the fact that New England did not want to fight. The profits of shipbuilding and trading were so great that New Englanders felt that they could better afford to have some ships captured than to go into a war and have all of their trade cut off.

Two attempts to invade Canada failed, and the British captured Detroit because the American officers were cowardly or were poor commanders. But on the sea the Americans had better results. The American frigate Essex captured the Alert. Another American frigate, the Constitution (known to us as "Old Ironsides"), began her career by making a wreck of the British Guerrière in half an hour. The Guerrière was not quite so large a vessel as the Constitution, but the American ship's fire was the most accurate that had ever been seen. A few months later the Wasp took the Frolic, and the frigate United States took the Macedonian. This British ship lost 106 men, while the American ship lost only 12. Two months later the Constitution took the Java, and early in 1813 the Hornet took the Peacock.

England was stunned. During almost continual war with France for twenty years she had lost only five vessels and had taken hundreds. Here in six months she had lost six and had taken none.

But during 1813 the tide turned. The British frigate Shannon, under Captain Broke, offered battle to the American frigate Chesapeake. Though the Chesapeake had a new and untrained crew, her captain, James Lawrence, had come to despise British skill, and sailed out to meet the Shannon, which had a good crew. In a few minutes the Chesapeake was disabled and her commander fatally wounded. As the dying Lawrence was being carried below decks he cried, "Don't give up the ship!" Some of the men refused to keep on fighting, and the ship was given up.

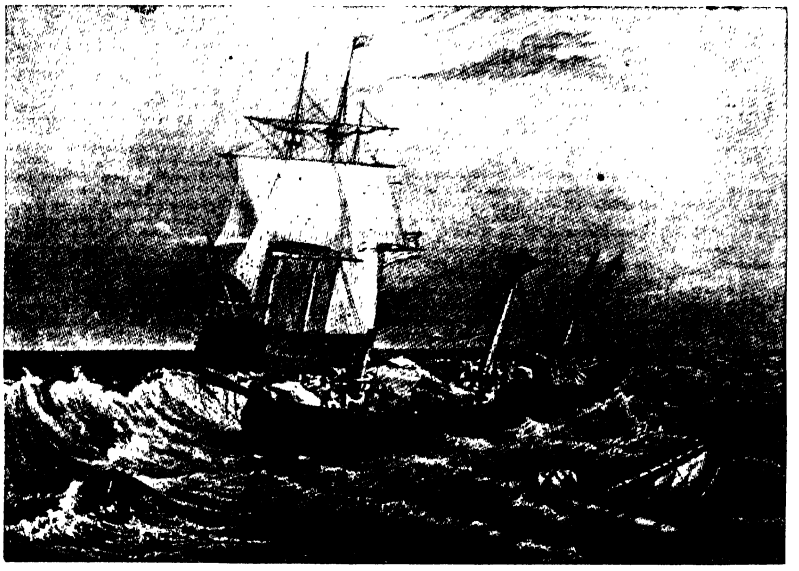
The fighting on land continued for some time to go against the Americans, and it

began to look as if we were going to lose some of our own territory instead of adding Canada. However, in May, 1813, the Americans captured York (now Toronto) and burned the government building; then, on September 10, the Americans won a real victory, the Battle of Lake Erie. A small fleet had been hastily built on Lake Erie, under the command of Lieutenant Oliver H. Perry. It met a British fleet and a fierce battle took place. At one point during the fight all but eight of the men on Perry's own little ship were killed or disabled. Perry and the men who were left made their way in an open boat to another of his ships, carrying their flag with them. They kept on fighting, and in a little while Perry was able to send the report, "We have met the enemy and they are ours." This victory cleared the way for General William Henry Harrison to defeat the British and Indians and recapture Detroit.

The following year another attempt to invade Canada was made under General Jacob Brown and General Winfield Scott. We shall hear much more about General Scott in the next story of our country. Two very bloody battles were fought at Chippewa and at Lundy's Lane, within sound of Niagara Falls; but though the Americans claimed the victory, they soon had to retreat. The British tried to send a fleet and army by way of Lake Champlain, along much the same route which General Burgoyne had taken during the American Revolution; but at Plattsburg both fleet and army were driven back.

Those who had thought that the Canadians would be glad to join the United States were wrong. On the contrary, the Canadians, both French and English-speaking, preferred to remain under British rule. The French had no reason to suppose that their language, religion and customs would be as safe under the Americans as under the British. Many of the British Canadians were themselves children of the Loyalists, or Tories, who had been forced to leave the United States after the Revolution. Their families had lost property and had suffered many hardships. They felt that they had been unjustly treated by the Americans and they were glad to fight alongside the British troops to drive out the invading enemy. This was one reason why, until near the end of the war, the British and Canadian forces were generally victorious, in spite of the fact that they were few.

Another reason was the difference in the quality of the military leaders. In the early days of the war the American forces were led by officers who had been appointed because they were popular, or else by men who had served in the Revolution and were really too old for active service in the War of 1812. The British commander, Major General Sir Isaac Brock, was a young man of great talent and ability, who was able to inspire the Canadians with confidence. His death at the Battle of Queenston Heights in October, 1812, was a blow to the Canadians. Some of the other British or Canadian leaders were not very good, and toward the end of the war the Americans put better generals in command of their troops. They had at last realized the sad truth that a man who is popular is not necessarily a good commander.



On August 19, 1812, the Constitution, an American warship, came upon the British ship Guerrière, and after about half an hour of fighting left it a hopeless wreck. The deeds of the young American navy in this war astonished the world.

One man who afterward became famous in American history now comes into notice for the first time. This was Andrew Jackson, who afterward became the seventh



A famous sea duel was fought on June 1, 1813, between the American ship Chesapeake and the Shannon, a British ship. The American captain, James Lawrence, was mortally wounded. Here we see him being carried below decks.

president of the United States. In 1813 Jackson commanded a force which crushed an uprising of the Creek Indians in Alabama. During the following year he defeated the British at Mobile, at Pensacola and at New Orleans. We shall tell more about the Battle of New Orleans farther on in this chapter.

In 1814 Napoleon was defeated and driven from France, and the British were able to send more soldiers to fight the United States. One force under General Ross found that Washington was not well defended, marched on the city and captured it without trouble. As a return for the burning of York, or Toronto, the British burned the Capitol and the White House. Next they tried to capture Baltimore, but failed. While a British fleet was bombarding the fort in the harbor of Baltimore, Francis Scott Key wrote the verses that afterward became our national anthem. The words tell the story of the battle.

All this time the Americans continued to do well on the sea. Most of the warships were blockaded in the harbors, but many privateers roamed the seas destroying British commerce. A privateer was a ship owned by a private individual, which was given permission by the government to capture merchant vessels belonging to the enemy country. Many of our shipmasters put a few small cannon on their vessels, and, instead of carrying cargo for trade, sailed about looking for the enemy's trading vessels. An English paper said of these privateers: "If they fight they are sure to conquer, if they fly they are sure to escape."

The New England states continued to oppose the war because it interfered with their profits. They would not allow their soldiers to fight outside their own state, and hindered the national government in every way. In December, 1814, a number of New England leaders met in Hartford, Connecticut, and advocated dissolving the Union. You will notice that during the first twenty-five years of our national government, New England was threatening to leave the Union a great deal of the time.

That section was not interested in manu-



Incident of the Battle of Lake Erie, September 10, 1813. The American commander, Commodore Perry, is being rowed from his battered flagship, the Lawrence, to the Niagara. The Americans were victorious in the battle.

factures. Much money had been invested in building ships, and the shipowners wished to trade with other nations. Then, too, New England was jealous of the West. Thousands of the best citizens had gone to the new western states. Ohio and other new states were growing rapidly in population, while some of the older states were growing very slowly. Moreover, the people of New England were, for the most part, Federalists, and disliked Jefferson, Madison and other Republican leaders.

The convention that met at Hartford did not decide to leave the Union at once, but did adopt some resolutions which would make it difficult to admit new states to the Union. They also demanded that the Constitution have certain changes made in it. A committee was sent to Washington to lay the resolutions before Congress, but something happened just then which put a stop to their plans.

Since the British had not succeeded in taking Baltimore, they decided to attack in another place. On January 8, 1815, they made an attack on New Orleans. General Andrew Jackson, who defended the city, had thrown up rude breastworks. Many of his men were Tennessee and Kentucky backwoodsmen who could shoot a squirrel in the top of the highest tree. The British commander, Sir Edward Pakenham, was a brother-in-law of the Duke of Wellington, and his force was made up of veteran soldiers who had fought against Napoleon's armies. Pakenham was like Braddock in looking down on the American troops, and instead of marching around them, which he could easily have done, decided to capture the breastworks. The British fought bravely, but the wonderful marksmanship of the backwoods riflemen was too much for them. Within less than half an hour the British retreated, leaving 2,600 dead or wounded. Among those killed was their commander, Sir Edward Pakenham. The American loss was only 8 killed and 13 wounded. This was the most brilliant land victory of the war.

It is sad to think that all this sacrifice of life was unnecessary. On Christmas Eve, two weeks before the Battle of New Orleans had taken place, a treaty of peace had been signed by the English and American commissioners. It had been signed in the city of Ghent, in the Netherlands. There was then no ocean telegraph, and no steamship

had as yet crossed the ocean. When the battle was fought nobody in the United States knew that the war was over, and it was not until many days after the battle that the news was received in this country.

The treaty of peace was a very strange paper. The chief reason why we had gone to war was because England had stopped our vessels to search for forbidden goods, or captured them if they were bound for France. Then, too, English captains had taken off sailors, claiming them to be British subjects. Not a word was said about these matters in the treaty; but England did not stop any more of our ships. The truth is that both countries were anxious for peace. England was tired after twenty years of the Napoleonic Wars; we were a young, not very well-established nation, and there was danger that our government might break down if the war lasted much longer.

The war had been a great strain on the government, and, except for the courage with which our sailors and our frontiersmen fought, we can not be very proud of it. Congress was afraid to levy taxes high enough to pay for the war, and many of our generals proved themselves poor leaders. The different sections of the country were so jealous of one another and of the Union that we did not do our best. But there was a bright side.

This war marks the end of the time of weakness for the new nation. It was again proved that, if the American was properly trained and was properly led, he was a match for the best soldiers of Europe. On the sea American ships and American sailors acknowledged no equals. Of thirteen naval battles we were successful in eleven. We had beaten England in battle on the sea.

All of these things brought out a feeling of pride in our country. We forgot the defeats of the war and remembered only the victories. Americans began to have more confidence in themselves as a nation, and the countries of the Old World began to have more respect for us. In the beginning of the Republic people were proud of their states and jealous of the national government. As new states were made, people came to feel that the Union was more important, for the Union had made the new states. At the end of the War of 1812 there were eighteen states, and six more were admitted in less than ten years.

Though the westward movement of the people had been great before the war, it was many times greater afterward. Thousands left the eastern states every year to make new homes in the wilderness. Forests were cleared, farms were planted, and towns sprang up almost like magic. In our chapter on The Growing West we tell you more of this great movement. •

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 1786.



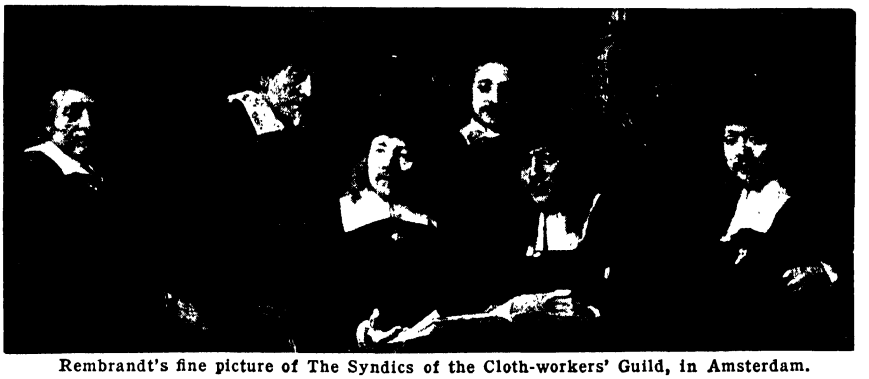
General Andrew Jackson leading the American troops at the Battle of New Orleans, January 8, 1815. Two weeks before, the peace treaty had been signed; but word had not yet reached New Orleans.

A REMBRANDT MASTERPIECE



Picture, courtesy, Metropolitan Museum of Art

Old Woman Cutting her Nails, in the Altman Collection, New York.



Rembrandt's fine picture of The Syndics of the Cloth-workers' Guild, in Amsterdam.

REMBRANDT

IF you look at the picture on this page with inquisitive eyes—eyes that look into it and inquire what makes it different from many other pictures you have seen—you will be trying to find out something of Rembrandt's secret. And that is a problem which has interested the world for years.

This picture, The Syndics of the Cloth-workers' Guild, is the achievement of the artist's ripe years, when he had long studied and worked to give his own impressions of light in paint upon canvas. His use of *chiaroscuro* (values of light and shade) is peculiarly his. By it he produces the feeling of form, and of more than form; in the faces he has recorded we perceive more than features copied in color. We get a glimpse into the real being beneath the flesh and blood. "The heads are enveloped in darkness, out of which emerge the features, the eyes especially arresting the attention. Through the depth and poignancy of their gaze one seems to look into the very soul of the subject."

The greatest art is never merely photographic. Genius sees a plain street of ordinary houses with one crooked chimney, perhaps, reaching toward the stars, and paints the scene so that this is the road to El Dorado, and coming and going along it are beautiful fancies that touch us with golden finger-tips in passing.

This separate eye of genius is one of the world's most precious possessions. Rembrandt was always conscious of his own secret vision. He had the clear insight of the artists of Holland into the beauty of everyday things and people, and if he had been just a Dutch master and not a world genius, he would have found an infinite satisfaction in painting faithfully scenes from his native land. As it was, the perfection which was the goal of the Dutch artists was his starting-point. He took for granted the things everyone else saw, and concerned himself with what they did not see—his secret.

In the same way Michelangelo took the perfection of the human form for granted, and built up his own world of men and women as he saw them—humanity invested with something of the largeness and strangeness of divinity.

Rembrandt Harmensz Van Rijn could not conceive of working in any other way than his own. From the first he was very sure of his ability, and at eighteen—an age when most artists were still at the apprentice stage—he took a studio of his own and announced himself an artist. His father, a miller, had sent the boy, while he was still young, to a Latin school, to prepare for Leyden University. After a year

of schooling there Rembrandt showed so plainly that art, and not letters, was his calling that his parents apprenticed him to a Leyden painter called Swanenborch.

There for three years Rembrandt studied drawing and painting; after that he went to Amsterdam to work with Lastman, a Dutch artist who had studied in Italy and was much influenced by Caravaggio, the realist. For six months the youth worked with this painter; then quite suddenly he threw down his brush and went home, saying he was going to work in his own way.

THE TIRELESS GENIUS WHO MADE NINE HUNDRED MASTERPIECES

This faith in himself was justified. In 1631, after three years of private study, Rembrandt, then about twenty-five years old, went to Amsterdam and there began a career of most amazing industry. He painted portraits and pictures for the wealthy, and made etchings for his poorer patrons. Apart from those which have been lost, and his earlier studies which he himself destroyed, this marvelous artist executed six hundred pictures and three hundred etchings. He seems never to have had an idle moment; in the earlier years of his profession he must have lived with an etcher's needle in his hand and a copperplate before him; and to this passion for the engraved line, and Rembrandt's determination to be himself and express that which he saw in his own way, the artist owes his place as the greatest etcher and one of the greatest painters the world has known. At the age of twenty-four he had "left himself no room for improvement" in the art of etching.

HOW REMBRANDT LEARNED TO PAINT THE THOUGHT BEHIND THE SMILE

In the course of his life Rembrandt painted and drew a variety of subjects, but all his interests really focused on the human face. His own eye was sensitive to the faintest shadow of change passing over a man's countenance.

Knowing so much and seeing so much, he made haste to record it. His father and mother, who must have been patient souls, allowed themselves to be drawn a great many times in all the moods and tempers which either the accident of the moment or their son's despotic will dictated. Or he would use himself as a model, sitting before his copperplate, needle in one hand, mirror in the other. Thus he drew his own face repeatedly, serious or smiling, "the artist with frightened eyes," "the artist with a scarf round his neck" and "the artist" in many other varieties of costume.

There were two far-reaching effects of this tireless industry: one was Rembrandt's ability to render easily every conceivable expression of the face, the other was a supreme mastery of technique.

THE WONDERFUL ETCHING OF THE RAISING OF LAZARUS

If we look at his large etching The Raising of Lazarus we shall see there surprise, consternation and other natural emotions drawn on men's faces in a way that is unrivaled in the story of art. It is not an easy or manufactured emotion that the artist shows: each man seems amazed or horrified in his own peculiar way, as his character dictates. We can almost follow the men home and hear them talk about the miracle to their friends.

A similar interest is attached to what is perhaps the most famous etching in the world—Christ Healing the Sick, known as The Hundred Guilder Piece. The artist never quite finished this etching, but as it stands it is a study we should not weary of looking at. On each of the faces Rembrandt has stamped the individual soul. The draftsmanship is superb; not a line is wasted. When, not long since, there came to light an old collection including a number of Rembrandt etchings, three of these, a fine impression of The Hundred Guilder Piece and two others, were sold at nearly $6,000 each.

THE MASTER'S TOUCH THAT MAKES A PICTURE SEEM TO LIVE

Rembrandt's technique was a separate gift. At first his line was a little tight and hard, as in the early etching of himself about the age of twenty-one. Presently it became loose and vibrating, very gentle and very strong at the same time, as in the incomparable etchings of his mother. As his line loosened, his brush work loosened also; at times he has the freedom of Velasquez, that supreme genius of technique.

Technique in drawing and painting, as we know, is the craft of art; that is to say, a person without any vision of beautiful things may be able to draw a perfect line. With some artists technique is the beginning and end of their peculiar gift. Very often too much attention to

technique will kill the freedom and spontaneity of the artist's thought. Technique is concerned mainly with two problems: outline and shade masses. An outline is really false to nature; faces can no more be truly represented by an outline than an orange can be represented by a circle.

The only true rendering of solid objects is in modeling or sculpture. But there are degrees by which the outline can attain to the qualities of sculpture. That is to say, a great master can, by a single outline, give the illusion of a rounded form. Generally speaking, the tighter a line is, the farther it is from representing a solid object. Michelangelo's cartoons or sketches, Goya's drawings and Rembrandt's etchings will show us what a loose, vibrating line is.

THE GREAT GIFT AND DEEPEST SECRET OF REMBRANDT

The dealing with masses, showing light and shade, is another and stouter problem. If you look at a person's face, particularly in lamp-light or candle-light, you will see that part of the features, the nose or the cheek bones or the chin, are very clearly in high light; other parts of the face are very clearly in shadow. If a face were made like a solid cube there would be an end of the matter. Anyone who can draw at all can draw or paint the high lights or the strong shadows on a face; that which artists spend years in trying to render is the part where high light slips into dark shadow; the tiny planes on the rounded flesh that join up the two extremes of white and black.

Here Rembrandt's technique was superb. A few lines, a little work of the brush, and he was across that terrible no man's land which many artists never cover at all. Leonardo da Vinci was another genius who had mastered this most difficult problem in portraiture.

But when we think of Rembrandt's art from the point of view of characterization, great as it is, or of its marvelous technique, we have not touched his outstanding genius. Rembrandt got into his work a luminosity—very different from actual light-and-shade treatment—which has never been found either in etchings or paintings before or since. In etching "no other master ever made white paper radiate as he did." This luminous atmosphere—in his etching and in his painting—was Rembrandt's secret, his genius, his gift to the world.

Anyone can make light light and darkness dark. Rembrandt made his darks glow with light, his lights hold a peculiar soft gloom. "He surrounded centres of light with waves of darkness. The darkness itself in his pictures is transparent; you can peer into it and discover half-concealed forms; everything provokes curiosity; there is mystery; and it acts upon the mind so that the real and the imaginary become mingled. It is at once a reality and a dream." A secret that can be told is no longer a secret. To attempt to explain Rembrandt's supreme genius is as difficult as it is to copy it. In some moods he seems to have tried to use light as actual material with which to build form; he seems to have composed in light.

The Venetians got light into their pictures, and often a gentle suavity; but they were painters willfully making beautiful things a little more beautiful—painters dealing with subjects of religious or classic story that were already full of interest in men's minds and only needed to be painted to become adored.

HOW REMBRANDT LOVED TO PAINT THE PEOPLE OF HOLLAND

When Rembrandt painted a religious subject he often gave it a genre feeling. For instance, in a Holy Family, now in Munich, he represents the father and mother in a Dutch home, bending over a familiar Dutch cradle in which lies the Babe. And instead of gods and princes, queens and nymphs, this artist chose for the figures in most of his pictures humbler folk, sometimes the ragged and poor. Yet there is nothing commonplace in these creatures, for the man who put them on canvas or paper saw human beings in a broad, sympathetic way, and gave character and dignity to their forms and faces when he drew or painted them. A gesture or a turn of the head might have the force of presenting some universal truth.

Not only the number of Rembrandt's works but the wide variety of subjects and kinds is astonishing. Of them all, as we have said, the portraits are of most importance and interest. True as likenesses, expressing the characteristics of each individual, they are interesting as pictures, too. Some of his portraits of old women are unequaled in the way they embody the calm dignity and courage of age, and record the traces of experience—the fruit of living. Stiffness and firmness

may still be there, but sharpness has been smoothed away by the touch of time. Into just the folded, quiet hands of an old woman Rembrandt could put such beauty and meaning that the sight of them almost brings tears of tenderness. A transparent delicacy or a sturdy capableness gives them distinction and suggests what part they have played in a long lifetime. No other has been so sympathetic a painter of old age. It is the impression made upon the painter himself that comes to us through the picture he made. We see his beloved young wife Saskia, or his good friend Jan Six, or his son Titus, as he saw them.

REMBRANDT AND HALS AS PORTRAIT-PAINTERS COMPARED

If Hals and Rembrandt are put side by side as portrait-painters, certain differences can be clearly noted. Hals is like one who can tell a tale quickly and brilliantly. His easy strokes play over the surfaces with ready skill, which can be understood and followed. Rembrandt's portraits, on the other hand, are built up, "constructed" with solid strength, giving evidence of bone and muscle beneath the surfaces. His is an art that cannot be expressed in a formula and imitated.

Yet when these two artists were engaged to make large group pictures for corporations, the method of Hals gave the greater satisfaction to the patrons. In his groups each solid citizen was unmistakably represented by an excellent portrait, whereas in Rembrandt's the portrait quality might be made second to the picture composition. This is particularly true of the Sortie of the Banning Cock Company, in Amsterdam, where the figures emerge from such deep shadow that the picture was long called, by mistake, The Night Watch. One whole figure and a few heads furnish "some focal spots of brilliance," but most of the personages are indistinguishable in the shadowy gloom, which has grown deeper with time. Instead of being ranged in neat rows, the members of the company are shown rushing out of their club-house —coming forward from the dim background. The Banning Cock Company were disappointed, but their picture stands as a record of Rembrandt's struggle between the impulse to give a detailed representation of outside appearances and the desire to express inner impressions of his own mind.

An early group picture, The Lesson in Anatomy, however, had made Rembrandt famous because of its clear characterization. And The Syndics of the Cloth-workers' Guild, in the Rijks Museum, Amsterdam, painted near the end of his life, brings together at last the two efforts in a most successful result. It is "a work of imagination and yet of real life."

HAPPINESS AND PROSPERITY FOLLOWED BY DARKER YEARS

For ten years after he painted The Lesson in Anatomy, Rembrandt lived in prosperity and comfort, busy with pupils and at work on the portraits of patrons. At this time he was happy in his home life with his wife, Saskia van Uylenborch, whose portrait he painted many times. Reveling in the beauty of sumptuous materials, he bought freely and lived generously. In these years of vigor and youth Rembrandt dipped his brush into many colors; as he grew older his tone was quieter, his color more restrained.

In 1642 Saskia died, and in the same year his Banning Cock Company picture gave dissatisfaction, injuring his popularity. The rest of his life was darkened by money troubles, although he painted with extraordinary industry and was faithfully helped by his son Titus and by Hendrickje Stoffels, a devoted servant, until she died, in 1656. There is a fine portrait of Hendrickje in Berlin.

As in the case of Michelangelo, Rembrandt's last years were lonely and sorrowful, though there was in his temperament none of the moroseness and sourness which kept from the great Florentine the joys of friendship. Rembrandt's failing, rather, was that he had been spendthrift —too generous, too trusting and too sure of the world's kindliness. But he would have been the last person to think his case over-sad. The thing that mattered most to him was his work, and this he had brought, in evil report and good, to a triumphant end. Born about 1606, he died in the year 1669.

While London, Paris, Dresden, Berlin, Petrograd and other European cities have notable paintings by the Dutch master, the great mass of his work is in Amsterdam and The Hague. In America, New York is especially rich in paintings by Rembrandt, and there are examples of his work in Chicago, Philadelphia and other cities of the United States.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 1731.

SOME PICTURES BY REMBRANDT



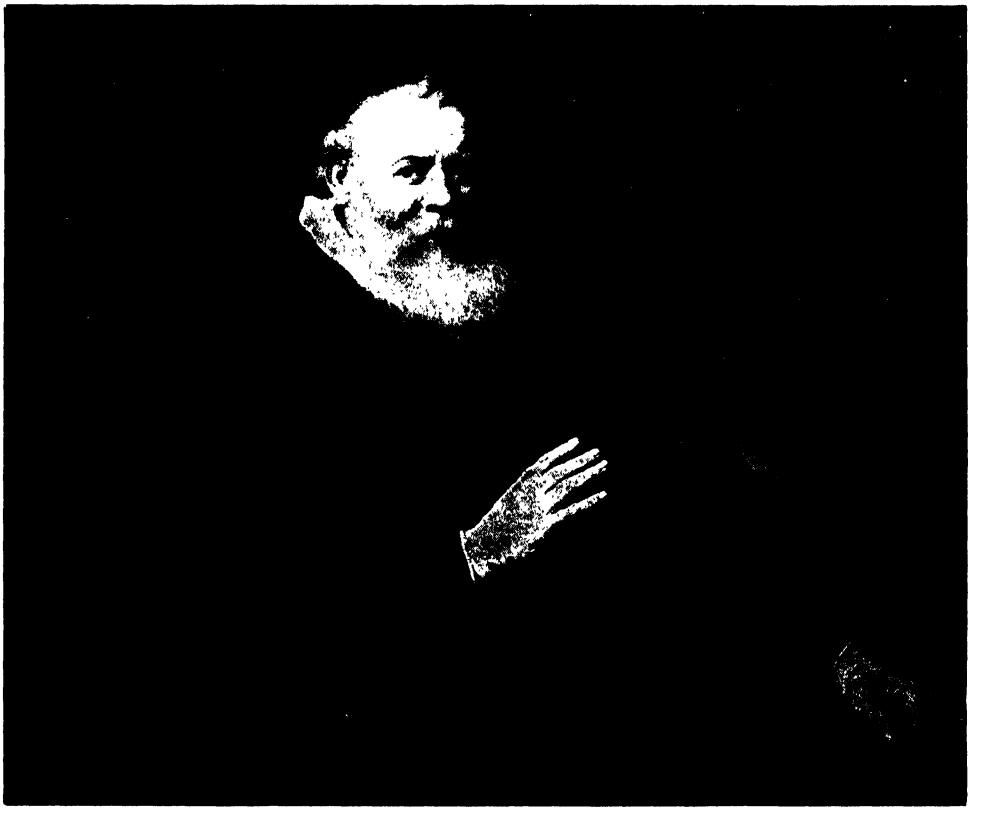
Rembrandt's fine portrait of himself as a young man. This is the way he wished to be remembered.



William of Orange.



A Girl at a Window.



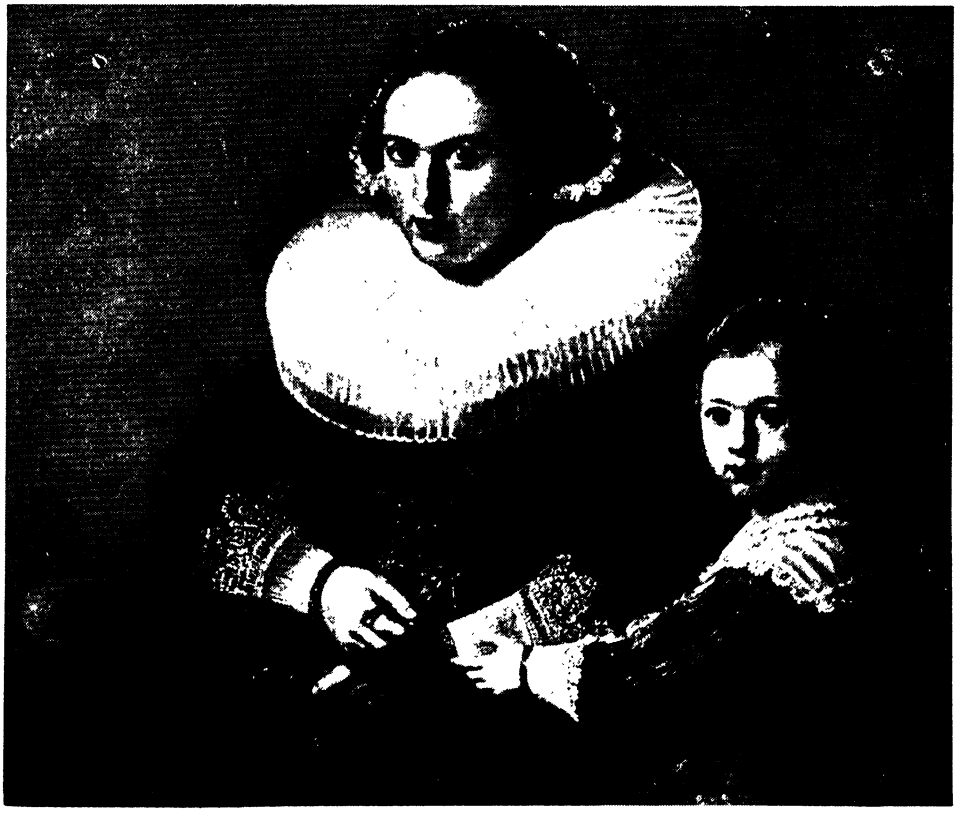
A portrait of Burgomaster Eleazer Swalmius.



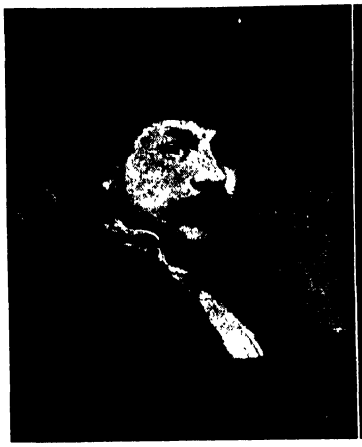
A Polish Soldier.



Rembrandt's Wife, Saskia.



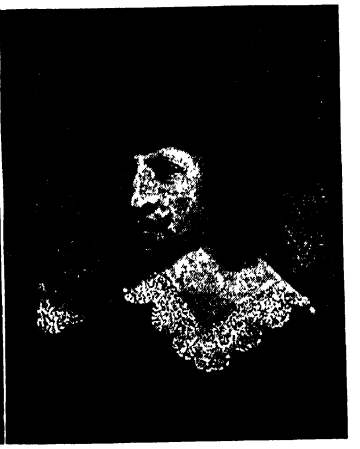
Suzanna van Coller with Her Little Daughter.



Rembrandt as a Young Man.



Portrait of a Woman.



Study of a Man.



This shows the upper part of the picture, The Lesson in Anatomy of Johann Deyman.



Rembrandt's Mother.



The Caligraphist.



The Flower Lady.

The photographs of many of these paintings are by Messrs. Bruckmann and Hanfstaengl.



Courtesy, The Hampshire Swine Record Association

Prize-winning Hampshires, at the National Swine Show. This fine stock was bred and raised in Iowa.

THE PIGS AND THE HIPPOPOTAMUSES

THE pig is the most widespread of any of the domestic animals except, perhaps, the dog. There are a number of reasons for this popularity. The chief reason is because of its flesh. Pork, ham, bacon and lard stand high in the meats eaten by man. A pig is an easy animal to keep alive as it finds nourishment in many kinds of food. In many places tame pigs are able to pick up their own living if given their liberty.

Pigs belong to the hoofed animals or ungulates, and to the order Artiodactyla, or even-toed ungulates. They are placed in the family Suidae, which differs from the other members of the order in having a simple stomach—pigs are not cud-chewers—and in having a long, movable snout. Their canine teeth form strong, upturned tusks. They are not particular about what they eat, being fond of both animal and vegetable food.

It is not known just when the pig was first brought under domestication, but it was certainly many centuries ago. The wild boar is undoubtedly the ancestor of most of the European breeds, but the crested pig, or Indian wild boar, also has domestic descendants, especially in southern Asia, and some of the domestic pigs of today are descendants of both of these species.

In Europe and America there are two main types of domestic pigs; the lard type—pigs bred for their large hams and lard—and the bacon type, which are long in body, producing the maximum amount of bacon. One of the oldest breeds of the lard type is the Berkshire, which originated in England and is still extensively bred there. Later it was introduced into the United States and Canada and proved to be very popular. It is medium in size, a large male weighing from 600 to 800 pounds when fully adult. In color this breed is black, with white on the nose and legs. A characteristic feature of the Berkshire is the short, upturned nose. Another English breed is the Hampshire, which has a longer, straighter nose than the Berkshire, and is a black pig with a white band passing over the shoulders and including the forelegs. Both the Berkshire and the Hampshire are now extensively bred in the United States.

A number of breeds of the lard type originated in the United States. The Duroc-Jersey originated in Pennsylvania and New Jersey and may be told by the solid red color. The Poland China originated in Ohio. This is a black pig with white nose and legs, differing from the Berkshire in appearance by its straighter snout. The Spotted Poland China is much like the Poland China but has black



U. S. D. A. photograph by Forsythe
A sturdy Iowa farm boy with three baby pigs.

and white areas over its body. The Chester White originated in Pennsylvania. As the name implies, the color is white.

The two best-known breeds of the bacon type of pigs are the Tamworth and the Yorkshire. These are both English breeds, long of body, with small hams. They are bred to produce the maximum amount of bacon. The Tamworth is a red pig, while the Yorkshire is white. Bacon types are not raised so extensively in the United States as are the lard types.

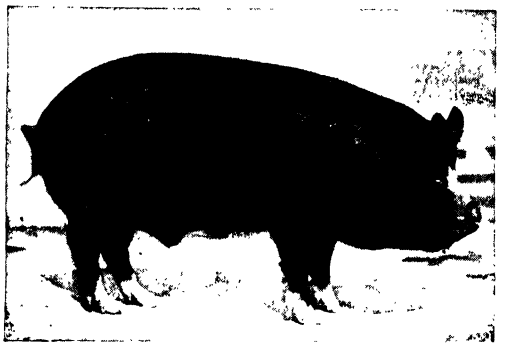
In certain sections of the United States pigs have reverted to a semi-wild life. They have developed longer legs and snout and a leaner body, the better to care for themselves in their wild surroundings. The razor-back hogs of the southeastern states are examples of these. Domestic pigs have also returned to the wild state on many of the islands of the world, including New Zealand and sections of Australia.

THE EUROPEAN WILD BOAR, ANCESTOR OF MOST OF OUR DOMESTIC PIGS

The European wild boar is the best known of the wild pigs. It is the ancestor of most of our domestic pigs and has a very extensive range which includes much of Europe and northern Asia, and as far south as northern Africa. It was formerly found in the British Isles but was exterminated there many centuries ago. It is still found in the less settled portions of France, Germany and Poland, as well as other European countries. It is a fierce and swift-footed animal; it is dangerous because of its great courage and its superior strength. Hunting the boar was a favorite sport in the days of old.

A large male boar may stand three feet high. The general color is brown, blackish, or sometimes reddish, often sprinkled with white hairs. The coat is long and coarse, and in the northern parts of its range in the winter there is an undercoat of woolly fur. The young, when small, are brown with conspicuous black stripes.

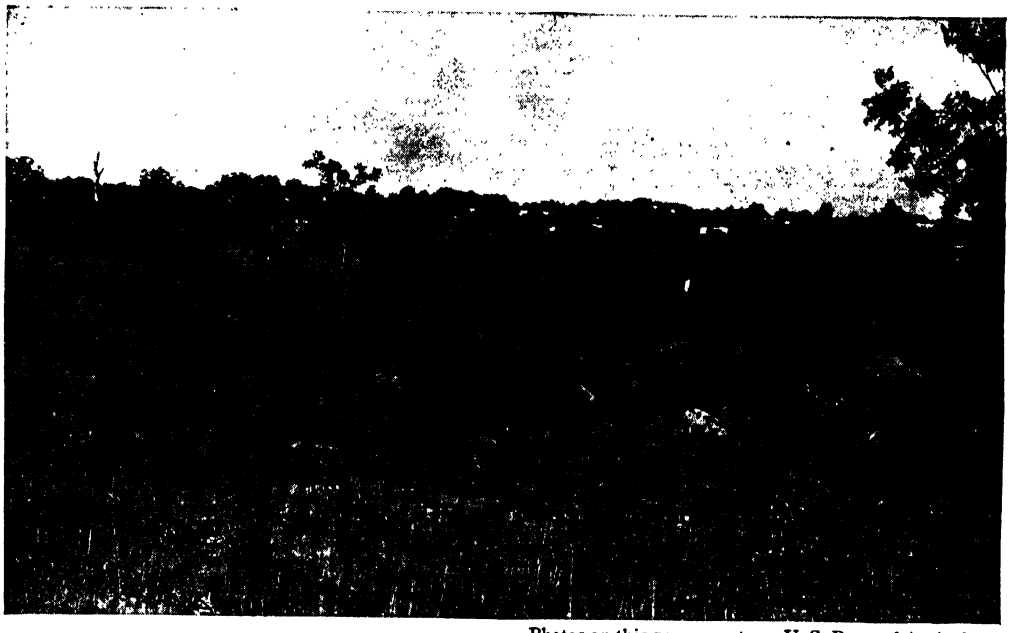
The European wild boar is a forest-loving animal and obtains much of its food from rooting up the ground. This food consists of roots and bulbs, insects and flesh, but when acorns and beechnuts are ripe and fall to the ground, these nuts appear to be favorite foods. Wild boars are not popular with the farmers living near the forests inhabited by these animals for at night they visit the



Courtesy, Live Stock Company
Grand champion Berkshire barrow.



R. F. Hildebrand
Duroc-Jersey sow.



Photos on this page, courtesy, U. S. Dept. of Agriculture

Spotted Poland Chinas. This lard-type breed is one of the most popular in the United States.

cultivated fields and do much damage. They not only eat the crops but also root up the ground, a habit which destroys much more food than the pigs consume.

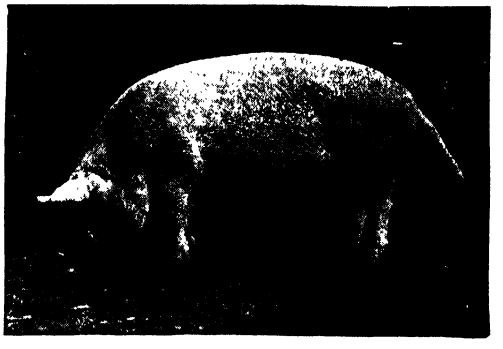
Wild boars go about in small bands, called sounders, but old males often lead solitary lives. They are hunted for sport. An old male may be very vicious and do much damage with his tusks.

The European wild boar has been introduced into some of the forests in the eastern United States. In the mountains of eastern Tennessee it has increased so that now it is hunted as game.

The Indian wild boar, also known as the crested pig, differs from the European wild boar in being less heavily haired and in having a distinctive mane, or crest, extending along the back and neck. It also differs in tooth formation. It and its many forms are found in India, Burma, Ceylon, the Malay Peninsula, and many of the islands of the East Indies, including Sumatra and Java. The habits of the Indian wild boar are very similar to those of the European. The boars stay hidden in dense cover during the day. Sometimes they build shelters of reeds or brush in which to rest during the daylight hours and to protect themselves from rain. They come out in the early morning and evening, often feeding on the crops of the natives.



Tamworth sow, a bacon breed.



Yorkshire sow. Yorkshires are also bacon hogs.



Robert F. Hildebrand

First call for luncheon! This promising litter of pigs was raised on a farm near Hopewell Junction, New York.

A favorite form of sport in India is known as "pig sticking." The boar is ridden down by a number of men on horseback and killed with lances or spears. This sport calls for skilled horsemanship and daring, for a big boar is often dangerous.

The young of the Indian wild boar, like their European cousin, are striped and vary in number from six to ten.

Boars have been introduced by natives on many of the South Pacific islands. These pigs live in a more or less domesticated condition, though many have taken to the forests and now live in a truly wild state.

The Java pig, found only on Java and Borneo, is distinguished by having three warts on each side of its face and by its very long head.

On the Andaman Islands, in the Bay of Bengal, is found a small species known as the Andaman pig. It is under two feet in height and differs from the crested pig in lacking the crest and in possessing a thicker coat and a relatively short tail. The smallest of all the pigs is the pigmy pig of northern India, under a foot high at the shoulder. It inhabits the forests of Nepal, Sikhim and Bhutan.

The bearded pig, so named on account of the long fringe of hair on the cheeks, inhabits the Malay Peninsula, Borneo, Sumatra and many of the neighboring islands. Other forms of wild pigs are found in Japan, Formosa, the Celebes and the Philippine Islands.

The babirusa is one of the most unusual of the wild pigs. It is found only in Celebes and on the near-by island of Buru. The tusks of the males of this pig are slim and long. The upper tusks, instead of protruding from below the upper lip, as in the case of other pigs, arise close together on each side of the nose, puncturing the skin. They grow upwards, then circle back and down, frequently coming in contact with the forehead. The lower tusks also tend to be longer and slimmer than those of the other wild pigs. The babirusa of Celebes has a very nearly naked skin, while the one on Buru has a coat of grayish white.

THE BUSH PIGS THAT DWELL IN AFRICA AND THE ISLAND OF MADAGASCAR

The bush pigs are native to Africa. They differ from the wild boars in having two less cheek teeth on the lower jaw; and the tusks are smaller. The males have a large wart in front of the eye and a smaller one behind it. In the female these warts are less noticeable and are covered with hair. The bush pigs have long heads and noses and vary in color from a reddish brown, or gray, to almost black. There is often a whitish mane, and the head is also covered with white hairs. The bush pig lives in forests or heavy thornbush and occurs throughout Africa where such country exists. One form is



Photo by Hirz

This Russian boar is a good specimen of the European wild boar, from which most of our domestic pigs are descended.

found on the island of Madagascar. The small young are striped; and the number ranges from five to eight in each litter. The habits of the bush pig are very similar to those of the wild boar. It feeds chiefly during the evening or at night, hiding during the day. It generally goes about in small herds. These are capable of causing considerable damage to the crops of a given area.

The most showy of all the wild pigs, the red river hog, is found in the forests of western Africa. This animal is a close relative of the bush pig but differs from it in the brilliant orange-red color of its hair and the long tassel of hair on the end of its ears.

The African forest hog was not known to science until 1904. It is a large, black animal and spends its time in the dense forests, seldom coming into the open. Consequently it is rarely seen. In shape of head and skull it shows relationship to the wart hog. It has an enlarged wart below the eye, but, unlike the wart hog, its entire body is covered with black hair.

The forest hog was first discovered in the forests of Mt. Kenya. Not very long afterward it was found in the Cameroons and in the forests of the upper Congo River. Now it is known that this large pig inhabits the forests from Mt. Kenya west, throughout much of the Congo River basin to the Atlantic coast.

The wart hog is often called the ugliest animal in the whole world, and well does he deserve this title. The creature's head is greatly enlarged, there are two pairs of large warts on the sides of the curiously flattened face, and the eyes are placed high on the head. The wart hog's body is round and barrel-shaped, the sides having very little hair. Along the back of the neck to the middle of the back there is a mane of long hair which often falls on either side of the body. The tail is tufted on the end, and there are generally white whiskers on the sides of the face. The two pairs of warts are particularly hideous in the case of the male hog; they are not so noticeable in the female. The wart hog lives in the hot, open plains of Africa, in the more open thornbush country. It is never found in the thick forest. Unlike most wild pigs, it is abroad during the day. It feeds chiefly on vegetable matter, rooting like other pigs, but it is also fond of grass. It often lives



N. Y. Zoological Society

The wart hog, which is often called the ugliest living animal.



The babirusa.



The bush pig.



All photos, N. Y. Zoological Society
The collared peccary.

in burrows in the ground made by the aardvark or some other animal. A family of wart hogs often occupy a single hole. I recall one morning while crossing an open plain in Ethiopia that suddenly, from my very feet, a wart hog emerged from a hole, and then another and another until there were four trotting off in single file, their tails held straight up and the hairy tip at right angles, as is their habit when disturbed. It was doubtless a mother and her three young which I had routed. Another habit of this animal is that it enters its burrow backward instead of diving into the hole headfirst as any other animal would do.

Wart hogs do not raise such large families as most of the pigs do, three or four being the number generally found in a litter. Unlike most baby pigs, they are unstriped and are colored very much like their parents.

Over most of the open plains of central and northern Africa, the wart hog is still common, but it has become extinct in Africa south of Zululand.

The peccaries are the only wild pigs found in America. They differ from the wild pigs of the Old World in a number of ways. Instead of the two small hoofs on the rear of the hind legs that are present in other pigs, the peccary has only one. The tusks of the upper jaw, instead of growing out and up, grow down, and are invisible unless the mouth is opened. There is also a gland in the upper back which secretes an evil-smelling oil, or musk. They have no tail, at least none that shows. Peccaries differ likewise in the small number of young that are born. Instead of the large litters most of the pigs have, the young generally number one or sometimes two at a birth.

There are two kinds of peccaries, the collared and the white-lipped. In general color they are very much alike, a grizzled black and gray. The young are browner than the adults. Besides being slightly smaller, the collared peccary is distinguished by having a gray collar extending from the throat to the shoulder. The collared peccary stands about thirty-two inches at the shoulder and weighs around forty-five pounds. It is found from southwestern Texas, southern New Mexico and southern Arizona south through Central and South America to Patagonia. The white-lipped peccary is a larger animal and has a white patch on the lower jaw. This peccary is found from Central America south to Paraguay.

Peccaries live chiefly in the forests and go about in bands. They root in the ground for much of their food and eat seeds, roots and fruits, as well as insects and reptiles. They are also known to eat the leaves and fruit of some of the cactuses. The white-lipped peccary generally go about in larger bands than do the collared, and many stories are told of their ferocity. Although I have met both kinds in the wild, I found them always ready to beat a hasty retreat. One interesting experience occurred in the forest of British Guiana. I came across a band

of about fifteen collared peccaries and as we needed meat for camp, I shot one. Unfortunately, this proved to be a mother with a very young baby, as I afterward found out. The band scattered at my shot. I sat down to rest and then noticed the baby about thirty feet away. I approached it, but it ran into the thick bushes and eluded me. As I was walking across the clearing with the mother on my back, I looked around and saw that the baby was following. It followed for over a mile to camp, where it was caught, and the next day it was drinking milk from a bottle. In a day or two it was given full liberty and proved to be a gentle and interesting pet.

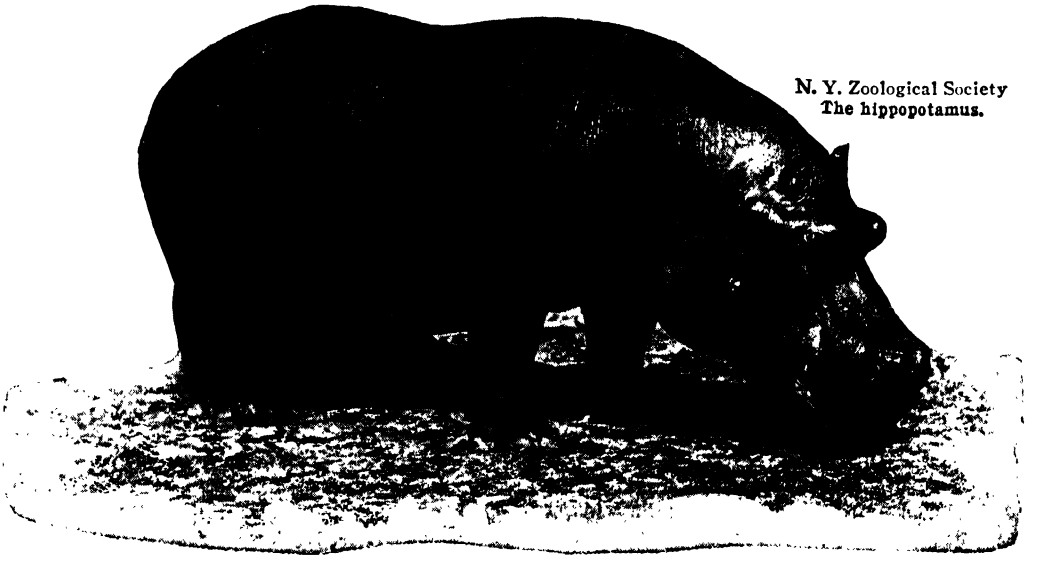
The flesh of peccaries is good to eat, but the musk gland must be cut out as soon as the animal is killed or the flesh will be tainted.

THE HIPPOPOTAMUS, OR "RIVER HORSE," IS FOUND IN LAKES AND RIVERS

The hippopotamus is a distant relative of the pigs. It and its small cousin, the pigmy hippopotamus, are put in a family by themselves, the Hippopotamidae. The name means river horse; hippos, as you probably know, spend much of their time in the water of rivers or lakes. The hippopotamus is a large, bulky animal with rounded body, short legs and a very large head. The eyes are prominent and are placed above the level of the forehead so that the animal may see when only a small portion of its head is above the surface of the water. The ears are small and, like the nostrils, can be closed at will when the animal goes into the water. There are four short toes on each foot, each bearing a rounded hoof, and all touch the ground when walking. Aside from a few bristles about the nose and head and the end of the tail, there is no hair on the body. The mouth can be opened very wide indeed. The canine teeth are long and form short tusks. A male hippo may measure as much as fourteen feet from the end of his nose to the end of his tail. The tail is about a foot long. A big male will weigh about four tons.

Although fossil remains of the hippopotamus have been found in many places in Asia and Europe, including England, the animal is now confined to Africa. In recent years it has become extinct in North and South Africa, but throughout the central part of the continent it is common in many of the lakes and rivers.

The hippo feeds on vegetation and reeds, grass making up much of its diet, but when the occasion occurs it will visit native gardens. While camped on the northern end of Lake Abaya in Ethiopia, I had a wonderful opportunity to study these animals. There was a large herd that spent most of the day in the lake, but at night they would come ashore to feed. Along one part of the shore was thick thornbush where the animals had made well-worn tunnels through which a person could crawl without difficulty. Waterbuck and other animals also used these tunnels as a means of reaching the lake, and one morning I unexpectedly came face to face with a leopard while I was proceeding



N. Y. Zoological Society
The hippopotamus.



Ava Hamilton

Hippopotamus herd, French Equatorial Africa. The hippo spends much time in the water, but comes ashore to feed.

on hands and knees. The leopard quickly vanished. Near the lake shore where we camped there was a large expanse of grass where our mules grazed. Every evening the hippos would come ashore and feed with the mules. The nights would resound with their deep bellowing. There were many young and they were often seen at rest on the backs of their mothers.

At this camp our tents were placed in a circle; and late at night, after the mules had fed, they were tied up in the center of the circle as a protection against the numerous hyenas. We were sleeping on cots between the tents to help form a more complete circle. Late one night I awoke with the feeling that I was being watched. Turning my head slowly, I was surprised to see a big hippo standing just a few feet away, looking down on me. From my position, his outline against the starry sky made him look much larger than he really was. We watched each other for a number of minutes, and then he turned and a moment later I heard a splash as he plunged into the lake.

The hippo is chiefly nocturnal in habits, feeding at night. It spends the day in the deep water or, if in a territory where it is not molested, will lie on a sand bank, basking in the sun. It is generally found in small herds of from seven or eight to fifteen, but sometimes larger numbers will congregate. Old bulls often live alone. At evening the hippo will leave the water and may travel some distance to find food. At Lake Abaya I was surprised to find traces where they had crossed a rocky ridge which was even difficult travel for our mules. The rocks in places were worn smooth by their passing. There was good food in the little valley on the other side of the ridge, and this undoubtedly was their reason for making the difficult trip.

African natives are very fond of hippo meat and frequently hunt them from canoes. A number of men armed with long lances or spears will take part in the hunt. A long cord is attached to the spear, and at the other end of the cord an inflated skin is fastened. The spear is hurled into the animal, which dives, and the inflated skin is then thrown on the surface of the water. This will float, thus giving the natives the direction which the hippo has taken under the water. When the animal comes up to breathe the hunters are ready and more

spears are thrown, and in this way the animal is killed. It is dangerous work, for a wounded hippo is likely to charge and overturn the canoes. Natives are sometimes killed from a bite of a hippo.

It is interesting to note that crocodiles and hippos live in the same waters. Undoubtedly the crocodile has respect for the bite of a hippo.

In southern Africa the hippopotamus has been exterminated south of Zululand. An interesting wandering of a hippo occurred when a female, named "Huberta" by the local papers, traveled south into country no longer inhabited by these animals. Huberta left Zululand in November 1928 and traveled more or less along the coast. She wandered through some of the main streets of the city of Durban, continuing south, visiting many towns and villages, and was finally shot in April 1931, in southern Kaffraria, 500 miles south of her home. In making this pilgrimage she actually traveled more than 1,200 miles.

The pigmy hippopotamus, found on the west coast of Africa, in Liberia and Sierra Leone, is about six feet long and three feet high. This animal makes its home along the banks of the smaller rivers in the deep forest, going about singly or in pairs. It is said to enlarge the hollows which water has washed under the banks of a stream for a sleeping place during the day. Few white men have been able to observe this rare animal.



The hippo's yawn is a most revealing spectacle.

By T. DONALD CARTER.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 1825.



Both photos, Philip Gendreau, N. Y.

A pigmy hippopotamus with its baby. This animal, found on the west coast of Africa, is about six feet long.



Painting by Margaret Dicksee. Photo, Brown Brothers

Jonathan Swift and Stella. When this little girl grew up, Swift wrote his JOURNAL TO STELLA for her to enjoy.

FOUR FAMOUS DIARIES

A GREAT many people have tried keeping a diary at least once in their lives, but few of them have remained faithful to the task. Fewer still have produced anything of interest to the world.

The good diary should be a genuine daily record, jotted down while the things with which it deals are fresh in the writer's mind, for it is the informal, day-to-day quality of a diary that gives its peculiar flavor. To be interesting, a diary need only be personal, honest and varied; but to rank as literature it must reflect either an extraordinary man or an extraordinary period in history. Ideally, it reflects both.

The first place among English diarists usually goes to Samuel Pepys (pronounced either Peeps or Peppis). For nine years and five months, January 1, 1660, to May 3, 1669, he wrote in secret shorthand exactly what he had been seeing and doing, day by day. Since he lived in London, held an official position and was in touch with many matters of public importance during a very interesting period, his DIARY is a valuable picture of the times and is still read today.

As we see him now, Samuel Pepys had the advantage of writing solely for his own pleasure, with no thought that any eye save his own would ever read his words. The result is complete frankness. Nothing in the life of Pepys is hidden. Ambitions, vanities, faults, vices are all there, and they are set down with a special humor hard to match in English literature.

Samuel Pepys (1633-1703) was the son of a London tailor. He had family connections with Sir Edward Montagu, afterward Earl of Sandwich, who was steadily his patron. After his education at St. Paul's School and Cambridge University, Pepys became a clerk, first in the Exchequer Office and later in the Admiralty, where he was no doubt advanced by his kinsman, the Earl of Sandwich. It was Sandwich who commanded the fleet which brought back Charles II from exile, following the death of Oliver Cromwell. A new era began with Charles II. We know it as the Restoration; and it is interesting to note that Pepys began his DIARY in the same year in which the Restoration began.

Pepys began his DIARY in his twenty-

seventh year. He introduced it by saying that, though he is esteemed rich, really he is very poor. Through the ten years' course of the journal we watch his growing prosperity and learn every detail of it. He died a rich man. On the day of his death, May 26, 1703, John Evelyn, his fellow-diarist, a gentleman of the first order, who knew him well, wrote:

> This day died Mr. Samuel Pepys, a very worthy, industrious, curious person, none in England exceeding him in knowledge of the navy, in which he passed through all the most considerable offices, Clerk of the Acts and Secretary of the Admiralty, all which he performed with great integrity. He was universally beloved, hospitable, generous, learned in many things, skilled in music, a very great cherisher of learned men of whom he had the conversation.

It may be added that twice Pepys was Master of Trinity House, twice a Member of Parliament, once Master of the Clothworkers' Company, and for two years President of the Royal Society. Anyone who did not know these facts might fail to understand him correctly from reading his DIARY. We must remember it was written when he was still quite young, that it was purely personal, and that, though much of it is trivial, the task of writing it was a monument of industry. No other man has ever written anything of the kind of such general interest. Surely the DIARY would not be half so much fun if Pepys had not been a great gossip.

SAMUEL PEPYS TELLS US HOW HE MADE A VERY FINE SPEECH

The most striking passage in the DIARY that shows the true Pepys as a man of mettle is his description of how he appeared at the bar of the House of Commons to defend the Admiralty staff from charges made against them. His superior officers were inclined to give in. Not so Pepys. Though he was disgusted with the whole business, he believed he could make good its defense, and he did so.

On March 3, 1668, he wrote in his DIARY:

> Up betimes to work again, and then met at the office, where to our great business of this answer to Parliament; where to my great vexation I find my Lord Brouncker prepared only to excuse himself, while I that have least reason to trouble myself, am preparing with great pains to defend them all.

Then two days later we have these entries, full of natural feeling, sound description and honest pride:

> With these thoughts I lay troubling myself till six o'clock, restless, and at last getting my wife to talk to me to comfort me, which she at last did, and made me resolve to quit my hands of the office, and endure the trouble of it no longer than till I can clear myself of it.
>
> So with great trouble, yet with some ease from this discourse with my wife, I up and to my office, whither come my clerks, and so I did huddle the best I could some more notes for my discourse today, and by nine o'clock was ready, and did go down to the Old Swan, and there by boat to Westminster, where I found myself come time enough, and my brethren all ready.
>
> But I full of thoughts and trouble touching the issue of this day; and to comfort myself, did go to the Dog, and drink half a pint of mulled sack, and in the Hall (Westminster) did drink a dram of brandy at Mrs. Hewlett's; and with the warmth of this did find myself in better order as to courage, truly. So we all up to the lobby; and between eleven or twelve o'clock were called in, with the mace before us, into the House where a mighty full House; and we stood at the bar, namely Brouncker, Sir J. Minnes, Sir T. Harvey, and myself, W. Pen being in the House, as a member. I perceive the whole House was full of expectation of our defence what it would be, and with great prejudice.
>
> After the Speaker had told us the dissatisfaction of the House, and read the Report of the Committee, I began our defence most acceptably and smoothly, I continued at it without any hesitation or loss, but with full scope, and all my reason free about me, as if it had been at my own table, from that time till past three in the afternoon; and so ended, without any interruption from the Speaker; but we withdrew. And there all my fellow-officers, and all the world that was within hearing, did congratulate me, and cry up my speech as the best thing they ever heard; and my fellow-officers overjoyed in it.

THE ROYALIST JOHN EVELYN WHO FLED HIS COUNTRY FOR HIS KING

John Evelyn (1620-1706), the other great diarist of the seventeenth century, was in many ways unlike Pepys. He was an English country gentleman, younger son of a wealthy Surrey family. He was a brilliant lad, and when only sixteen he was admitted to Oxford University. During his youth England was torn by inner conflicts. The Puritans were gaining strength, and Charles I was steadily losing the confidence of his people. The Evelyns were Royalists (on the King's side); and, like many another, John Evelyn left England and lived abroad for years, during the storm and stress at home. He traveled on the Continent from 1641 to 1652. By that time he judged it safe to return home.



Culver Service

The gentleman sitting down is Samuel Pepys. Here we find Pepys in the midst of one of those scenes which he so loved to describe in his DIARY. Dressed in her finest furbelows, his wife is having her portrait painted.

After Cromwell had died and there was again a strong Royalist sentiment in England, Evelyn was one of those who urged the recall of Prince Charles. As we know, the Prince did return in 1660 and was crowned Charles II. Evelyn enjoyed the constant favor of the King, but the man from Surrey did not always approve of the goings-on around the court. Evelyn was no Puritan, but he was shocked by the pleasure-loving conduct of Restoration society.

Evelyn was one of the founders of the Royal Society, and later was its secretary. In forestry Evelyn was the most widely known expert in the country. As a patron of art he noted the excellence of the wood-carving of Grinling Gibbons and introduced him to the notice of Charles II. His DIARY has not the racy gossip that flowed naturally from the pen of Pepys. It is grave and earnest; but as we read on, it impresses us more and more, and we feel that through it we are living in another age and that our companion is a man of the rarest moral quality. Evelyn's DIARY extends from 1640 (just before he went abroad) to 1706 (when he died). As an example of his style, we quote from the description of the Great Fire of London, which took place in 1666.

> The conflagration was so universal, and the people so astonished, that, from the beginning, I know not by what despondency, or fate, they

hardly stirred to quench it; so that there was nothing heard, or seen, but crying out and lamentation, running about like distracted creatures, without at all attempting to save even their goods; such a strange consternation there was upon them, so as it burned both in breadth and length, the churches, public halls, Exchange, hospitals, monuments, and ornaments; leaping after a prodigious manner, from house to house, and street to street, at great distances one from the other.

For the heat, with a long set of fair and warm weather, had even ignited the air, and prepared the materials to conceive the fire, which devoured, after an incredible manner, houses, furniture, and everything.

The noise and crackling and thunder of the impetuous flames, the shrieking of women and children, the hurry of people, the fall of towers, and houses, and churches, was like a hideous storm; and the air all about so hot and inflamed, that at the last one was not able to approach it, so that they were forced to stand still, and let the flames burn on, which they did, for near two miles in length, and one in breadth.

HOW THE BRILLIANT JONATHAN SWIFT KEPT A DIARY FOR A DEAR FRIEND

Jonathan Swift (1667-1745), the author of GULLIVER'S TRAVELS, wrote a diary during one of his stays in London. It is a day-by-day account of what he saw and did there. It was intended for no eyes except those of Esther Johnson, a dear friend, whom he addressed in the diary as Stella (star), and her companion, Mrs. Dingley.

Swift was engaged in important political activity, but the diary says little about such things and much about the writer's social pleasures and triumphs. Although Swift lived to become a very bitter man, the atmosphere of his JOURNAL TO STELLA is often playful and affectionate.

The diary is not one of Swift's great works, but it is famous because of the extraordinary man who wrote it. Jonathan Swift was born in Dublin, Ireland. He was educated at Trinity College, Dublin, and then, for ten years, was secretary in the household of Sir William Temple, the English statesman and essayist. Swift was brilliant, poor and proud, so that the need to work in a



Culver Service

The diarist John Evelyn, an English country gentleman.

minor position hurt his pride even though it gave him a chance to read a great deal and to write two books which later made him famous. These books were A TALE OF A TUB, a work about religion, and THE BATTLE OF THE BOOKS, an extremely clever satire on the question of which is better, ancient or modern learning.

After he had been ordained a clergyman in the Church of England and upon the death of Sir William Temple, Swift spent much time in London, where he gradually gained a big reputation as a political writer. He is remembered now for his other writings, but at the time his political work mattered most to him. He expected big rewards for it; and he never got over his terrible disappointment when he received nothing more than the deanery of St. Patrick's Cathedral, Dublin, in return for his brilliant services to the government.

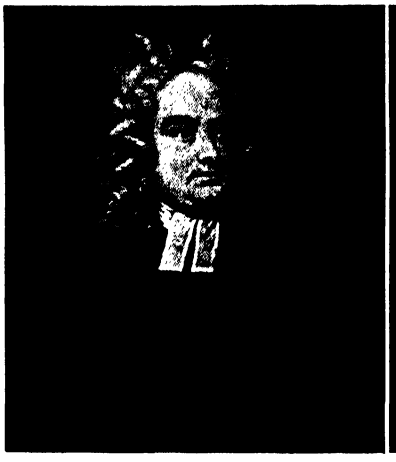
For thirty years he lived like an exile in Dublin, hoping for advancement which never came, and apparently blind to the fact that his books would make him immortal. Actually he never even cared to sign his name to most of his books.

When he lived in London, Swift was not only in the center of political affairs; he was respected and admired by the literary men of the day also, and welcomed into their circle. Alexander Pope, Addison and Steele, Congreve and Gay were among Swift's friends.

His political and philosophical writings

and his criticisms of literature were widely read. He was a master of satire, with an acid style which those he ridiculed found hard to forgive. Brilliant as he was, he never seemed to learn that the more comically successful his satires were, the bitterer his enemies became.

The last ten years of his life were shadowed by oncoming madness, but before that time he had created GULLIVER'S TRAVELS, which is both a fairy story of wonderful originality and a criticism of human nature as complete and severe as anything that has ever been written. GULLIVER'S TRAVELS was published in 1726. At Swift's death in 1745 he was buried in the cathedral by the side of Stella, the one person this brilliant, lonely man seems truly to have loved.



Jonathan Swift.



Pictures, Culver Service
Fanny Burney.

John Evelyn's DIARY ran from 1640 to 1706—and was a sober account of a serious man's life. Samuel Pepys' DIARY ran from 1660 to 1669—and was a witty, worldly-wise and detailed story of official London in the early years of the reign of Charles II. Dean Swift's JOURNAL TO STELLA ran from 1710 to 1714, and was a tenderly playful series of letters from a great man to the woman he loved.

Now we come to another English diary, that of Fanny Burney (1752-1840). As you see, she lived to be a very old lady. For almost seventy-two years, from the time she was fifteen until her death, Fanny kept a journal which gives its readers a glimpse of English society and letters a hundred and more years ago. Fanny was a bright, eager girl who educated herself.

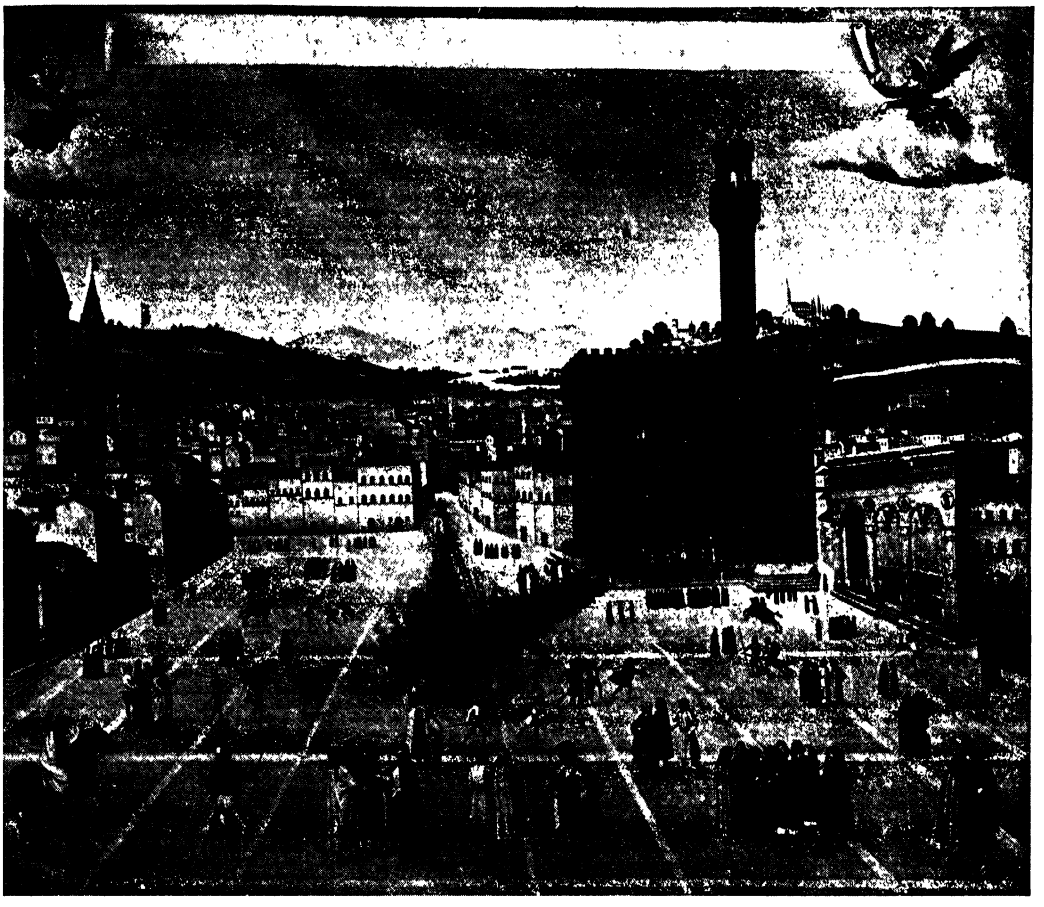
She loved books and she loved, too, to be scribbling, a thing which her stepmother felt would destroy her feminine charm and keep her from ever getting a husband. Appalled by such a dreadful prospect, Fanny one day burned all her writings. But she began writing again almost at once. Her novel EVELINA was published, without her signature, when she was twenty-six. It was an instant success, and Fanny admitted that she was the author. The great Doctor Johnson, ruler of the literary society of the day, was delighted with the novel and became Fanny's lifelong friend.

The Queen gave Miss Burney a court position, which she held for five years, and the journal entries covering those years are full of spirit and show keen observation. In 1793 Fanny married a French refugee from the Revolution, a M. d'Arblay, and soon became a member of the French literary circle in England. She published several other novels, none of them having the story-quality or bloom of EVELINA. Critics say that she tried to copy the style of Doctor Johnson, failed and lost her own fresh way of writing in the process.

The earlier parts of Fanny Burney's DIARY, before she was influenced by Johnson, are brightly descriptive of scenes and people surrounding Johnson. Indeed, from her fifteenth year Fanny lived in the midst of an exceptionally brilliant social circle.

Fanny Burney lived so long after the great events mentioned in her DIARY that it could be published almost at once without fear that anybody would suffer from its revealing contents. Swift's DIARY waited 21 years. Evelyn's DIARY was published 112 years after its writer's death; and Pepys' DIARY saw the light 156 years after it was finished, having been deciphered three years earlier, in 1822. It seems, therefore, to be a rule, and a good rule, that diaries, which are almost sure to be personal, shall wait before they are printed.

THE NEXT STORY OF LITERATURE IS ON PAGE 1867.



A square in medieval Florence during an execution. The square was the daily meeting-place of the Florentines.

THE BUILDERS OF FLORENCE

AMONG the many cities of Europe that we desire to visit, none calls to us more clearly than the ancient Italian city of Florence, which lies in the lovely valley of the river Arno. An old legend says that it was built by Julius Caesar, who called it Fiorenza. This may be only a tale, but we know that the city was founded by the Romans. (In Italy today it is called Firenze.)

It was not much more than a trading town in ancient Roman times. In the early Middle Ages it had to fight more than once for its life against invading hordes of barbarians from the north. Charlemagne, in the ninth century, rebuilt the walls of the city, which the barbarians had torn down. Then Florence began to flourish again as a center of commerce; but it was at the mercy of Germanic barons who dwelt in strong castles beyond the city. For more than 250 years the men of Florence fought for their liberty, until at last the barons were conquered, one by one, and forced to give up their castles and live inside the walls. This was not a wise thing, for the barons banded together in a political party, called the Ghibellines, and tried to rule the citizens, called the Guelphs. Strife between the two parties continued into the thirteenth century, when some of the strong, rich workers' guilds organized a government of their own. It was a council, or committee, form of government, called a Signory; and during much of its existence it had the confidence of the Florentines, and worked for their welfare.

This was the most democratic form of

government in the world at the time. The members of the Signoria, the council, held office for only a short term. The standard-bearer, or leader, the Gonfalonier, also had a limited term, so that no man could think



Cimabue is instructing his famous pupil, Giotto.

of himself as ruler, but only as temporary representative. The Signoria did not decide important questions. Instead, a great bell in the council palace would ring; the male population would assemble in the square before the palace, and vote by voice on the question. Nobles had no rights of citizenship.

During all these hundreds of years after Charlemagne rebuilt the walls, Florence had been growing in trade and prosperity. Now she had many families whose wealth was enormous. Among them was the family of the Medici (may'-di-chee), members of the Bankers' Guild. Let us watch this family as we follow the story of Florence.

It was in 1282 that the wealthy guilds established the Signory; and almost at once the Signory laid plans for making Florence beautiful. The wonderful thing is that men were easily found who were capable of carrying out, in the best possible way, the high ideals from which the search for beauty grew. They were architects and sculptors whose works have seldom been excelled in the history of the world. Many of them sprang from such humble circumstances that we do not know their early history.

One of these men of humble birth is Arnolfo di Cambio (1232-1300). He was one of a band of workmen and artists (architects and sculptors) who went from town to town, building and improving churches and palaces. Arnolfo was chosen to build a great new cathedral in Florence, and the Signory's instructions to him specified that the cathedral "should be designed so as to be worthy of a heart expanded to much greatness, corresponding to the noble city's soul, which is composed of the souls of all its citizens."

Arnolfo succeeded even beyond the spacious dreams of the City Fathers. He was



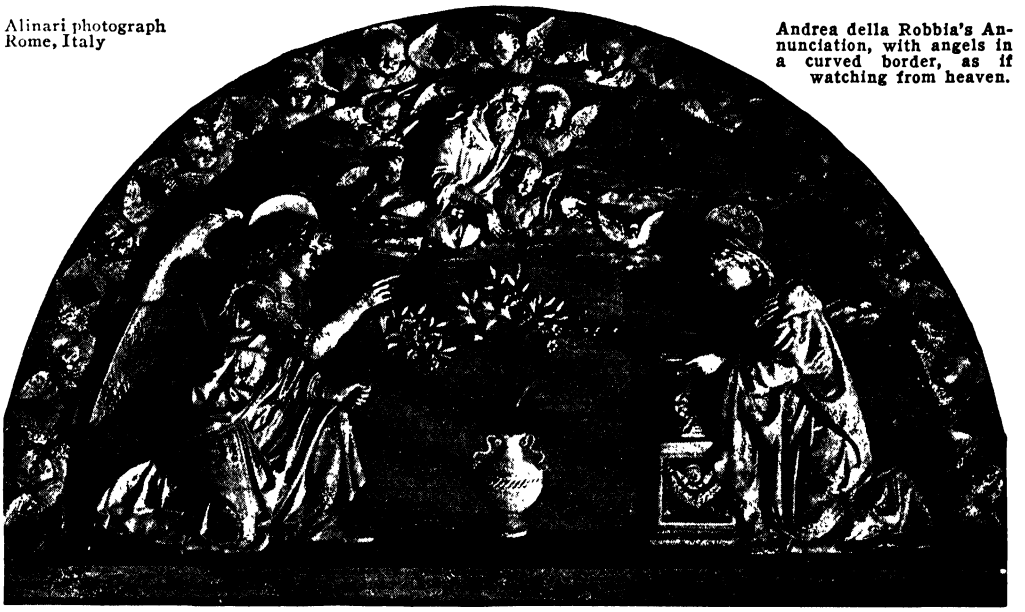
Cimabue surveys his work in a Florentine church.

the father of Florence's architecture. He designed her noble cathedral and built much of it; he built two of her most beautiful churches. He surrounded the city with stately new walls; and he planned the famous Council Palace, the Palazzo della Signoria. The building is now called the Palazzo

Vecchio, Italian for the Old Palace.

In Italy at this time the art of painting was given almost no attention. Church decorations were done in mosaic or were painted by foreign artists who followed Byzantine models. Only one or two Italian artists had begun to paint in a different way, copying or imitating the works of old Roman artists. In 1240 there was born at Florence Giovanni Cimabue, who became a worker in mosaics and perhaps a painter, too, although we are not sure now that he made the pictures which for many years were thought to be his. His name was held in high honor in Florence, and there is a famous old story which tells

Alinari photograph
Rome, Italy



Andrea della Robbia's Annunciation, with angels in a curved border, as if watching from heaven.

of his finding and training an artist greater than himself, Giotto di Bondone. Giotto it was who turned to a new, a more independent way, representing nature as it appeared to him.

Giotto was born in, or about, 1266, the son of a peasant at Vespignano, near Florence. While he was still a little boy Giotto was placed by his father with some shepherds to watch his flocks. Giotto may have been a loving shepherd, but he loved art better. Without having had a lesson, he used to give all his leisure to drawing on the rocks with chalk. It is said that while he was thus engaged one day making a drawing of a sheep, Cimabue found him. The great artist, pleased at the boy's industry and talent, asked if he would like to go with him and learn to paint. Permission having been gained from the boy's father, Giotto was taken to Florence and instructed by his good friend. Giotto proved a ready pupil.

And now there came about a great change in the methods of artists. Pattern-making became of less importance than the expression of life and nature. Giotto was really the first to paint in this way. He was about twenty-four when he gained his first important commission—to paint a picture of Paradise over a church altar. An interesting thing happened in connection with this. Dante, the great poet of Florence, had proved to be a good friend of the poor young artist. So, as Giotto sat perched high up on his little platform near the roof of the church, he thought of what he owed the poet and showed his gratitude by painting a beautiful portrait of Dante among the angel faces of his picture. That portrait is the finest of the great poet that we have, for it was painted before sorrow and care had marred the noble features of Dante.

Giotto's talent was speedily recognized. He was paid to do paintings for the famous church in which St. Francis of Assisi is buried; for churches at Rome, Padua, Verona, Naples and elsewhere, and, of course, for many in Florence. Wherever he went he was always the simple laughing peasant turned artist. He had a merry jest for every-

body, whether it was king or clown. Said a king who employed him: "I wouldn't work upon that scaffold this hot day, if I were you." "Nor would I, if I were you," answered the laughing artist.

On another day he and a famous lawyer were caught in a storm, and as they went their way, drenched and plastered with mud, the lawyer turned to Giotto, and noting how comical he looked, said: "Do you think that anybody seeing you at this moment for the first time would believe that you are the greatest painter in the world?"

"Yes," said Giotto, "if he could believe that you knew your ABC."

It is told also that the Pope sent a man round to all the cities to collect specimens of the work of the artists, saying that the painter whose work he liked best should go to the Vatican to carry out a great scheme of decoration. The other artists were anxious to show the best thing they had done; but Giotto merely took up his brush, dipped it in red, then drew with it a circle, so perfect that it looked as if it had been drawn with the assistance of the very best compass.

"Am I to have nothing but this?" gasped the envoy.

"That is enough," answered Giotto. "Send it with the others, and see if it is understood."

Apparently it was understood, for it is said that the Pope sent for him, and that Giotto painted some pictures in St. Peter's at Rome.

When he was an old man, only two years before his death, Giotto was made master of the public works of Florence and given charge of the building of the cathedral which had been left incomplete by the death of Arnolfo, about thirty years before. Giotto now had to superintend the work of others; and he had to create, with measuring instruments, with hammer and chisel, as he had been wont to create with his paints and brushes. He was called upon to design a campanile—a tower in which to hang bells. He planned and designed one of the most beautiful towers ever built. It is one of the marvels and beauties of Florence today, and visitors from far lands carry away with them



Gramstorff Bros.

Dante was a good friend of Giotto, and took a kindly interest in seeing his poor young friend succeed. Here we see the great poet presenting the struggling artist to Guido, Signore of Ravenna, a man of influence and one who could help secure work for the painter. Giotto in turn painted the most striking likeness we have of Dante.

the lovely memory of it. Giotto's Tower, it is still called. Not only did Giotto plan it; he worked with mallet and chisel at some of the carvings which adorn it. One of the carvings represents a little puppy—a puppy, it is said, which he had loved as a child when

named Bartoluccio, a goldsmith, who instructed young Ghiberti in his own art, and then did a wise thing in sending the lad to travel and enlarge his knowledge of art and, at the same time, to earn his living.

Ghiberti was a wonderful fellow. When



Giotto has been called the first of the modern painters, as his work paved the way for the other great masters of Renaissance painting. The deep feeling shown in this painting of the burial of Christ is in contrast to the stilted quality of the work of the earlier Italian painters.

minding the sheep and still remembered when he was one of the most famous men in Italy.

The beloved Giotto passed to his rest in 1337. For a number of years afterward the work of making Florence beautiful was in the hands of artists who had skill but not genius. We take up our story again when we find in Florence three other wonderful men. These are Filippo Brunelleschi (1379?-1446), Lorenzo Ghiberti (1378?-1455) and Donato di Betto Bardi, called Donatello (1386?-1466).

The first two came into prominence when Ghiberti was about twenty-four; they met as friendly rivals. Ghiberti was of a poor family. We know little about his father, but we hear of his stepfather, an excellent man

he was not painting pictures he was modeling in wax, or making figures in bronze or doing something with trinkets. Before he turned his face homeward, he had earned fame by painting some fine frescoes in a palace at Rimini. He was working at Pesaro when he got a letter from his anxious stepfather telling him that all the most skilful artists in Italy were summoned to show their genius in designing gates of bronze for the famous Church of San Giovanni. (This church is often called The Baptistery, because it is dedicated to St. John the Baptist, and because all the children of Florence were taken there to be baptized.) Here was Ghiberti's chance. He made his model for the bronze doors, and sent it to take its place with designs of the famous men of the time.

Among the other competitors was young Filippo Brunelleschi. He was a lawyer's son, and his father had desired him to follow the law. But Filippo early gave his heart to the work of the goldsmith. Dearly he hoped now to win the prize. When the models were exhibited he took with him his humble young friend Donatello. They examined the designs and saw that Brunelleschi's was better than all except that of Ghiberti, which was superior to all the rest. And so workmen he was engaged in other labors, too. He did some beautiful work for two or three churches of Florence, as well as for the cathedral; he modeled fine statues and did some beautiful goldsmith's work.

His grandest monument is the second pair of gates to The Baptistery, which for mingled grace and grandeur are finer than anything else of the sort in existence. Michelangelo declared that they were fit to be the gates of heaven. Ghiberti loved the work.



Part of the painting by Simone Martine, in the Church of Santa Maria Novella. The picture symbolizes the Church. Gaddi, Giotto and Cimabue, three of the great artists of Florence, are seen standing in the foreground near the lambs.

the judges found. Ghiberti was ordered to undertake the work. There were two pairs of gates to be made.

Ghiberti started now upon the work of his life. To understand what he had undertaken we must examine the picture of his gates, on page 1741, or, better still, we may see a cast of them in the Corcoran Museum in Washington or in the Metropolitan Museum in New York. This is his second pair of gates, on which he spent nearly thirty years. The first pair took twenty years. Thus fifty years of his career were given to the work. But while Ghiberti was doing the gates with the assistance of a staff of artist-

In those days Florence was an unlighted city at night, save for the torches which people carried, and everybody not specially authorized had to be indoors by dark. But Ghiberti, though no higher in rank than the rest of the common people, became an important public character when he began the gates, and he and all his work-people were allowed to walk about the streets at night and to carry lanterns at whatever hour they liked—a rare privilege indeed in those days.

It was well for Filippo Brunelleschi that he did not get permission to make the gates, for there was other important work for him to do, even greater in some respects than

Ghiberti's. Himself an ugly little man with a nature not of the kindest, he had a soul for beauty.

Having yielded the palm to Ghiberti in the contest over the gates, he gave up trying to be a sculptor (for he wanted to be first in whatever he did) and went to Rome where he studied architecture. In that field he was resolved to be foremost among living men, and he amply made good that promise to himself. In the year 1418 the grand cathedral in Florence which Arnolfo di Cambio had begun 120 years before was nearly finished. All but the roof. So vast was that great structure that no man had a plan for roofing it. Then Brunelleschi came forward, though not with a plan. He offered to do the work, if he might do it in his own way, without being hampered by the Guild of Wool Merchants who had supervised the building of the cathedral. After much haggling, Brunelleschi won the commission on his own terms; and he built the lovely airy dome, or Duomo, the wonder of the age.



Lorenzo Ghiberti, master craftsman and friend and rival of Donatello.

It is said that Brunelleschi got the idea for the dome by climbing up on the roof of the Pantheon, an ancient domed temple in Rome. The name of the cathedral in Florence is Santa Maria del Fiore; yet it is best known simply as the Duomo, the dome.

The dome took over forty years to build, and Brunelleschi had been dead fifteen years when it was completed. But his plans were so perfect, his methods so excellent and his labors during the last twenty-six years of his life so persistent, that the faithful band of workers who followed him had but to carry out what he had begun to make his work one of the grandest features in the architecture of Europe. Measured across, the dome is still one of the biggest in the world, and its beauty remains unsurpassed. Two other great works in Florence which show the genius of Brunelleschi are the church of Santo Spirito and the church of San Lorenzo. The latter was built by a group of wealthy men, one of them a Medici, and some years later the Medici family gave money for the upkeep of the church. The Medici also paid for much of its decoration. There are famous tombs in San Lorenzo, where members of the Medici family lie. The Pitti Palace, too, a very noble and impressive building, was planned and begun by Brunelleschi, but finished by others after his death. The palace gallery contains some notable paintings.

So far we have met Donatello only by name. He was the young friend who went with Brunelleschi to see the models which had been submitted for the gates. Donatello was a merry soul, and perhaps it was because of the youth's sunny nature that Brunelleschi, who was ten years older, became his friend and companion. Donatello was the son of a wool merchant, who apprenticed him to a man who is supposed to have been Ghiberti's stepfather. At any rate, the boy learned, like Brunelleschi, the goldsmith's art and, going to Rome with his friend, was able to support himself there by his skill in working in metals.



One of the many young artists befriended by the Medici was the sculptor Verrocchio.

While Brunelleschi was studying the classic architecture of Rome, Donatello was studying the statuary. He had not his friend's

capacity for great schemes and buildings, but he had just as fine a genius; and though he laughed and joked his way through life, he was destined to become one of Italy's greatest sculptors, looked upon as the father of modern sculpture.

Donatello was very young when he did his first work for Florence—statues for niches on the outside walls of the cathedral (the Duomo) and another church called Or San Michele. Each figure that he made marked some change leading in the direction of naturalism. The position was less stiff, the feet were placed more naturally, or the face was given more expression. The finest of these early works was the young Christian warrior St. George, made for Or San Michele and now in the National Museum, London.

Donatello was one of the sculptors engaged upon the decoration of Giotto's tower. He carved for it several statues, among them a lifelike figure called Zuccone; and as he gazed upon his finished work he took up his mallet and, giving the statue a playful tap, said to it: "Speak!" Michelangelo, who was not born until nine years after the death of Donatello, admired Donatello's statues. Once, when he was looking at the wonderful figure of St. George, clad in mail, looking as if ready to step out to battle, he remembered what Donatello had said to Zuccone, and he shouted: "March!" Could there be a finer compliment to a great sculptor's work?

All Donatello's statues are famous. They are beautiful in themselves, but they are important also because of the effect they have had upon later sculpture. Their creator had closely studied the glorious work of the ancients, and he reproduced their methods, stamped with his own genius. Until his day men had been content to let the statues they carved be part of the building to which they belonged, as a cornice or a scroll is part of a building. Donatello made them actual portraits in stone, things of life and beauty, standing out from their surroundings, figures whose merits command attention and admiration for themselves.

He had a joke and a kind word for everybody who deserved them, but once when a niggardly man complained that the sum charged by Donatello for a great head amounted to twenty-five cents a day for a month, the sculptor took his hammer and smashed the head to pieces. It was not that he cared anything about money. All that he earned he used to put in a basket and hang up in his workshop, so that his friends and workmen could help themselves without troubling to ask him. He lived through a happy old age and died when he was eighty.



The Bettmann Archive

Begun by Giotto and Pisano, this representation of the metal trades was completed by Luca della Robbia.

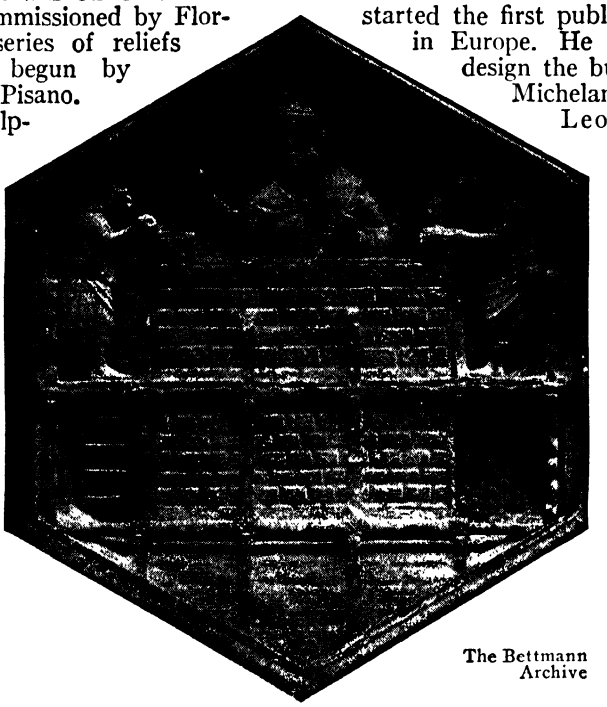
The Medici family gave a number of commissions to Donatello, the most famous being a bronze statue of David (we show you a picture of it on page 4614) and the singing gallery in the church of San Lorenzo (see page 1745). Donatello also made a very beautiful singing gallery in the Duomo; and in the city of Padua he completed the first bronze equestrian statue since Roman times. This was the statue of the Venetian general, Gattamelata.

The next man of genius to carry on the work of making Florence beautiful was the great sculptor Luca della Robbia. He was born in Florence about 1400, and for about a century he and his successors, known everywhere as the Della Robbias, were famous in the art world of Italy. They belonged peculiarly to Florence, living in a house which Luca had bought. Like many other sculptors, Luca began his career in a gold-

smith's shop. There he learned to model in wax, and passed from that stage to shaping objects in bronze and marble.

His first important work for Florence was the carving of a beautiful gallery in the cathedral to face the singing gallery sculptured a few years earlier by Donatello. Luca carved a happy band of singing and dancing figures along the marble gallery. The rollicking boys are so merry and free that when we look at them we forget they are in marble and listen for the music coming from their lips.

Luca's next work was on Giotto's Campanile. He was commissioned by Florence to finish a series of reliefs which had been begun by Giotto and Andrea Pisano. He was a quick sculptor and finished these five panels in one year. The next year he set to work on two altars for the cathedral. One piece of work upon which Luca spent part of his time for over twenty years was the bronze doors for one of the sacristies of the cathedral. Donatello had been given the order first, but he was too occupied to get started upon the work; so Luca was the one who finally made these doors.



The Bettmann Archive

On the doors of the cathedral of Florence are sculptured tributes to workers. This one has to do with the builder's craft.

But the kind of work which we think of as peculiarly belonging to the Della Robbias is not in marble or bronze but in glazed terra-cotta. Statues or figures in relief were first modeled in the clay composition. After they had been tinted in soft, beautiful colors they were covered with a glaze, or kind of enamel, and fired. The same kind of enamel had been used in Persia two hundred years before, but Luca did not know that and he was happy and proud when his new process of glazing terra-cotta proved so successful.

He took his nephew Andrea into his service to work at this terra-cotta; and Andrea had seven sons, five of whom became artists in the same workshops. Of these Giovanni was, after Luca and Andrea, the most famous of the talented family. Two of the seven sons became monks, in order to follow Savonarola. These two sons of Andrea were probably drawn into the company of Fra Bartolommeo, who, born in 1475, became one of the most renowned of Florentine artists. He worked at the monastery of San Marco, which Cosimo dei Medici was then rebuilding at his own expense. Giovanni of Fiesole, the artist-monk who was generally called Fra Angelico, also worked in San Marco. At about this time Cosimo dei Medici also started the first public library to exist in Europe. He had Michelangelo design the building for it.

Michelangelo, Raphael and Leonardo da Vinci were the greatest artists of Florence. We tell you about them elsewhere, for they were, and are, not of one place or of one age. Yet Florence in her heyday of art claims them rightfully. Michelangelo was born there in 1475, and carried out there some of his finest work. Florence adopted his statue of David for her own silent champion. Out of a long, slender block of marble, whose awkward proportions were the despair of other sculptors, Michelangelo summoned this tall, frowning youth with his sling—a figure of energetic protest against tyrants. And in 1504, on the terrace of the Signory Palace (Palazzo Vecchio), a site chosen by a council of artists, the statue was set up.

Other noble works by Michelangelo in Florence are tombs of two of the Medici, in the church of San Lorenzo. The tombs are surmounted by statues of surpassing excellence. One of the tombs is that of Lorenzo the Magnificent, who did more than anyone else in his day, by fostering learning and art and encouraging young men of talent,

to make Florence the world center of culture, the Athens of the West. When Michelangelo was a poor young man, Lorenzo invited him to live at his home. The artist was treated as one of the family and given an allowance, for four years. The artist never forgot his patron's kindness. When we think of the builders of Florence we must include, among the architects and sculptors, this family of Medici who recognized genius and talent and gave work to artists who might otherwise have gone to other cities.

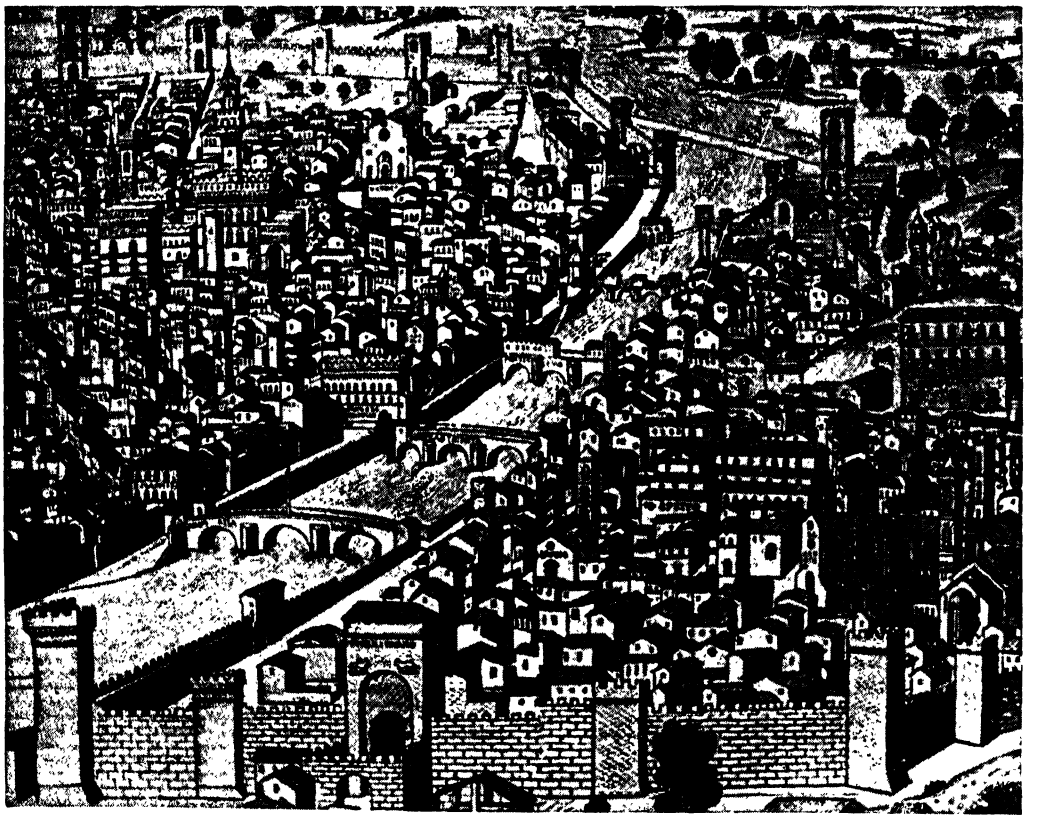
Another sculptor befriended by the Medici was Verrocchio (1435-1488). He is said to have created many works for Lorenzo the Magnificent, but only a few remain. Among them is a tomb in the church of San Lorenzo. He also executed a bronze statue of David (a favorite subject of sculptors).

The passage of time has wrought many changes since the days when the builders of Florence were creating her masterpieces, and many perils have beset her cherished treasures. But somehow her loveliness has eluded all dangers. No greater threat ever fell upon the city than the battle that raged there in August, 1944, when the British Eighth Army drove the Germans from her streets. Some of her buildings were destroyed, but her most glorious old palaces and churches were little harmed. The famous old Ponte Vecchio was the only bridge left standing, though there was considerable damage on both sides of it and it was weakened by other explosions.

A few of the painters of Florence have been touched upon in this article. They are given a chapter beginning on page 691.

No one can understand the spirit of Florence in her best era, "the morning and noon of the Renaissance," without knowing more about the Renaissance itself. The following chapters in The Book of Knowledge tell the amazing story: The Wonder Men of Florence, page 691; Raphael and His Time, page 957; Leonardo and Michelangelo, page 823; Italy's Immortals, page 4603; Scientists of the Renaissance, page 641; Makers of Venice, page 1454.

THE NEXT STORY OF FINE ARTS IS ON PAGE 1794.



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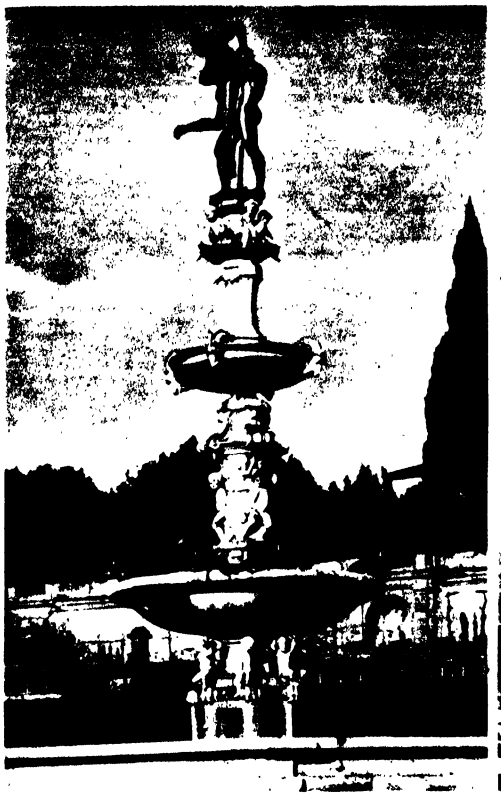
The river Arno cuts Florence in two. In medieval times, strong walls surrounded each part of the city.

GLIMPSES OF FAIR FLORENCE



GHIBERTI'S NOBLE BRONZE GATES FOR THE BAPTISTERY, WITH OLD TESTAMENT SCENES

The pictures in these pages are reproduced by courtesy of Messrs. Alinari, Anderson, Brogi, McLeish, the Metropolitan Museum of Art, and others.



A FOUNTAIN IN A GARDEN NEAR FLORENCE



MICHELANGELO'S DAVID, IN BRONZE LOOKS DOWN ON FLORENCE



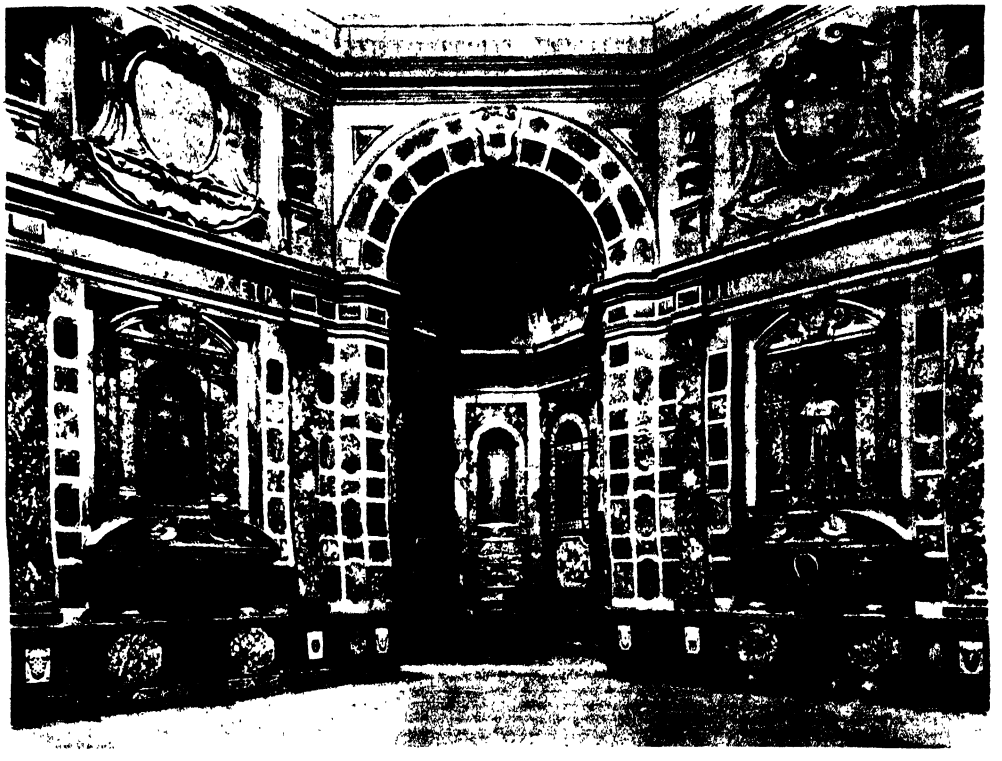
A MARBLE COPY OF THE DAVID



A STATUE OF HERCULES AND CACUS



THE FAMOUS FIGURES BY MICHELANGELO ON THE MEDICI TOMBS



THE INTERIOR OF THE MEDICI CHAPEL



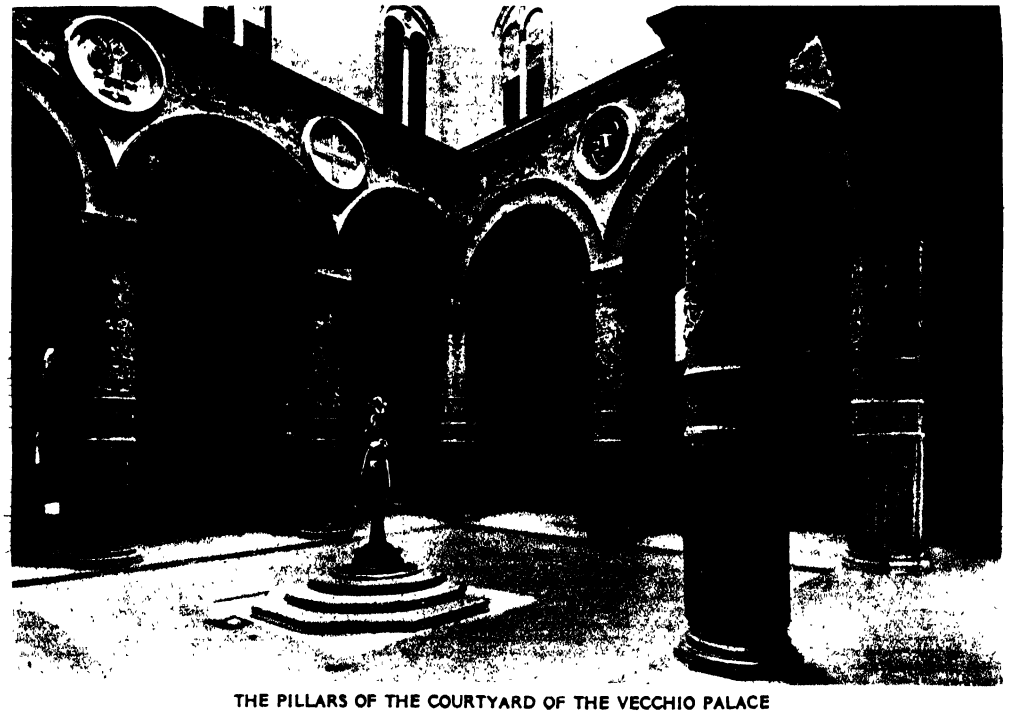
THE VECCHIO PALACE, BUILT 600 YEARS AGO



THE BAPTISTERY FOR WHICH GHIBERTI'S GATES WERE MADE



A WINDOW IN GIOTTO'S TOWER



THE PILLARS OF THE COURTYARD OF THE VECCHIO PALACE



A BRIDGE ACROSS THE ARNO, LINKING THE TWO PARTS OF FLORENCE



PONTE VECCHIO, THE OLDEST BRIDGE IN FLORENCE



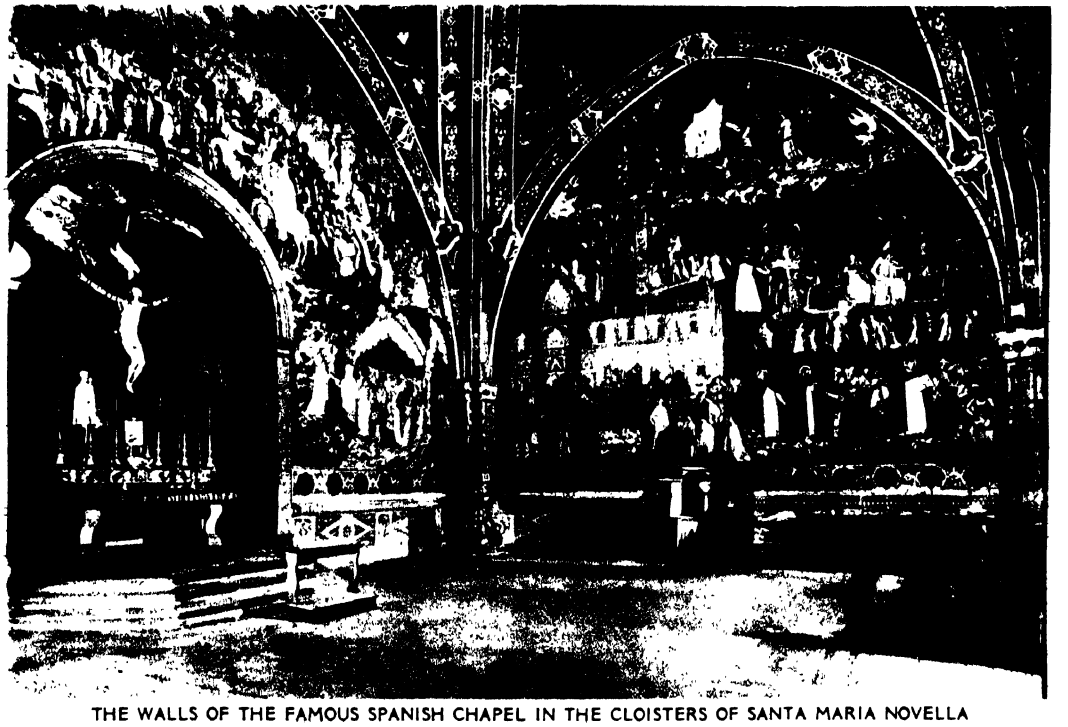
MADONNA AND CHILD, BY BENEDETTO MAJANO, IN SANTA MARIA NOVELLA



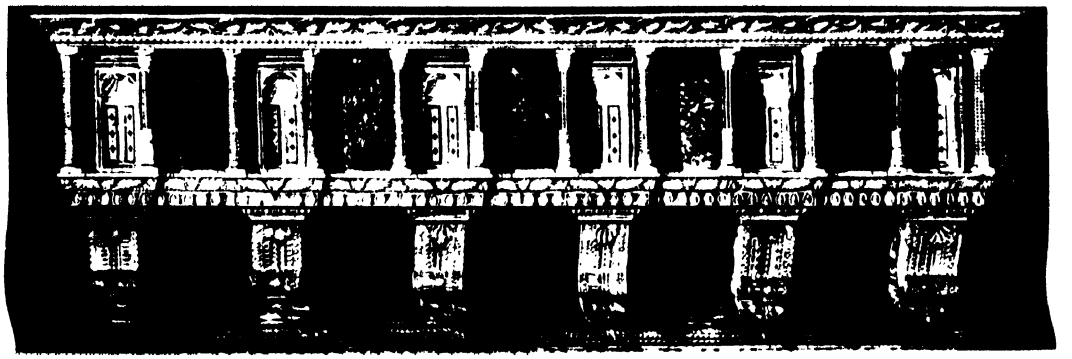
LORENZO DE MEDICI AS ONE OF THE MAGI, BY BENOZZO GOZZOLI, IN THE RICCARDI PALACE



DONATELLO'S SCULPTURE OF THE ANNUNCIATION, IN SANTA CROCE



THE WALLS OF THE FAMOUS SPANISH CHAPEL IN THE CLOISTERS OF SANTA MARIA NOVELLA



THE SINGING GALLERY, BY *DONATELLO, IN THE CHURCH OF SAN LORENZO*



FLORENCE FROM A GARDEN ON THE HILL



GIOTTO'S TOWER AND BRUNELLESCHI'S DOME



THE TOWER OF THE VECCHIO PALACE



THE ROOFS OF FLORENCE, WITH SANTA CROCE ON THE RIGHT



BRUNELLESCHI'S DOME TOWERING ABOVE THE RED ROOFS OF FLORENCE



AN ANGEL, BY LUCA DELLA ROBBIA, ON THE WALL OF A LITTLE CHAPEL IN THE CHURCH OF SANTA CROCE

Can We Fall Off the Earth?

WE can not fall off the earth, no matter where we are on its surface. The earth is round, a great ball, and if we were to journey in the same direction forever, we should simply continue to go around and around it, as a fly walks around and around a tennis ball. We should not come to any place where we could fall off.

The earth contains an enormous amount of matter—we say that its mass is great. You may remember that one of the great laws of the universe says that every particle of matter in the universe pulls upon or attracts every other particle of matter. We see this law in action when we watch the tides in the ocean. It is the pull of the moon upon the earth and its seas that causes the tides.

The massive earth pulls upon you and me and holds us to it. This pulling force, known as the force of gravity, keeps us from flying off into space. Airplanes can overcome the force of gravity because they have such powerful engines. If their engines fail, however, they are pulled right back to the earth.

Hundreds of years ago people believed that the earth was flat, like a wide table. Sailors were afraid to venture out of sight of land, lest they fall over the edge of the earth and be lost forever. However, a few wiser men at least suspected the truth, which in time was proved by such brave mariners as Columbus and Magellan.

WHY DO WE NOT FEEL THE EARTH GOING ROUND?

Because the earth turns so smoothly, with no bumps or jolting, and because we move with it, we do not feel the earth going around. When you are on a train, even with your eyes closed you can often tell that you are moving, because you can feel the friction of the wheels on the tracks, or you may be aware of a swaying or jolting. On a train, too, you can tell that you are moving by watching the trees and houses fly past. The heavenly bodies, however, are too far from us for us to get any feeling of our motion in relation to them.

If you would like to get the sensation of the earth's going round, you can try a little experiment. Some morning, get up early—before sunrise. Keep your eyes on the eastern horizon, where the sun will come up.



Then, as the sun comes slowly above the horizon, keep saying to yourself, "It is the eastern horizon of the earth that is tipping downward, as the earth turns. As the horizon tips downward, the sun only appears to be moving upward." Then you may be able to get the feeling of the earth's motion.

IS THE EARTH GETTING SMALLLER ALL THE TIME?

Most geologists agree that as the earth cooled and solidified, after it was first formed, it passed through a shrinking process. Scientists, however, do not agree as to whether the earth is still growing smaller. Some geologists believe that the shrinking is still going on, while others see no evidence of it.

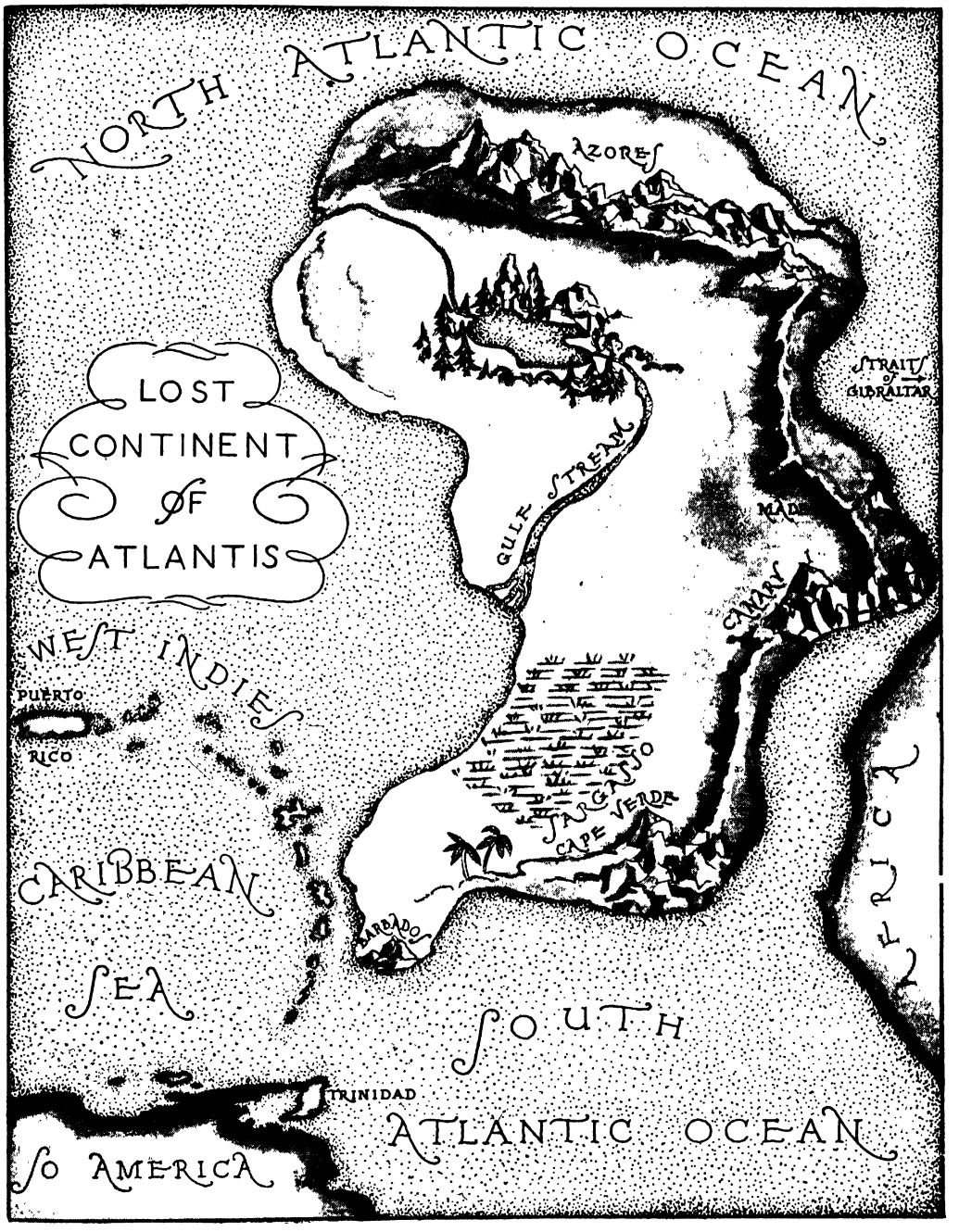
The earth is growing smaller in one sense. Its atmosphere is constantly losing some of its atoms into outer space. This may mean that after a long time the earth may be without an atmosphere, as Mercury and the moon are.

We can say, however, that the earth is growing larger, very slightly. As the earth travels through space, it sweeps up many tons of meteoric material each year in the form of meteorites and meteoric dust. This material adds a very little to its bulk.

HOW DOES THE EARTH TURN WITHOUT SHAKING?

When the solar system was first formed, the earth and the other planets were in some way pulled out of the sun and set in motion. Just what force started them moving we do not know. However, once started, there was nothing to stop them or to interrupt the even smoothness of their motion through space. One of Newton's great laws of motion says that any body continues in a state of rest or of uniform motion in a straight line unless it is compelled by force to change that state or motion. As the earth turns on its axis and moves through space, there is nothing in the vacuum of empty space to alter in any way the smooth motion of the earth. It is only the crust of our planet that shakes and quivers when an earthquake happens, and this has nothing to do with the turning of the earth.





WHAT IS THE LOST CONTINENT?

There is more than one lost continent. The earth's surface is slowly but constantly changing. Mountains rear their heads where oceans once were; seas wash over areas where dry land stood. Asia and Australia were probably once connected by a continent. A chain of islands (Borneo is one) is all that remains now above the water. England and France were probably once united, before the English Channel formed.

The Greeks spoke of Atlantis, a continent in the Atlantic Ocean, where a fine civilization was supposed to have flourished in the mythical past. The continent was believed to have sunk out of sight after a great earthquake. Many people believe that Atlantis was just a myth with no reality, while others think that it was once an actual continent. This imaginary map of the lost Atlantis is based on the old legends.

IS THE INSIDE OF THE EARTH A VAST HOLLOW?

Although no one has ever been able to travel very far down into the earth, we believe that its interior is not empty. One thing we are sure of—that the interior of the earth is hot. Volcanoes and hot springs prove this. From our studies of deep wells we have learned that, in general, the temperature increases by one degree Fahrenheit for every fifty feet we go down.

Scientists believe that the central core of the earth is composed of iron or nickel-iron. Both of these materials are very common in meteorites. Since the earth and the meteors were probably formed at the same time and in the same way, it seems probable that they are much alike in material. The fact that the earth acts like a great magnet—and iron is the magnetic element—also seems to prove that there must be a great core of iron at the earth's center.

Outside the iron or iron-nickel core, there are probably very dense layers of iron and stone, tightly packed. Then comes an outer layer known as the crust, which is made up of granite and other rocks. The upper crust, the surface of the earth as we see it, is a thin layer, and in the upper mile of this layer we find the surface of the earth as we know it.

Until the beginning of the twentieth century, scientists believed that the inside of the earth was largely composed of very hot liquids. Now, however, from our study of earthquakes, we believe that the inside of the earth must be both elastic and rigid.

The earth weighs—as we understand weight at the surface of the earth—about 6,600,000,000,000,000,000,000 tons.

IF THE EARTH IS SHRINKING, SHALL WE EVER BE TOPPLED OFF?

No. If the earth is actually shrinking—which is doubtful—the stuff of which it is made is simply being packed more closely together. The force of gravity will continue to hold us to the earth's surface and we are in no danger of falling off. Actually, if the earth is shrinking, the force of gravity will become more powerful as time goes on, because, as the earth gets smaller, we shall be nearer to its center and held more firmly by its attraction.

HAS THE EARTH A LIGHT OF ITS OWN LIKE THE SUN?

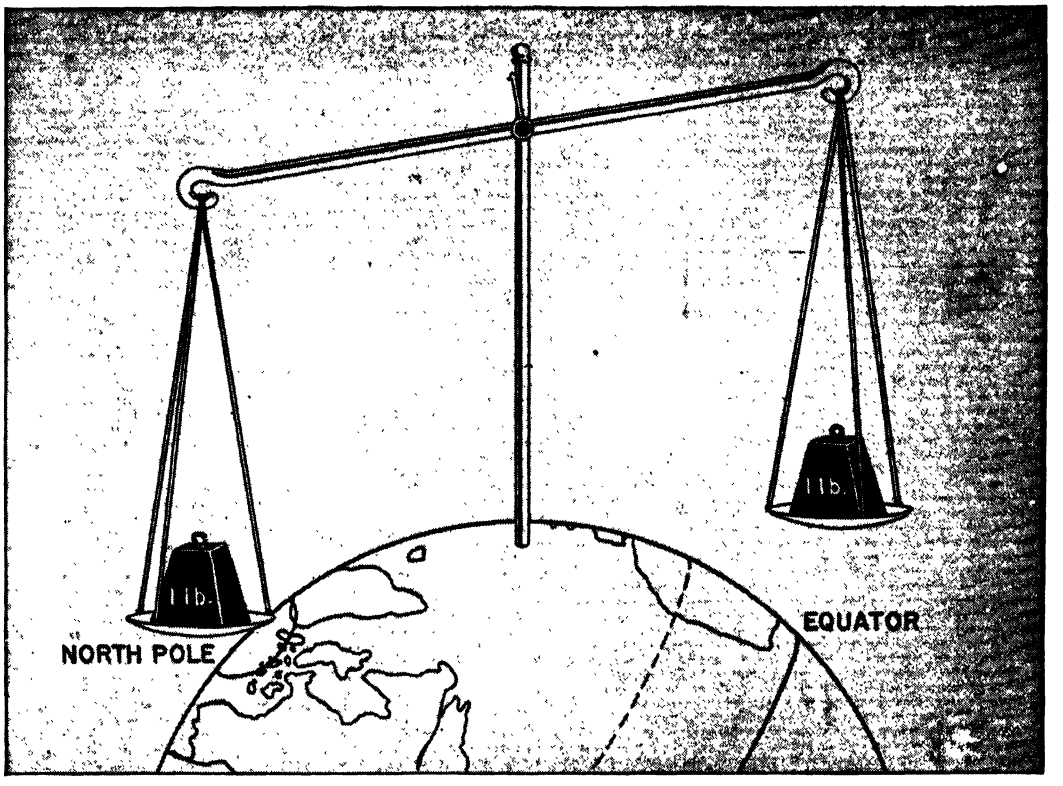
The earth is a dark body, and has no light of its own. It shines, as the other planets and the moon do, because it reflects the light of the sun. If you hold a mirror in the sunlight, you will see that the mirror reflects the sunlight, but, like the earth, it has no light of itself. The earth and the other planets no doubt once shone with their own light, just as the sun does now. We believe this because it seems probable that the planets were originally formed from the same hot, bright material as the sun. The planets, however, being so much smaller than the sun, cooled down long ago, at least on their surfaces.

DO THE PEOPLE AT THE POLES SPIN ROUND LIKE A TOP?

Of course there are no human beings actually living at either the North or the South Pole. This does not, however, make your question about the spinning any less interesting. You know that the earth spins around once in twenty-four hours. Since it moves all in a piece, any place on its surface will take twenty-four hours to spin around once. A place on the equator will have to move faster to complete a turn in this time than a place near one of the poles—as you can see if you examine a globe of the earth. A man at the equator is being whirled along at the rate of about a thousand miles an hour, but a man actually standing at one of the poles would simply be turned around once in twenty-four hours.

IS THE EARTH EXACTLY ROUND?

While we know that the earth is a ball, we also know that it is not quite a sphere, but is slightly flattened at the poles. The shape is often described as like that of an orange, though this is an exaggeration, for the flattening is very slight indeed. If the earth were represented in exact proportions by a globe eighteen inches in diameter, the difference between the greatest and the least diameters would be only about one-sixteenth of an inch. On such a globe the highest mountains, the Himalayas, would project



The tipped scale shows that an object weighing one pound at the equator weighs more than a pound at the poles, because the surface at the poles is nearer to the center of the earth than is the surface at the equator.

only about one seventy-fifth of an inch. The earth is actually much smoother and rounder in proportions to its size than the balls in the bowling alley.

We know in several ways that the earth is flattened slightly at the poles. In the first place, we know that other heavenly bodies are of this shape and it is reasonable to suppose that our earth is no exception to the general rule. Then we know the earth was once in a fluid state, and has always revolved on its axis, and, in revolving, any ball that is not absolutely rigid will bulge midway between its poles.

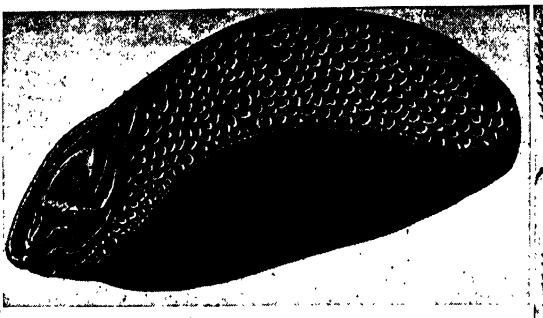
Another proof of the flattened shape of the earth—or of its oblateness, as science calls it—is the fact that as one approaches the poles the force of gravitation is found to increase. Suppose a huge scale could be built, as in the diagram, with a pound weight hanging directly over one of the poles, and another pound weight hanging over the equator. The one over the pole would drop. The reason for this is that the center of the earth from which the force acts is nearer the surface at the poles than it is at the equator. The difference is only a little, but still it is great enough to be measured by ordinary scales.

Finally, the flatness is proved by actual measurement. If the earth were a perfect sphere, its circumference in any direction would measure the same. A circle is divided into 360 parts called degrees, and each degree on a perfect ball must be equal in length. When the degrees of latitude on the earth's surface are measured, they are found to be longer as we get nearer the poles. This can be the case only on a sphere that is flattened toward the poles. We know when we have traveled through one degree of latitude measured along a meridian of the earth, for such a distance causes a difference of one degree in the altitude of the Pole Star. These degrees of latitude are found, when actually measured, to vary considerably. At the equator a degree is 68.70 miles; at latitude 20 it is 68.77 miles; at latitude 60, 69.21 miles; and at the pole it is 69.39 miles. This is conclusive proof that the earth is flattened toward the poles.

THE NEXT WONDER QUESTIONS ARE ON PAGE 1807.

THE STORY OF A GRAIN OF WHEAT

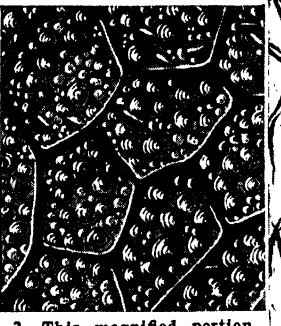




1. On the left is the embryo, in which the root and stem are packed. The rest of the grain, the endosperm, consists of food stored up to nourish the young plant.



2. The embryo magnified still more, showing the root and stem.



3. This magnified portion of the endosperm shows cells packed with starch.





4. When the seed germinates, the roots burst out and spread to draw nourishment from the soil.



5. The rod is really a hollow sheath inclosing a green core, which develops into stem and leaves.

6. This is the wheat plant in flower. Male and female parts appear on the same plant.

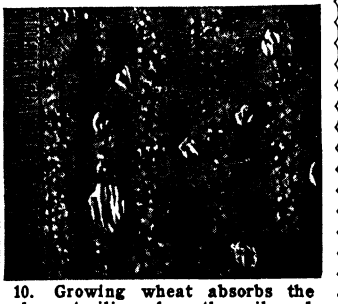
7. Here is the ripe wheat plant. It will be seen that several stems grow from one root.



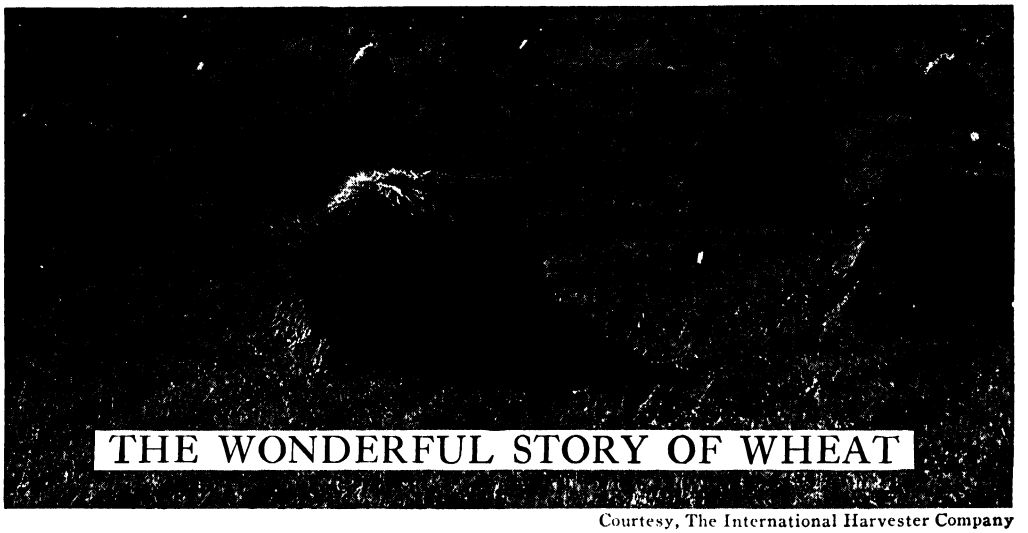
8. This is the wheat flower magnified. Wheat is a grass, as we see by looking at grass flowers.



9. The wheat grain is inclosed in a husk, or protective covering. The husk is chaff and bran.



10. Growing wheat absorbs the element silicon from the soil, and forms it into silica crystals.



THE WONDERFUL STORY OF WHEAT

Courtesy, The International Harvester Company
Wheat cut and shocked ready for threshing.

OF all the food plants of the world Wheat is king. In proportion to the nourishment it yields it is the cheapest of all foods, and a scientific comparison of wheat bread with meat shows that one gets much more nourishment for the money in bread than in meat. And wheat has a very wide range, growing on almost any soil and in any temperate climate.

The story of wheat is the story of our civilization. Wherever the white man has gone he has taken this king of plants with him; so that the spreading of wheat over the virgin lands of the world has followed the spread of the white population.

We can trace most of our cultivated plants back to their wild ancestors. We still have wild plums and apples and cherries, for example, and these grow side by side with the finer and choicer kinds that man has bred from them.

Wheat (*Triticum*) was already in cultivation when written history began, but the ancestry of the plant is not known. Early in the twentieth century Mr. Aaron Aaronsohn, director of the agricultural experiment station in Palestine, reported that he had found a wild wheat on the slopes of Mt. Hermon. He believes that this gave rise to emmer wheat, from which our ordinary wheats are descended. This theory has not been accepted by all scientists.

Wheat is a cereal grass, belonging to the same family as oats, corn, barley, rice, rye and other food plants. It is an annual plant with a hollow stem, though it has partitions at the knots along its length. One seed may give rise to several stems. The leaves are narrow. The grains grow out from the upper part of the stem, and each has a woody covering which we call chaff. This is separated from the grain in many ways. In Biblical times we find that it was usually threshed by spreading the sheaves on a floor, and compelling animals to walk over them. Now it is separated by a threshing machine, or by the great "combine" of which we show you a picture.

Eight types of wheat are usually recognized, and are grown somewhere in the world. These are Einkorn, Spelt, Emmer, Common wheat (which has hundreds of varieties), Club, Poulard (Mediterranean), Durum and Polish. In our story we speak chiefly of the many varieties of common wheat, though durum wheat is becoming important.

Dean Swift declared that "whoever could make two ears of corn or two blades of grass to grow upon a spot of ground where only one grew before would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together." In the case of wheat men have done much more than this.

The wheat of primitive man was a poor thing. Probably there was only one stalk and the amount of grain was small. Now we have six to twelve stalks, or even more, from a single grain and the heads are much heavier. It is estimated that if each head bears one



Land like this where the plant roots are matted together is difficult to plow. Here we see a sulky plow, drawn by six horses (often by a tractor), which plows three furrows at a time, though the plows themselves do not show clearly because of the soil they are turning over. Behind, a harrow which pulverizes the clods is attached.

more grain, it amounts to about fifteen million bushels in the United States alone.

WHAT IS MEANT BY WINTER AND SPRING WHEATS

Wheats are first divided into winter and spring wheats. In the former the seed is sown in the fall, comes up, and then seems to grow little during the winter, though the roots are developing. In the spring it begins to grow and ripens in early summer. In colder regions the wheat would be killed during the winter, and therefore the seed is sown as early as possible in the spring, and grows during the whole summer, ripening in the fall, unless it is killed by frost. Both kinds have been much improved.

This improvement has come from the care and intelligence of man. If you will turn to the article on What Man Can Do With Plants (Volume 4; pages 1469-75) you may learn of the methods he has used. At present several hundred varieties of wheat are grown and others once grown have been abandoned. Some were brought from abroad. Most of them originated from selection, or from chance crossing with another variety. Wheat is self-pollinating, but pollen from one stalk may be carried to another by the wind.

For a half-century or more most of the best varieties have been produced by intentional crossing at government experiment stations, though some private breeders are active. A. E. Blount of the Colorado Experiment Station, one of the earliest breeders, produced a dozen varieties, some of which were used to improve wheats in Australia. We have told you of the development of Marquis wheat in Canada by the Saunders family, and of the efforts to produce better wheats (pages 1469-76). Mr. Seager Wheeler, of Saskatchewan, breeder of Red Bobs, Kitchener and other varieties, is a famous private breeder. There are scores of other men at work on the problem of producing better wheats, who deserve to be mentioned.

WHAT IS MEANT BY STRONG AND WEAK WHEATS

Before going on to tell you what they are trying to do, it is worth while to explain the difference between strong and weak wheats. Strong or hard wheats have much gluten, about which we tell you later. A strong wheat makes a large light loaf. A weak or soft wheat has less gluten, and will not make

such a light loaf, though it is better for making cakes and pastry. Most strong, hard wheats are spring wheats though some varieties of winter wheat, such as Turkey, Blackhull, and Kanred, are classed as hard winter wheats, and millions of bushels are grown in the Middle West. Most winter wheats, however, are soft or weak.

A breeder then would seek to produce a wheat with strong straw, good color, hardiness, heavy yield, good gluten, resistance to drought and disease, and (if a breeder of spring wheat), early ripening. All of these are important, and many wheats possess some or most of them.

The breeder takes a wheat which has already most of the good qualities desired and crosses it with a wheat which shows the missing quality, such as resistance to disease. Many of the plants from the cross will be worthless but perhaps a few will show promise. The best plants are selected, and the wheat from them is sown and selected again, and again; or perhaps the best plants are back-crossed on one of the parents. Sometimes there is a double cross. For example, Thatcher, an excellent hard spring wheat, is the result of a cross between Iumillo, a durum wheat, and Marquis, which was then crossed with a cross between Marquis and Kanred.

Many insects prey on wheat, but against these the breeder can do little or nothing. The chinch-bug, the Hessian fly, the fruit-fly, the gall-fly, the bulb-worm, and the grasshoppers are enemies of all the different varieties of wheat. Much, however, can be done with the dreaded fungus growths—wheat rusts and smuts.

In recent years rust has been the great enemy of wheat. For twenty years, Marquis was looked upon as almost the perfect wheat but, when the fields became infected with rust, Marquis could not resist. Breeders in Canada and the United States set themselves to work to find wheats as good as Marquis which would resist the fungus growths.

We show you a diagram of the withering leaf-rust on page 1764. The fungus sucks the juices of the plant, and the leaves



Courtesy, International Harvester Co.

After plowing land for wheat it is necessary to break the clods to make a smooth seed bed. Sometimes it is necessary to use a heavy disk harrow first, or another form of harrow may be used. When all the large clods have been broken a machine like this, drawn by a tractor, is used on some of the great farms in the West. The increasing use of improved machinery on farms is one of the important developments of recent years.

wither and die. When men first discovered the relationship between wheat and the barberry, they thought they had found the answer. Destroy all barberry plants, and rust would disappear. It has been found, however, that wheat sometimes suffers from rust in regions which are free from barberry bushes. Apparently some other plant can keep the spores alive during the winter, though not so well as the barberry. In the diagram you may see the effect of the rust.

The black stem rust usually comes later, and, in the past has been less common. It can destroy a whole crop in a few days. The spores attack the stems, which show black splotches, which infect other plants. Soon they fall over. In 1935, it was calculated that the loss from rust in Canada alone was over 85,000,000 bushels. No remedy has been found for rust.

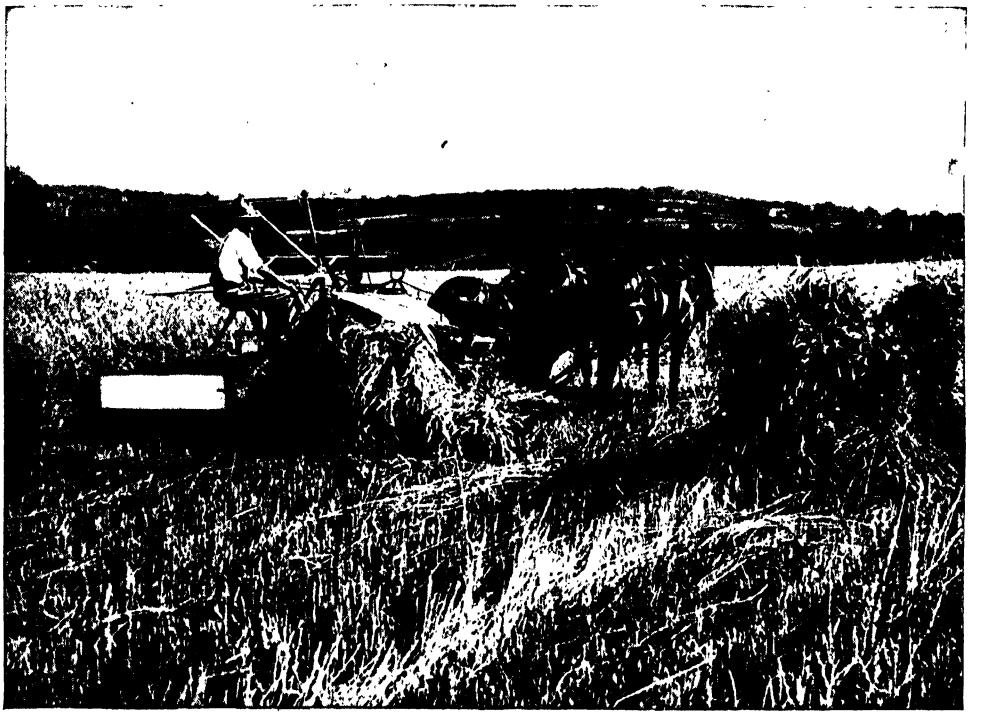
However, it has been discovered that two kinds of wheat, emmer and durum, are resistant to rust. Emmer is little grown in America, as it is not a good bread wheat. Durum is very hard, with high gluten. It is often called macaroni wheat, and is grown for making macaroni and noodles, though some is used to mix with soft wheats, in order that a lighter loaf may be made. Thatcher, of which we spoke above, has Iumillo, a durum wheat, as one of its ancestors. A cerealist of the United States Department of Agriculture, M. A. Carleton, was instrumental in introducing varieties of durum wheat. The story has been made into a film.

A plant breeder in South Dakota, Mr. E. S. McFadden of the United States Department of Agriculture, crossed emmer wheat with Marquis and produced Hope and H-44. These were good wheats, but not quite satisfactory. However, by crossing one or the other of these with other good varieties, three wheats have been developed in Canada which seem the answer to the problem of rust and smut. Renown and Regent, developed at the Dominion Rust Laboratory in Manitoba and



Courtesy, International Harvester Co.

This is the reaper invented in 1831 by Cyrus Hall McCormick on a farm near Steele's Tavern, Va. One person guided the horse while the other raked the grain from the platform.



The self-binder cuts the grain and ties it into bundles with twine. This machine is one of the most important inventions ever made in agriculture as it saves an immense amount of labor and time. On the largest farms this machine has been succeeded by the "combine" which also threshes the grain.

Apex, developed in Saskatchewan, seem to have the good qualities of Marquis and are little affected by rust. Thatcher, which has a durum ancestor, is not affected by stem rust, but, in Canada, has been attacked by leaf rust.

Bunt, or stinking smut, attacks the head, and if a few grains are affected, the spores cling to the other grains. If such grains are sown, the resulting plants will suffer, and the spores will be blown to other plants. The heads sometimes become black masses of fungus spores. By soaking the seed wheat, in warm water or some antiseptic solution, the danger may be much reduced.

HOW COMMON SMUT AFFECTS THE PLANT

Common smut floats in the air, falls on the stigma of the flower, and the spore is enclosed in the grain. It develops with the sprouting grain, but does no harm until the plant flowers, when it fills the new seed with dark spores, which infect other plants. Nothing can be done except to plant seed from smut free fields, or to seek varieties which are resistant to the fungus.

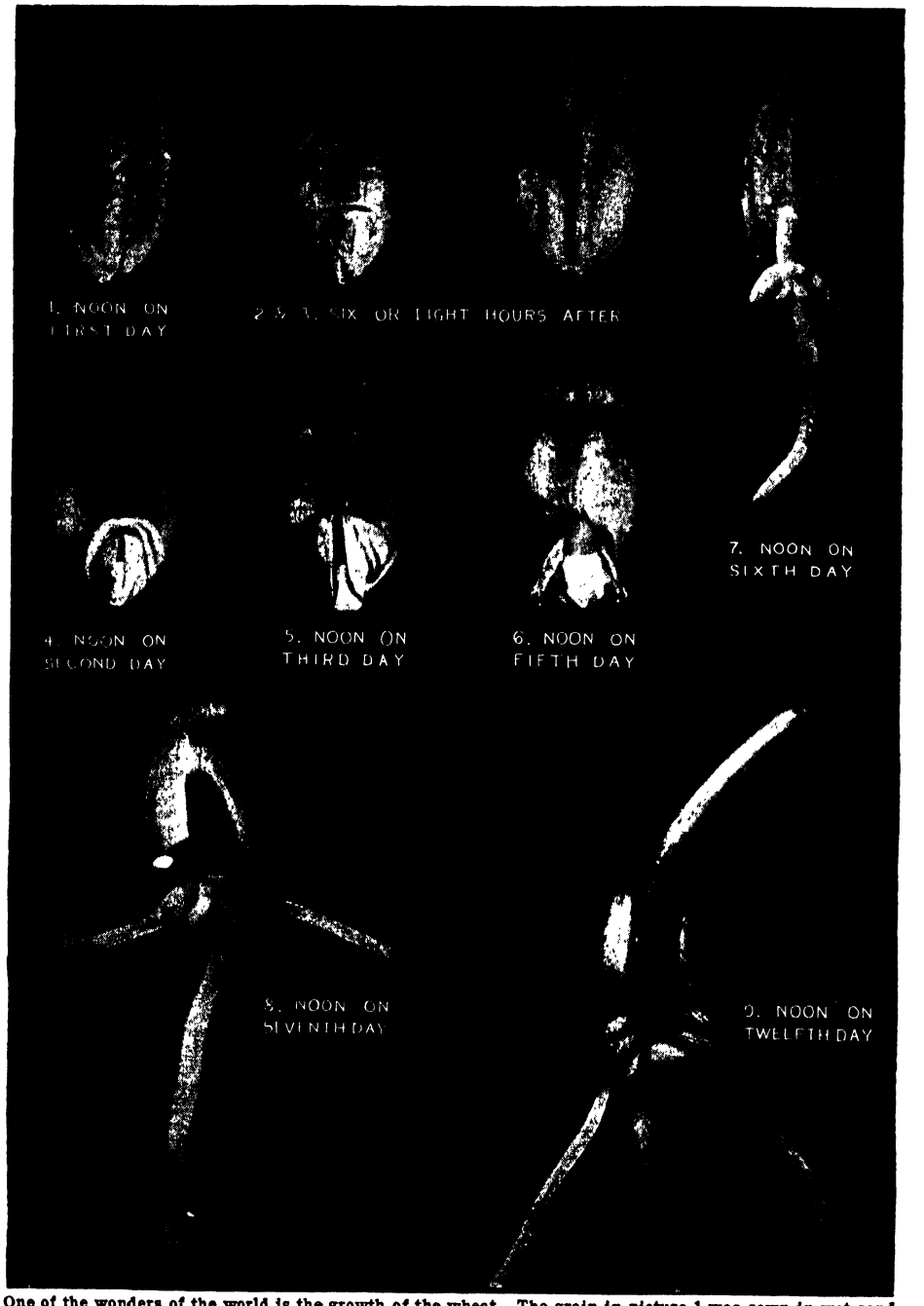
The wheat grain is interesting. Before the wheat is ripe, and while it is still growing, the seed gradually gets longer, and the sides of the grain fall inward so as to form a groove on the surface, which we can see. If we remove the coat over the small projecting part at one end, we see the embryo—the infant plant—wrapped up in the grain. It is quite easy to distinguish the root end from the bud end, and by using a needle we can separate the young leaves of the bud. A pocket-lens or a reading-glass will help us to see all these details.

The outer coat of a grain of wheat, consisting of six layers, forms the bran, which is separated from the flour cells inside when the grain is ground up by the miller. The embryo forms only a small part of the grain, and all the rest is material stored up for the use of the plant when it begins to grow. It forms a perfect food for the young wheat plant, and almost a perfect food for man.

THE THING THAT MAKES WHEAT VALUABLE FOR THE BAKER

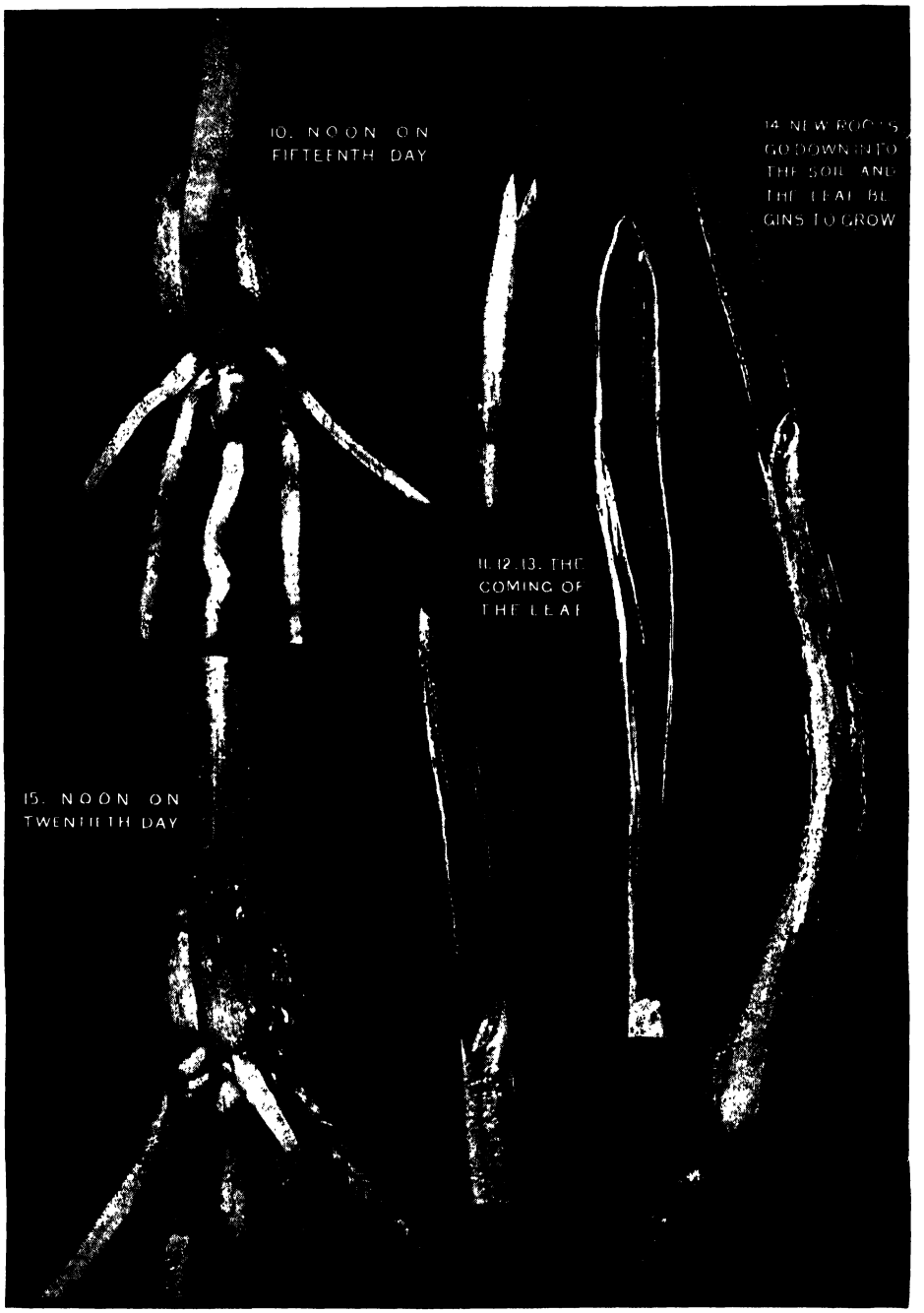
The substance which makes wheat so valuable for the baker is the gluten which appears

THE WONDERFUL BIRTH OF THE WHEAT



One of the wonders of the world is the growth of the wheat. The grain in picture 1 was sown in wet sand at noon one day, and if we follow the pictures it is easy to see the great marvel. At the bottom of the grain in picture 2 is a little raised part. This is the germ, or real seed; the rest is a store of food to feed the seed until it can find food for itself. The channel down the middle in picture 3 is a little river-bed which brings the water to the seed. On the third day appears a sheath which guards the root in its early life, and on the fifth day a young shoot strikes out from the other end of this sheath. On the seventh day we notice that the root has grown down into the earth, sending out little white hairs to search for moisture.

HOW WHEAT TAKES LIFE FROM THE EARTH



The tip of the root of wheat is a wonderful thing; it takes in what it wants from the earth and rejects what it does not want. On the twelfth day we see the beginning of two further roots, which grow remarkably by the fifteenth day; so that our baby plant has now five roots, all working in the earth for its benefit. All this time the plant is growing at the top, and we see the leaf come forth. This is about the sixteenth day, and the leaf grows as seen in the pictures. Of the wonderful way in which the roots take in food from the earth and build it up into wheat, we read on page 744. These photographs show us how the grain planted in the earth takes to itself new life, until it reproduces itself, some 30, some 60, and some 100 fold.

in tiny granules. When wet it is a sticky, elastic substance which can be separated from the starch in the flour by continued washing. When yeast is added to flour and water, it begins to turn the starch into carbon dioxid and alcohol. The gluten forms a fine mesh which prevents the bubbles of carbon dioxid from escaping, thus causing the dough to rise. When placed in the oven, the bubbles increase in size, with the heat, and the alcohol passes off during the process of baking. Wheat without a large percentage of gluten will not make a light loaf. Generally, spring wheats have a larger amount of gluten than winter wheats.

The world usually grows around four billion bushels a year. By far the greater part is grown in the Northern Hemisphere. As said above, Canada and the United States produce about one-fourth of the total. Either Russia or the United States usually leads in production, and China is third. France, Italy, Argentina and Australia also grow much wheat. It is claimed that the best wheats from the standpoint of bread-making are the hard wheats of Canada, the United States and Hungary. The Canadian wheat grown in the Prairie Provinces is all spring wheat. This is also grown in the northwestern part of the United States, and a little is grown in Maine. Varieties of hard winter wheat have also been developed in the United States, and many millions of bushels of such varieties as Turkey, Kanred and Blackhull are grown. Much soft winter wheat is raised, however.

The hard spring wheat industry in Canada and the United States has grown from a single grain. Many years ago, Mr. David Fife of Ontario received from a friend in Glasgow a small package of wheat supposed to have come from Russia, though it really came from Poland. He sowed the seed, but only one plant showed promise. He planted the grains, selected and planted again until the variety known as Red Fife was developed. When mills which could grind it properly were built, it soon came to be the most popular wheat in Canada, and was widely grown in the United States. It was a good wheat, but was not particularly early in ripening, and an early frost sometimes damaged the crop. Red Fife, however, was one of the parents of Marquis and other wheats which have, in turn, been the ancestors of most of the hard spring wheats now grown.



Courtesy, International Harvester Co.

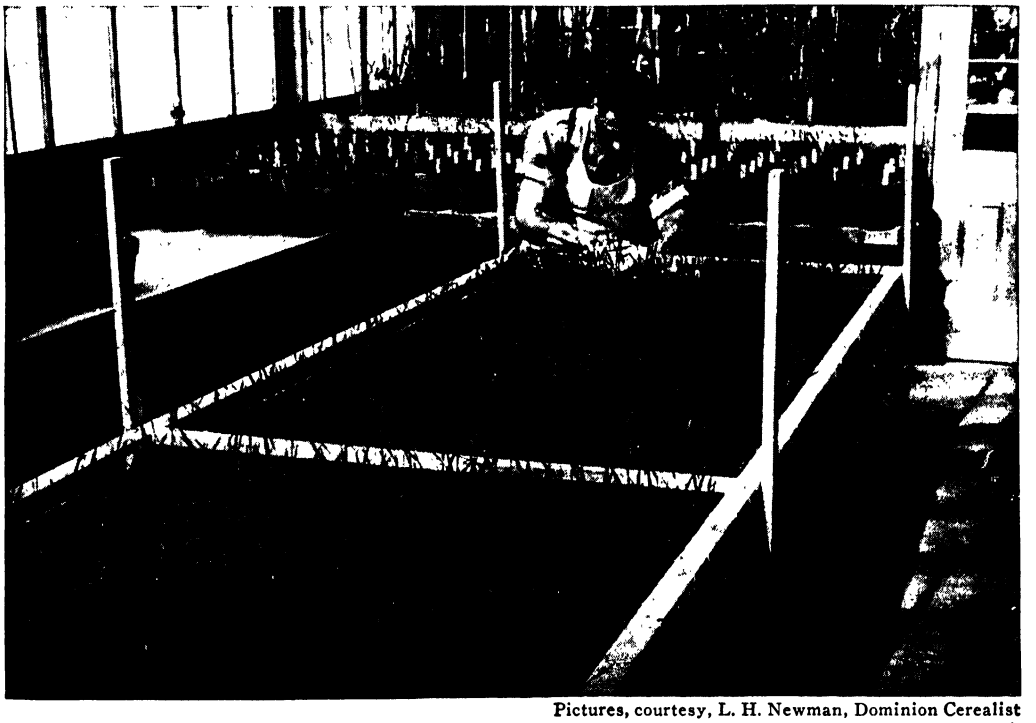
Here is a close-up view of a harvester-thresher, releasing its stored wealth of wheat into a truck. As may be seen, only the ears are harvested, while the straw is left standing, frequently to be plowed under. Each combine is pulled by a tractor and with it two men can cover from 35 to 55 acres a day.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 1851.

WHERE WHEAT DISEASES ARE COMBATTED



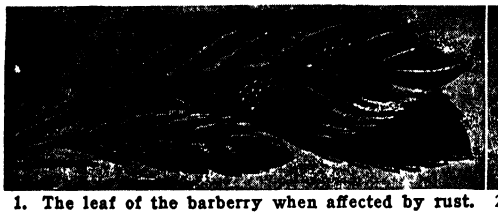
The Dominion Rust Laboratory in the grounds of the Manitoba Agricultural College is devoted to conquering the fungus growths which have threatened the welfare of the Prairie Provinces, and, in fact, of all Canada.



Pictures, courtesy, L. H. Newman, Dominion Cerealist

It is possible to grow two or even three crops of wheat a year in greenhouses. This fact shortens very much the time required to test thoroughly the results of the crosses which the breeders are constantly making.

PICTURE-STORY OF A PLANT PLAGUE



1. The leaf of the barberry when affected by rust.



2. Magnified, the rust looks like a cluster of cups.



3. Here is a transverse section through the barberry leaf. The rust has penetrated the tissue, forming different kinds of bodies on both sides of the leaf. Those above are flask-shaped, and produce spore-like bodies. Underneath are the cluster-cups, open and empty. The middle ones show the spores escaping.



4. When the spores escape they are blown on a wheat leaf, and enter through its pores. The spores germinate, and filaments spread through the tissue.



5. The previous picture shows what we can see through a microscope, but all the naked eye sees is the rusty color known as wheat-rust.



6. This picture of the magnified surface of the wheat leaf and a section through its thickness, shows what happens. After penetrating the leaf and draining its vitality, the rust fungus branches near the surface and produces spores. These cause a swelling, which bursts, and spores are blown to other wheat plants.



7. When wheat is ripening, a strange thing happens, the rust producing another kind of spore.



8. The spores rest through the winter and in the spring produce spores which grow on barberry leaves,



1. The fishes in this picture belong to the species known as Mollienisia; they are familiarly known as Mollies. The two black fishes are specimens of the Black Mollienisia or Black Molly.

HOW TO CARE FOR TROPICAL FISH

THE popularity of tropical fishes is due to various reasons. For one thing you will have a constant source of delight in their gorgeous coloring, which includes all the colors of the rainbow mixed together in profusion. Again, the remoteness of their origins adds a romantic interest to these beautiful little fish. Nor is it difficult to keep them, for they adapt themselves beautifully to home *aquaria* (an *aquarium* is a tank for marine animals; the plural is *aquaria*). While tropical fish cost more than the domestic variety, they may be bought for as little as 25 cents each. Rarer specimens, however, will bring as much as $90 a pair.

Tropical fishes may be divided into two groups, the live-bearers, which as the name implies bear their young alive, and the egg-layers, which reproduce through eggs. The first kind, the live-bearers, may be found in great numbers and many varieties in our own hemisphere. The other group of fish, the egg-layers, includes many more varieties and these are found in many parts of the world.

Tropical fish have been bred in such large numbers in this country that the number imported has been continually decreasing. Generally speaking, only the rarer species are now imported.

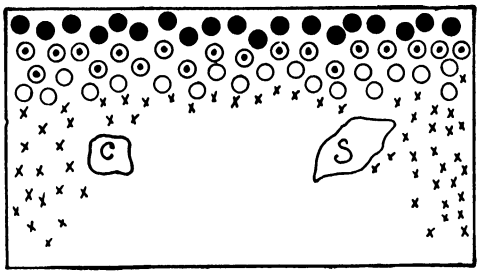
While almost all the small tropical fishes can be kept in home aquaria, there are some important rules that must be observed if the fish are to be kept in good condition.

For one thing, since fish have a soft mucous coat over their scales to protect them against bacteria, the water must be soft or this mucous coat will be destroyed with consequent harm to the fish. If the tap water is too hard, rain-water or water from a pond may be used. Futhermore the water should be kept sweet by healthy plants, which liberate oxygen and absorb gases that are harmful to the fishes.

An aquarium of five, ten or fifteen gallon capacity should have enough coarse sand to cover the bottom to a depth of at least an inch. It should be placed near a window, so that the plants will have sufficient light. Better results may be obtained by using artificial light from a reflector that fits over the top of the tank. A reflector of this sort concentrates the light on the fish and plants and brings out the best coloring of both. Besides, artificial light supplies a steady, dependable source of light. An ordinary 40-watt incandescent lamp will suffice for a 10-gallon tank and a 50-watt lamp for a 15-gallon tank. This artificial light should operate at least

eight hours a day.

An important thing to remember is that most tropical fishes are jumpers and that many of them could easily leap from the average aquarium. To keep them from doing so, place a glass cover (window glass will do) over the entire aquarium. This glass will also keep out dust and other foreign matter. Be sure that the glass cover fits loosely, so that air can easily enter the aquarium.



2. Diagram showing the arrangement of plants in an aquarium, as it would appear if we were looking down at it. The black circle represents the Vallisneria plant; the circle and spot, Sagittaria Sinensis; the white circle, Sagittaria Subulata; X, Hairgrass; C, Spatterdock. S is a stone.

The plants called Vallisneria, Sagittaria Sinensis, Sagittaria Subulata, hairgrass and spatterdock may be put in the aquarium (Figure 2). Remember that the front center of the aquarium should be left free of plants so that you may be able to observe the fish without difficulty.

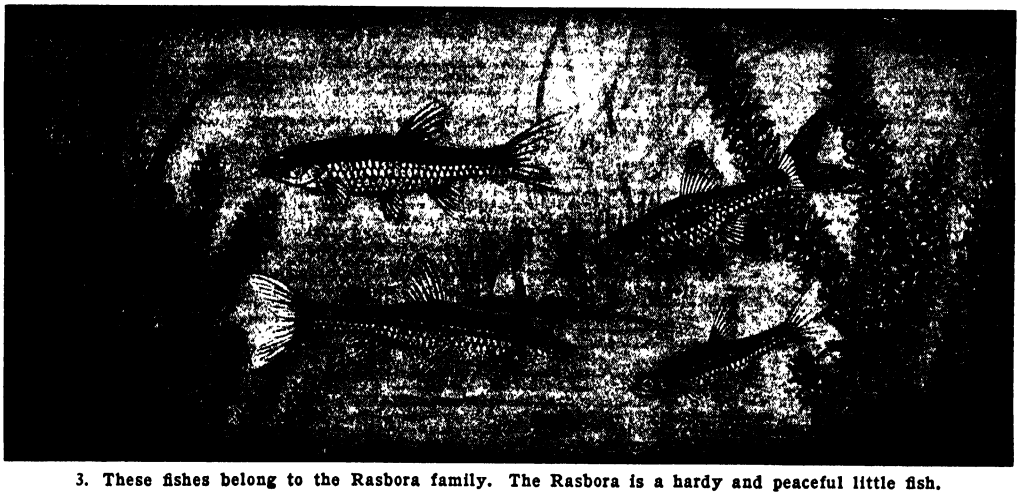
When you have put the plants into the tank, a period of three days should elapse before you introduce the fish into the aquarium. This three-day interval will give the plants a chance to grow, and the chlorine that is often present in water for purifying purposes will have disappeared. As this chlorine is harmful to fishes, they should not be placed in *fresh* tap water.

When the water in the tank has been well conditioned, it is time to stock the aquarium with fish. In order to have enough oxygen for the fish, not more than two fish per gallon should be put into a tank. A good collection to start with would be a pair each of Angel Fish, Red Platies, Zebras, Black Mollies and Guppies.

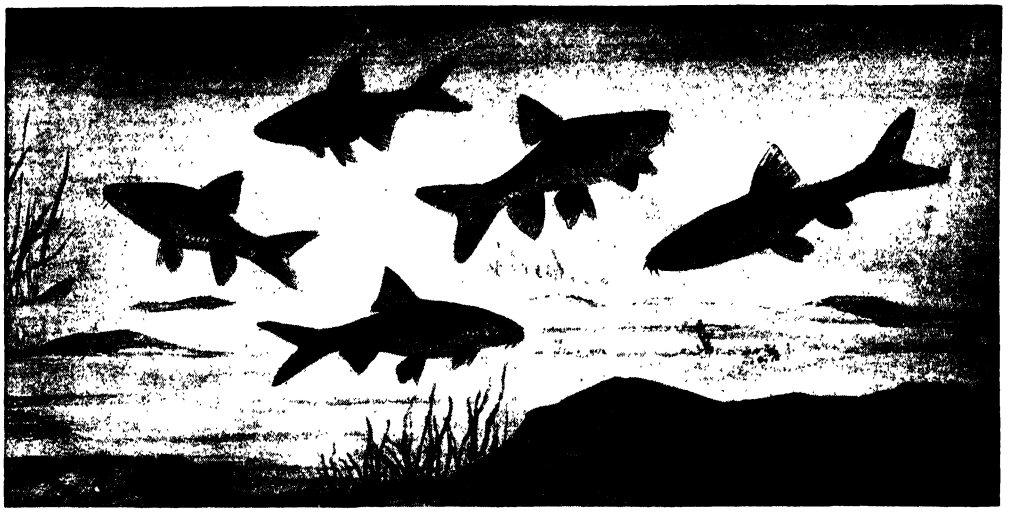
The Angel Fish is noted for its haughty, dignified manners. The black vertical bars across the body contrast beautifully with the underlying silver-green. The Red Platy is a beautiful fish, vividly colored. The young in some strains are gold in color but become blood red as they reach maturity. The Zebra is the most peaceful of all aquarium fishes. Though it may chase other fishes, this is due only to its habit of swimming in schools. If there are no other Zebras in the tank, it will follow the fish of different species. The Black Molly is the only fish suitable for aquarium purposes that is entirely black.

Perhaps you may want to start a colony of Guppies. This exquisite little fish is very popular with fish fanciers. Its coloring has been described as "every color combined into one harmonious whole."

Fish do not require much food and are not very particular eaters. Any prepared food, which you may buy at your dealer's, will answer the purpose. It is well to use two



3. These fishes belong to the Rasbora family. The Rasbora is a hardy and peaceful little fish.



4. Some members of the Barbus or Barb family. This species is well represented in home aquaria.

or more foods alternately and occasionally to feed a little cooked spinach to the live-bearers. Live foods, such as mosquito larvæ and small worms, are good; these too may be bought at your dealer's.

Do not overfeed the fishes. The food which is not eaten lies on the bottom of the tank and decomposes, causing the water to become cloudy. Harmful gases will be formed and the water will become deficient in oxygen. Overfeeding may be avoided by feeding no more than your fish will eat in ten or fifteen minutes. If food is left after that time, you have fed too much. It would be well not to feed the next day, and to feed less thereafter. Feeding once a day is usually enough.

Snails are useful scavengers in an aquarium; they consume surplus food and decaying vegetation. The Red Ramshorn Snail is a favorite with fish fanciers. Its red shell and body make an effective contrast with the green vegetation of the aquarium. Other species of snails that are used as scavengers are the Australian Red Snail, the Pond Snail and the Trumpet Snail.

Tropical fish require a water temperature of from 70 to 80 degrees. Since variation in temperature is one of the chief sources of trouble in an aquarium, everything possible should be done to avoid or minimize this variation. It would be well to have a heater that will supply heat along the bottom of the tank. If you cannot obtain a heater for the aquarium, cover the tanks on cold nights with a blanket or other cloth covering.

In spite of all your precautions, fish may sometimes become sick. The most common fish disease is *White Spots* or *Ich.* The word Ich is really the shortened form of Ichthyophthira, a tiny parasite that causes the disease. Ich is characterized by pinched fins and white spots on the body and fins. It is best to remove the affected fish from the aquarium and to place it in a separate container. Some common salt or patent fish remedy should then be added to the water. The tiny white spots should disappear in about a week.

Another common disease is *Tailrot* or *Fungus.* The fungus is a white scummy coating that may be found on many parts of the fish. The affected fish should be placed in clean water to which some salt has been added. Swabbing the affected parts with cotton soaked in mercurochrome or vinegar is effective.

When plants and food are placed in the aquarium, fish enemies may be introduced with them: such enemies as the diving beetle larva, the larvæ of various dragon flies and the water scorpion. It would be well to consider all unknown bugs and larvæ that are found in the aquarium as fish enemies.

If you wish to find out more about keeping tropical fish, you will find a great deal of useful information in the following books: Peters' Life and Love in the Aquarium, Stoye's Tropical Fish for the Home and Innes' Exotic Aquarium Fishes.

Article and illustrations furnished by Empire Tropical Fish Import Company.

TESTS FOR TEXTILES

THERE are times when children, as well as grownups, desire to know whether a piece of material is made from cotton, linen, wool, silk or rayon. If you would like to be able to distinguish these materials by other than the feeling test, the following comparisons will aid you. Then, too, you will have lots of fun with these simple tests while you are finding out how to recognize the differences between the five materials in question.

First provide yourself with strips of cotton, linen, silk, wool and rayon, and tear each of these strips. Cotton tears easily with a shrill sound and the ends of the yarn curl up. Linen does not tear so easily as cotton; it tears with a dull sound, and the edges of the yarn are quite straight. When linen is torn, the edge is irregular, while cotton, when torn, tears with a smooth edge. Silk, like cotton, tears easily with a shrill sound and an irregular edge. Wool is more like linen in that it tears with difficulty, with a dull sound and an irregular edge. Rayon tears with a shrill sound and the edges of the material do not curl.

Here is another test. Place samples of wool, silk, cotton, linen and rayon in porcelain, agate or glass containers and cover with a five per cent solution of caustic soda or a solution of lye (one tablespoon of lye to one-half pint of water) and boil for ten minutes. Wool and silk are completely dissolved by either of these solutions; the cotton, linen and rayon are weakened but not dissolved. Next, secure samples of wool or silk mixed with some other fibre and test them with the same solutions. The residue left in every case is cotton, linen or rayon.

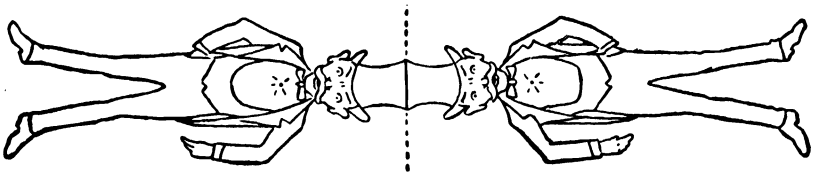
Now ravel the warp and filling threads of pieces of silk, wool, cotton, linen and rayon. Burn the ends of each in a flame. Observe the way that each burns, the ash and the odor while burning. Cotton and linen burn quickly with the odor and appearance of burning paper, leaving a small quantity of light gray ash. Rayon flares up and burns more evenly than cotton or linen. Wool burns more slowly, with the odor of burning hair, leaving a black gummy ball. Burning silk gives the same odor, but leaves a more brittle ash. If the silk is heavily weighted, it keeps its original shape. This is the simplest method of distinguishing between pure and weighted silk.

If you can get samples of goods that you wish to buy, you may take them home and apply the above tests to them. You will then know whether they are really as represented.

ELECTRICITY AT HOME

THERE is magic in electricity and its marvelous powers. It is one of the most powerful and the most mysterious forces in the world.

The experiments which made the properties of electricity known go back a long time.



1. The rolling man.

It was in the eighteenth century that Benjamin Franklin began to find out something about this mysterious power. Some of the methods he used are very simple and any boy can try them for himself.

Take a piece of ordinary brown paper and warm it before the fire. When it is hot, lay it on the table and brush it briskly with a warm, dry clothes brush. Then pick it up quickly and hold it to the wall. You will find that the paper has become electrified and that it will cling to the wall. It clings because it is *electrified* and is attracting the wall to it. If you warm the paper and brush it as before, and then hold it over some little bits of lighter paper, the small pieces will fly up and cling to the electrified paper.

It is even possible to get sparks from electrified paper. Take a large sheet of stout drawing-paper, warm it till it is thoroughly dry, place it on a dry wooden table, and rub it very briskly with a piece of flannel. Then put a piece of metal—a watch-chain or a bunch of keys—in the middle and lift the

paper off the table by two corners. If someone else puts his knuckle or finger to the metal, a bright spark will pass between his finger and the metal, which, however, he will not feel. If the weather and the paper are thoroughly dry, you may get a spark an inch long.

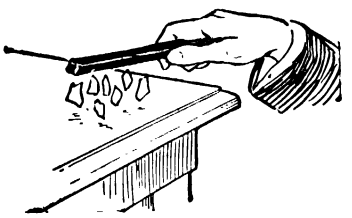
But paper is not the best thing with which to make these experiments. For one reason, it will not retain electricity very long; and for another, it is not the easiest substance to electrify.

A piece of glass rod or tube is a better *exciter,* as we call anything electrified by rubbing. A solid rod is the better, and a druggist can sell us a piece for a few cents. To excite or electrify this, we must rub it briskly with a piece of dry silk. Or we can take a stick of ordinary sealing wax, which must be rubbed with flannel.

A third kind of exciter, and a very good one, is a piece of vulcanite rubbed with flannel. Vulcanite is hard rubber, and fountain pens are generally made of it. So if we can get an old fountain pen it will do very well.

We take our glass rod, sealing wax, or fountain pen, and excite it by rubbing with the silk or flannel. Then we hold it near some tiny scraps of paper or bits of bran, and it will pick them up, as seen in picture 2.

We must be careful that everything is quite dry, and the articles must be warmed



2. Exciter picking up paper.

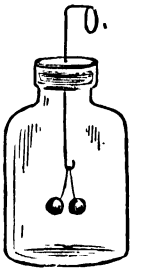
before the fire to make sure they are dry. All experiments with this kind of electricity will fail most disappointingly unless everything is warm and dry, including the weather. We shall find sometimes that the rod will pick up the paper, and afterward will not attract the same piece. This is because the little bit of paper has received a charge of electricity from the rod, and when two electrified bodies come together they repel one another if both are electrified with the same sort of electricity.

If the bodies are charged with opposite kinds of electricity they will attract one another. These two sorts of electricity are called *positive* and *negative* electricity. Glass rubbed with silk gives positive electricity, and sealing wax or vulcanite rubbed with flannel gives negative electricity.

Take a piece of thin paper—the white edge of a newspaper would do—and cut a strip, say, about 4 inches long and about 1 inch wide. Double it over and bring the two



3. Cork and bent wire.



4. The electroscope.

ends together. Now draw a man, as shown in picture 1, and cut it out, taking care not to cut the hat, so that the figure when folded along the dotted line will stand up. If you excite the glass rod and hold it near one side, the figure will roll over toward it. If you then hold the excited vulcanite or sealing wax at the other side, he will roll back that way, and so you can attract him all round the table.

Another experiment is to make a tiny ball of pith out of the centre of an elder-berry stick. This pith is very light when it is dry, and can easily be made into a small ball about as big as a pea.

Fix the ball to a thread of silk, and the silk to an electric fixture or to some object from which it can hang. Now excite the rod by rubbing and hold it near. The pith-ball will fly toward the rod, but after touching it it flies away again, and will keep off as long as the electricity remains in the rod. But if you have used the glass rod and then bring the vulcanite or sealing wax near, the ball will fly to it. This shows the difference between the two kinds of electricity.

The pith-ball electroscope is a contrivance which will be very useful in many electrical experiments, and it is easily made. With the electroscope you can always test the presence of electricity and make a good estimate of its kind. Take a glass pickle bottle with a big neck and clean and dry it thoroughly. Provide a cork stopper for the bottle. Then put a piece of copper wire through the cork. You can do this if you make a hole in the

cork with a nail. Any piece of fairly stiff copper wire will do. When you have put it through the cork, bend one end—the one to go *inside* the bottle — into a small hook-shape. The other end first has to be bent round like a ring, and then the ring must be bent down at a right angle. Then we shall have a piece like picture 3.

Now make two small pith-balls and hang them each on a piece of cotton, both pieces being of the same length. Tie the two ends to the hook in the wire and put them into the bottle and fix in the cork.

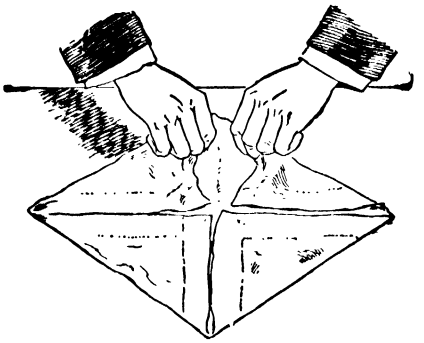
The pith-balls should then be about two inches, or three inches from the bottom of the bottle, as shown in picture 4.

Of course, you must not forget to see that the bottle and everything else is quite dry. If you excite the rod and touch the top of the wire with it, the two pith-balls will become excited; and, as both will be charged with the same sort of electricity, they will stand out apart from each other, and if you bring anything that is electrified against the copper wire you will see the pith-balls move.

These experiments are the simplest you can undertake. But it was by such experiments that great inventors came to understand the mysterious powers of the force that makes possible the telephone and the telegraph, and the motors and dynamos that drive railway trains and street cars.

THE DISAPPEARING QUARTER

THIS is a mystifying trick. Two things only are needed for it—a handkerchief spread out upon the table, and a quarter laid in the middle of it. The corners of the handkerchief are folded down over the coin, and anyone is permitted to feel that it is still there. And yet, at the conjurer's command, it passes through handkerchief and table, and is found on the floor beneath. The



handkerchief is shaken out and proves to be empty. This trick is good enough to make quite a reputation for the youthful wizard, and yet it is simplicity itself—when you know how it is done.

In the first place, you must have two quarters in appearance as nearly alike as possible. Take an opportunity beforehand quietly to drop one of these under the table at which you propose to perform the trick. The only other thing required is a little pellet of beeswax the size of a pea. This you must knead between the fingers till it is fairly soft, and then press against the back part of the lowest button of either your shirt or your vest.

To perform the trick, take the wax off the button, and press it against one corner of the handkerchief which you are going to use. Then lay the handkerchief on the table squarely in front of you, with the waxed corner nearest to the right hand. Lay the quarter on the centre of the handkerchief, or, better still, let somebody else do this, to prove that there is no deception. Then fold down the corners of the handkerchief one by one over the coin, beginning with the waxed corner and pressing this down a little, so as to make it adhere. This done, ask someone to make sure, by feeling through the handkerchief, that the coin is still there. Each person who does so presses the wax a little closer.

Now comes the exciting moment. "Now, ladies and gentlemen," you say, "I am going to make the quarter pass right through the table on to the floor. If you will all be very quiet, perhaps you will hear it fall." They won't, but they may as well imagine that they do so. Their imagination helps the conjurer.

We blow upon the centre of the handkerchief, saying, "Presto, pass!" Then, hooking the first and second fingers of each hand inside the nearer opening of the handkerchief, as shown in the picture, we draw the two corners smartly apart, one in each hand, and shake it out. The coin, adhering to the handkerchief, is drawn into the right hand. "Look under the table, and see whether it has gone through," you say, and while general attention is occupied by looking for and picking up the other coin, you will have ample

opportunity to get rid of the one in the hand.

Of course we are not bound to make the coin pass "through the table." If we prefer it, we may order it to pass under a candlestick, into a vase on the mantelpiece, or even into somebody's breast-pocket. We simply place the duplicate quarter where we intend that it shall be found, and alter the command accordingly.

It is difficult, of course, to place the quarter in a person's pocket without his knowledge. A good way to do so is to draw his attention away from the place where you put the coin by slapping him heartily on the back while you slyly "plant" the coin.

THE GAME OF CHESS

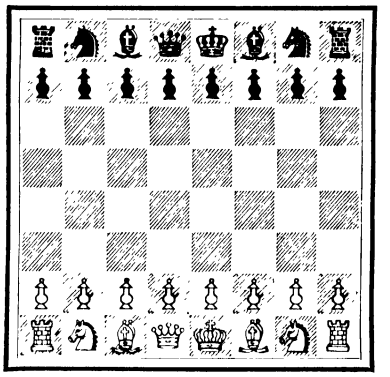
THE game of chess dates back to very ancient times, although no one knows, with certainty, who first invented it.

It is played on the same board as checkers—with 64 squares arranged in eight rows of eight. Alternate squares are black and white. There are 32 men—16 white and 16 black. Each set consists of king, queen, 2 castles or rooks, 2 bishops, 2 knights and 8 pawns.

The two players sit facing each other, with the board between them so placed that there is a white square in the corner to each player's right. The pieces and pawns are arranged as shown in the diagram on this page and it is important to note that the queens must always be placed on squares of their own color.

The men move as follows: the kings one square at a time in any direction—forward, backward, sideways or diagonally; the queens any number of squares in a straight line in any direction; the rooks move any number of squares in any direction except diagonally; the bishops any number of squares backward and forward but only diagonally; the knights move peculiarly—two squares, changing from a square of one color to a square of the other color—that is, they move one square forward or backward and one diagonally. The knights are the only pieces which can leap over squares occupied by other men. Pawns move forward only and one square at a time except on their first move when they may move one square or two. If a pawn reaches the farthest row of squares from its original position, it must be exchanged for any piece of its own color except a king.

Unlike the men in checkers, the leaping knight does not capture men over which it passes. All pieces may capture an opponent's man (except the king) on the square to which they move. Pawns, while moving straight forward, may capture only diagonally. They have one peculiar capturing privilege, known as capturing *en passant*. When one side, say black, has a pawn advanced to the fifth row, and an adjacent white pawn which has not made its initial move is advanced two squares, the black



How to set the chessmen.

pawn may capture it as if it had moved only one square—diagonally of course.

Once in a game each player is allowed to "castle" if he so desires. He may move either rook next to his king and place the king on the other side of the rook (although it is not a very closely observed rule that the two pieces must be moved simultaneously or the king first). A player may not castle if he has previously moved either king or rook, nor if his king is in check or either square over which he must pass is attacked by an opposing man, nor if any pieces intervene between king and rook.

When a king is attacked by an opposing man it is said to be checked, and when checking the opponent's king, it is customary and polite for a player to say "check" although this is not compulsory.

The king must immediately get out of "check" either by moving, capturing the

checking man or interposing one of his own men between the checking piece and himself. Obviously, he can not interpose a man when checked by a knight.

When a player's king is checked and he is unable to capture the checking piece, move his king to an unattacked square or interpose one of his own men he is "checkmated" and has lost the game. Checkmating the opponent's king, rather than merely capturing men, is the final object of the game, although with a superiority of material, and one's own king in a safe position, checkmating the opponent's king is simplified.

If, when it is a player's turn to move and he can not move his king without placing it in check, and no other move of any man is possible, he is "stalemated" and the game is drawn. The game is also drawn if the force remaining on the board on each side is unable to give checkmate.

If exactly the same position occurs three times in a game, either player may demand that the contest be declared drawn.

A drawn game may also be brought about if either player is able to give "perpetual check" to his opponent's king—i.e., check the king repeatedly move after move, the opponent being either unable or unwilling to avoid the repeated checking.

A player who touches one of his men must move it if he can legally do so and, once he has moved and taken his hand off the man moved, he cannot retract the move.

At the beginning of a game, the players must come to an understanding in order to decide who shall move first, either by agreement or by lot, and the player who secures the white men moves first. Subsequently the players move alternately.

When games are contested between unequal players, the superior player frequently concedes "odds" to his opponent. If the odds are "pawn and move," the superior player conducts the black men and removes the pawn in front of the bishop next to his king (known as the king's bishop). If a piece is conceded as odds it is customary for the superior player to conduct the white pieces. The usual piece odds given are the queen's knight or the queen's rook or, in the case of a great difference in playing strength, the queen.

Chess is essentially an intellectual game. It has been described as both an art and a science. Actually it is a contest in which the brains and skill of one person are pitted against those of another. Strictly speaking, luck does not enter into the game.

The rules that we have given you in this article will enable you to play the game with your friends and you will come to realize what a wonderful game chess really is. When you have mastered these rules you will want to go into the principles of the game more deeply and to make a study of the various openings, the middle game and the end game. You will find all this material in the standard manuals of the game, like the Chess Player's Handbook by H. Staunton and the Breviary of Chess by S. K. Tartakover. A manual of this sort will prove to be a fine investment.

TOY FURNITURE FROM SCRAPS OF WOOD

TOY furniture is sometimes made from paper, but it proves more satisfactory when it is made from wood. Nearly every boy or girl can find suitable scraps of soft wood, even though he has to visit the grocer and then break up old packing boxes to get it. Of course toy furniture may be bought at a toy shop, but this does not give you the fun of making it either for yourself or for little sister or brother.

The table and the chair shown in Plate I are easily made from soft wood with the aid of a saw, a hammer, a few wire nails and a sheet of fine sandpaper. This chair is made from three pieces of ⅜-inch wood, as shown in Plate II. If you do not have wood of this thickness, either ¼- or ½-inch material can be used. In constructing a chair of this particular size you will find it easier to cut out one piece of wood 2 inches wide and about 6½ inches long. From this piece cut one piece 3⅜ inches long for the back; another piece 1¼ inches for the front (legs) support; and still another piece 1½ inches for the seat. If you have carefully marked and cut these parts so that the ends are square with the edges, you have only to use fine sandpaper to finish the surfaces and to remove any rough edges.

After shaping and finishing the parts, you are ready to assemble them by nailing in the proper positions, as shown in the side view of the working drawing (Plate II). In order to have the seat of the chair exactly level, you

should be careful to measure and mark off the actual length of the front leg piece on one side of the back piece, as shown in the front view, before beginning to nail. Above this line one-half of the thickness of the wood, nail through the back of the chair into the seat, which is flush with the sides of the back, with 1-inch wire brads. Likewise, by placing the piece for the front legs slightly inside of the front edge of the seat, nail through the top of the chair seat into this piece, as shown in the top view. If you have carefully followed these directions, your chair should stand firmly on the floor or any other level surface. If you should want more than one chair for this set, you will find it possible to construct each additional one more quickly than you did this first one.

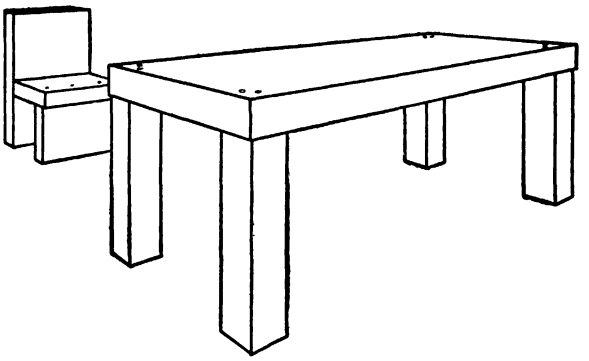


PLATE I.

This *table* is made 3 inches high so that the seat of the chair may be pushed under it. As may be seen in Plate III, the table consists of a top and four legs. The top is made from ½-inch soft wood and requires a piece 3½ inches wide and 8 inches long. The legs are made from ⅝-inch-square stock, although wood ¾ inch, ⅞ inch, or even 1 inch in thickness may be used. In shaping the legs it is more satisfactory to secure a piece about 10½ inches long from which each of the four 2½-inch legs may then be cut. After sawing out the top and legs, the surfaces and edges are finished with fine sandpaper. The table is then assembled by placing each of the four legs ⅛ inch from either edge of its corner of the top and by nailing it in position, as shown in Plate III. If the table has been carefully laid out and constructed, it should now rest firmly on all four legs. If one of the legs is a trifle longer than the others, smooth it down to fit by means of coarse sandpaper, finishing with a finer quality of sandpaper.

The table and chair or chairs may be finished by staining a suitable shade with wood stain which you may buy at any paint store. If you wish you may use attractive water-color paints for a base-color, to which you may add a simple design of a brighter color. A design of this sort is usually applied to the back of each chair and also on the corners, or possibly the centre of the table tops. If you study the designs on the chairs and tables in your own home or in the homes of your friends, you will get many useful ideas that you may apply to the little furniture pieces that you have just made. When you have finished applying stain or paint to your furniture, it would be well to add a coat of floor-wax or furniture-wax as a final finish.

The resourceful boy or girl who enjoys this work will readily think of a number of other pieces of furniture, such as beds or dressers, which can also be made from these scraps of wood. In making them, it would be well to draw up a plan like those we have shown and to follow it carefully. You will note that each square in the plans that we have given represents one square inch. To make these squares you simply rule a number of parallel lines on the paper each at an equal distance from the other. Then make a series of lines at right angles to those of the first

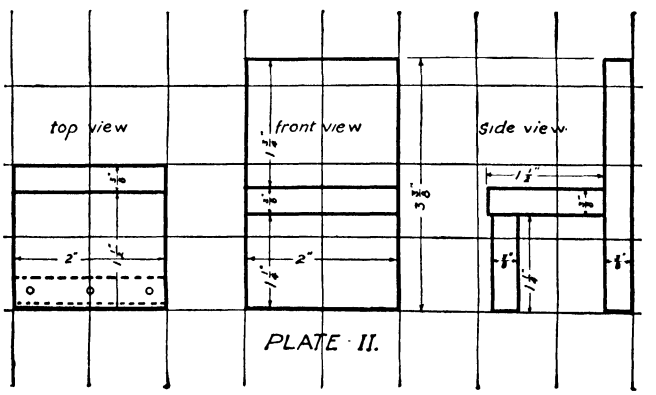
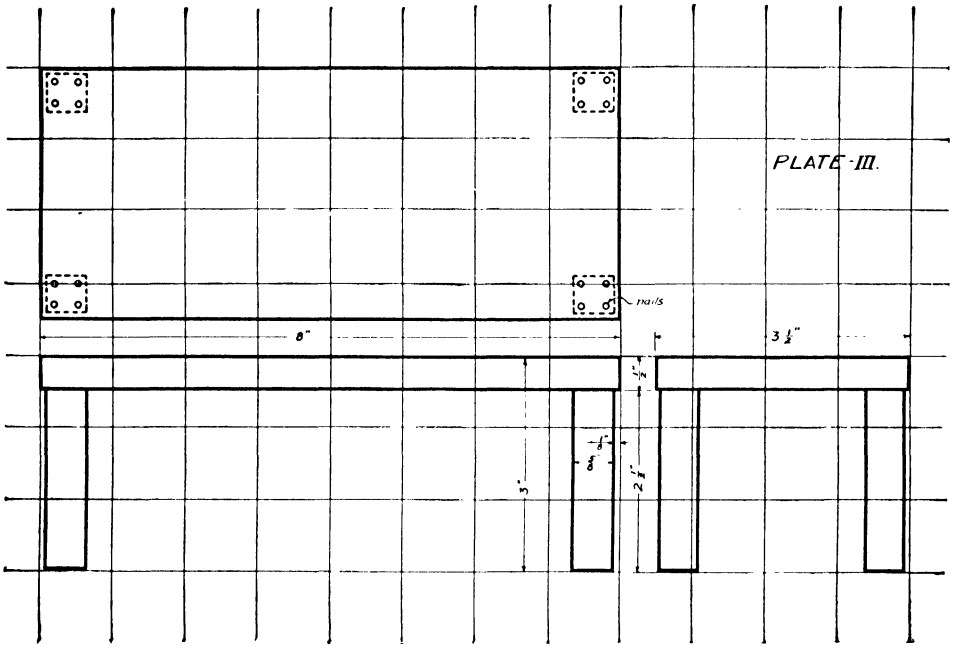


PLATE II.



series and at the same distance from each other. To be sure that the two series of lines meet at right angles you may use a T-square.

If you wish, you may buy graph paper at any stationery store. This paper is ruled in squares and consequently it will not be necessary for you to make your own squares. If you are going to make a good many plans, you will find that this graph paper will undoubtedly save you a good deal of time.

AN EASILY MADE STENCIL PLATE

IF we have a design or pattern which we should like to transfer to a book or sheet of paper and use the same pattern over and over again, we can do so by making a stencil plate in the following way, which, for outline designs, is very much simpler than the more elaborate stencil plates described on page 336.

We must lay the drawing we wish to copy upon a sheet of thick paper, such as cartridge paper, and with drawing-pins fasten the two sheets together upon a table or drawing-board. Then with a pin or needle we must prick all over the outline of the design or picture, being very careful that we make the pinholes neat and clean and at fairly even intervals all over the lines.

Now let us remove the drawing-pins and take away the upper picture. We shall find that the clean sheet of paper has the outline of the pattern transferred to it in a series of little holes. To multiply the pattern in a book or upon other paper we have only to pin this perforated sheet down and dust it over with powdered charcoal, a bag of which may be bought at any paint shop for a few cents.

The powdered charcoal will penetrate through the holes in the upper paper and the design will be transferred to the paper or book below. Then we can remove the stencil and ink in the design, or, if we so desire, color it with paint or crayons. The stencil plate can, of course, be used a great number of times; in fact, it will last for a very long time indeed if treated with ordinary care. If we find any difficulty in getting a piece of white paper that is stiff, we can, if we like, use a sheet of brown paper. This will do quite as well as the white, and will probably last much longer.

THREE MORE ANIMAL TOYS FOR YOU TO MAKE

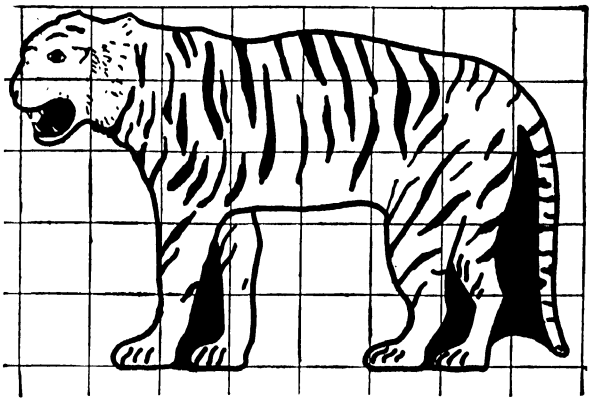
HERE are three additional suggestions in animal toys which may be made to match those you have. You will find that the tiger, the buffalo and the lion are almost as easily made as the bear, the wolf and the hippo, for which directions were given on page 892. These three animal toys may also be made from cigar boxes or other thin soft wood.

Perhaps you will need to be even a little more careful in placing the patterns of these animals on the wood in such a manner that you may avoid short-grain, as you will see how easily parts of their tails and feet might otherwise be broken off while you are shaping them.

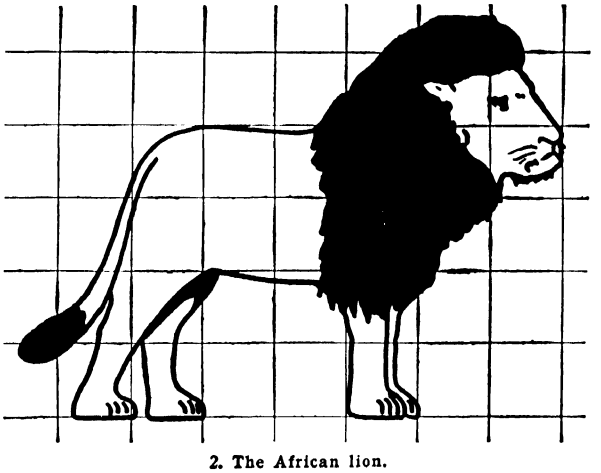
First make each one of your patterns either by laying out your sheets in inch squares and then sketching in the outlines as was suggested previously for the bear, the wolf and the hippo. Or else you may note the general proportions of the animals and draw the outlines in free-hand. You may wish to change some of the proportions slightly, if you find that you wish a larger or smaller tiger, buffalo or lion. If you prefer to make your drawing on the wood, you will not need any patterns.

Some children say that it is much easier not to sketch the animal at all, but to trace the patterns from books or toys which they have at home. Where pictures are traced from books, the tracing paper is laid over the animal to be copied. After the outline has been carefully traced, it is then transferred to the wood from which the animal is to be made. If the copy is to be made from an old toy, it should be laid flat on the wood and its outline neatly drawn with a sharpened pencil. Now you are ready to cut out the tiger or other animal by following the outline with a saw or knife. If you find it too difficult to cut the tail of any one of these animals from wood, you may use heavy twine or small rope, which can be fastened with either nails or glue.

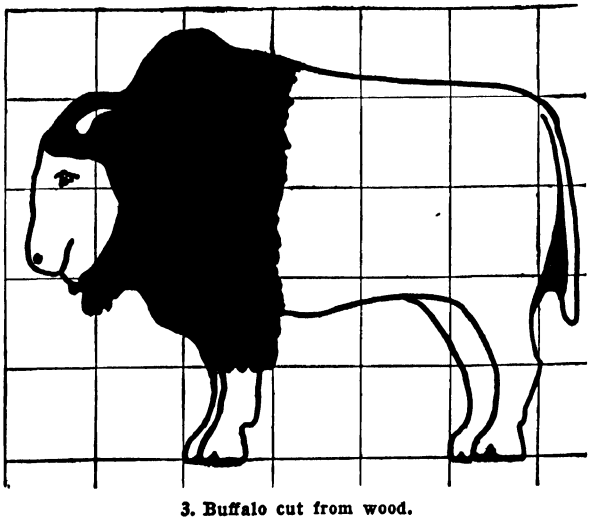
Some children have made the legs of their animals in separate pieces in order to have these appear more life-like. It will be necessary to fasten the legs to the bodies with small-



1. Tiger cut from thin wood.



2. The African lion.



3. Buffalo cut from wood.

headed nails or brads. The legs are cut from the thin wood. Of course they will have to be made considerably longer than the original pattern because of the overlapping of the legs in forming the joints with the body. As soon as these parts have been cut from the wood, the corresponding legs (two hind and two fore) are placed in position on either side of the body, and small holes are made with an awl or other sharp-pointed tool to prevent the wood from splitting. A wire brad or small-headed nail, slightly longer than the three thicknesses of wood, is then driven through and riveted by hammering the point with the head resting against an iron surface. This pivots the tiger's legs so that he can be made to stand or sit. You may even arrange his legs so that he will seem to be running after his prey.

Now, jointed or unjointed, as the case may be, you are ready to paint the tiger his natural color. As in the case of the animals that you have already made, you may use common oil paints or water-colors. Do not forget the black stripes of the tiger, his green eyes and his bright yellow coloring, for he is very proud of all these markings. What colors would be chosen for the buffalo and the lion?

If you have already made the bear, wolf and hippo, described in the article in Volume III, you will now have six jaunty animals in your circus menagerie. It would be well to make a circus wagon in which to keep them, for you will not want to lose even one.

TO MEASURE THE HEIGHT OF A TREE

THERE is a very easy way to measure the height of a wall or tree—a method that any boy or girl can use if he or she can do a problem in simple proportion. It is necessary that the sun should be shining at the time and that a shadow should be cast. That is all that is required to do this easy problem.

Suppose that you wish to measure a tree and that the sun is shining; then the shadow of the tree is cast on the ground. You must measure the distance from the tip of the shadow to the place right under the top of the tree. If the top point of the tree is right above the middle of the trunk, you must calculate half the diameter of the trunk in making your measurements.

Suppose that the distance from the point of the shadow to the trunk of the tree is 40 feet, and that the tree is 2 feet thick. Then the total distance is 41 feet (40 feet + half the diameter of the tree). Now take a stick of which you know the exact length. Suppose that it is 3 feet long. Hold this upright with one end on the ground, and notice how far its shadow extends. You will find, perhaps, that it is 6 feet long. Multiply the length of the tree's shadow (41 feet) by the length of the stick (3 feet); divide by the length of the stick's shadow (6 feet). This gives 20½; that is, the tree is 20½ feet high.

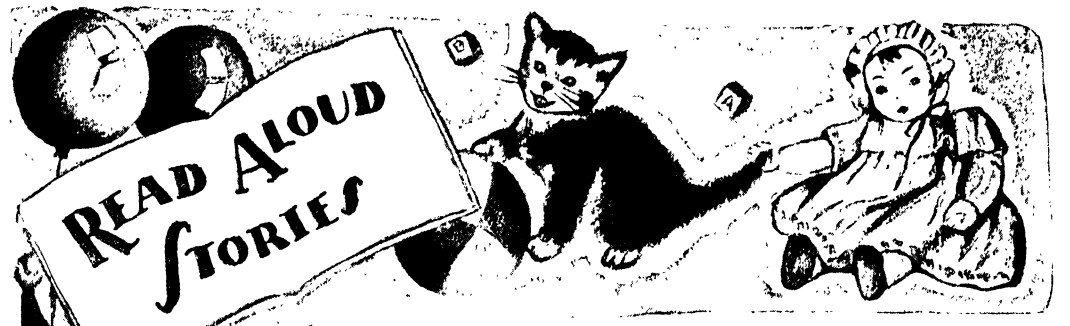


The height of a tree shown by its shadow.

You can also get the answer, though not quite so correctly, by seeing how many steps it takes to go from the edge of the shadow to the tree, being careful to make your steps as nearly equal as possible. Then, after measuring the length of one step, multiply its length by the number of steps. This is the distance from the shadow's edge to the tree.

Be sure that you take the distance to a point right under the highest point. If it is a church spire, for example, make allowance for the distance between the wall up to which you measure and the center of the church tower topped by the spire.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 1962.



The DISCONTENTED PENDULUM

AN ADAPTATION OF THE STORY *by* JANE TAYLOR

ONCE there was an old grandfather's clock that stood in a farmer's kitchen. It went tick-tock for fifty years, winter, summer, spring and fall: Tick-tock; tick-tock; tick-tock. Then early one summer morning when the farmer and his family were still in bed, the old clock suddenly stopped.

At this the Face grew red, the Hands were held up in surprise, the Wheels and the Weights looked at one another angrily.

Every member blamed the others. Each one said *he* didn't do it.

Then a voice spoke up. "I did it." It was the Pendulum speaking. "The truth is," he explained, "that I am tired of tick-tocking. It's been nothing but tick-tock and going back and forth for fifty years!"

"You lazy thing!" said the Face angrily.

"It is easy for you, Mistress Face," answered the Pendulum, "to set yourself up above me, and to accuse me of laziness. You have nothing to do but look pretty and stare at people and watch all that goes on in the kitchen. But how would you like to be shut up for life in this dark closet, and do nothing but wag back and forth year after year as I do?

"I tell you all," went on the Pendulum, "I am tired of my life. Last night, I thought things over. I figured up how many times I have to tick while the Hour-hand just goes around once. Have you any idea how many times that is?"

The Minute-hand, being quick at figures, spoke up brightly "Forty-three thousand two hundred times."

"Exactly. And in one week how many times must I wag?"

The Minute-hand was slower to answer this. "Six-hundred-and-four-thousand-eight-hundred."

"Correct!"

Every one praised the Minute-hand.

But the Pendulum went on, "And in a year?"

The Minute-hand thought hard. All the others held their breath. The Hour-hand gave a little push and said "Go on, dear, you can do it."

The Minute-hand figured and figured and at last shouted:

"THIRTY-ONE MILLION, FOUR HUNDRED AND FORTY-NINE THOUSAND, SIX HUNDRED!—Half ticks and half tocks."

There was silence. Everyone waited for the Pendulum to say whether the answer was correct.

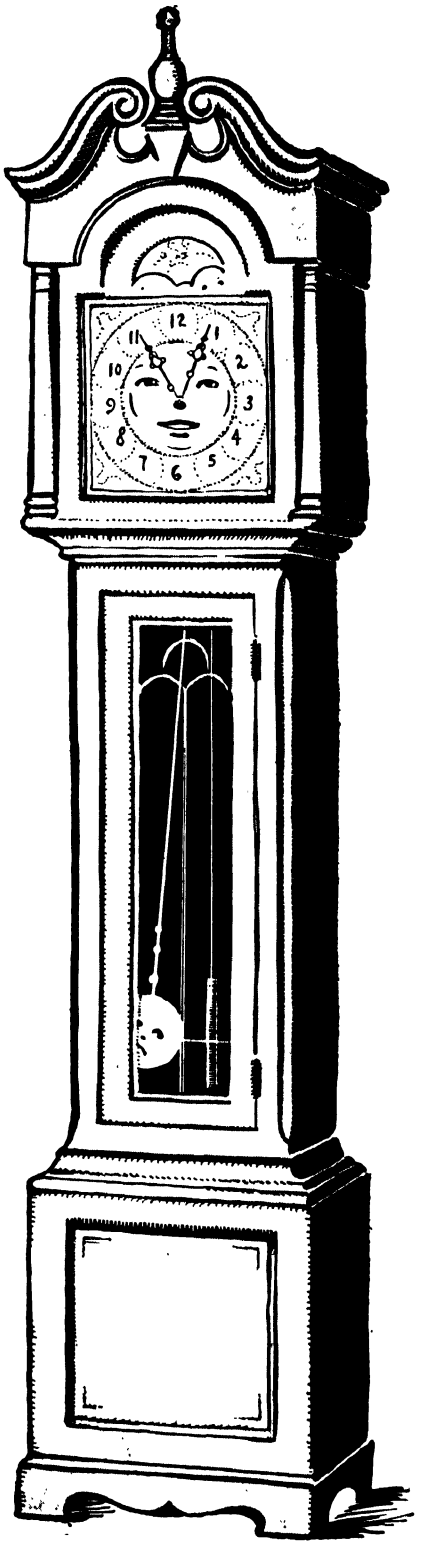
"Good!" said the Pendulum. "You're a smart little fellow. So now you all see why I am tired of tick-tocking. It's too much to ask of anyone."

But Mistress Face answered, "Mr. Pendulum, would you mind wagging six times, only six times, to please a lady?"

"With pleasure," said the Pendulum, and he wagged six times—"Tick-tock; tick-tock; tick-tock."

"Thank you," said Mistress Face. "I hope it did not tire you."

"Of course not," said the Pendulum. "Sixty times would not tire me, nor six hundred, nor six



thousand, but when it comes to thirty-one million —! It's too much to ask of anyone."

Mistress Face smiled. "It tires you to think about all those wags, but it does not tire you to wag one wag at a time. Isn't that true?"

The Pendulum said "But thirty-one million!"

Mistress Face said "You *say* it in a minute, but you take a whole, long year to *do* it. Winter, summer, spring and fall. Nobody hurries you. Spring can not come until you have comfortably tick-tocked enough times. The roses can not bloom until you have tick-tocked so many million more times. The leaves can not turn red in the autumn; Jack Frost can not appear before you give the signal."

"That's so! I'm an important person!" said the Pendulum. "And you are right, I never have to rush. There's always a year's time for a year's tick-tocking. So!" he raised his voice, "Let us all get back to our work! Tick-tock; tick-tock; tick-tock."

With that the Wheels began to turn, the Hands began to move, Mistress Face smiled brightly, and you might have thought nothing had happened.

But when the farmer came down to breakfast he looked at his watch and he looked at the clock and he said to his wife:

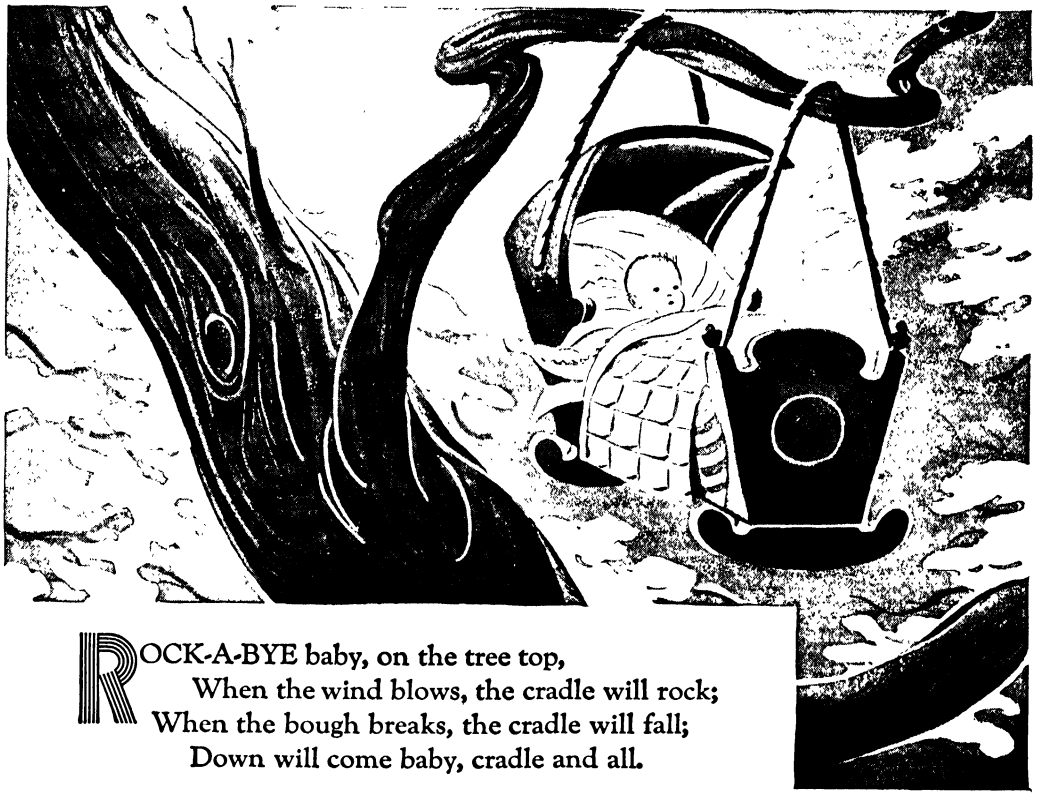
"Would you believe it? My watch gained half an hour during the night!"

THE NEXT READ ALOUD STORIES ARE ON PAGE 2031.

JACK and JILL went UP the hill
To fetch a pail of water;
Jack fell DOWN and broke his crown,
And Jill came tumbling after.



POOR old Robinson Crusoe!
Poor old Robinson Crusoe!
They made him a coat
Of an old nanny goat;
I wonder how they could do so!
With a ring-a-ting-tang,
And a ring-a-ting-tang,
Poor old Robinson Crusoe!



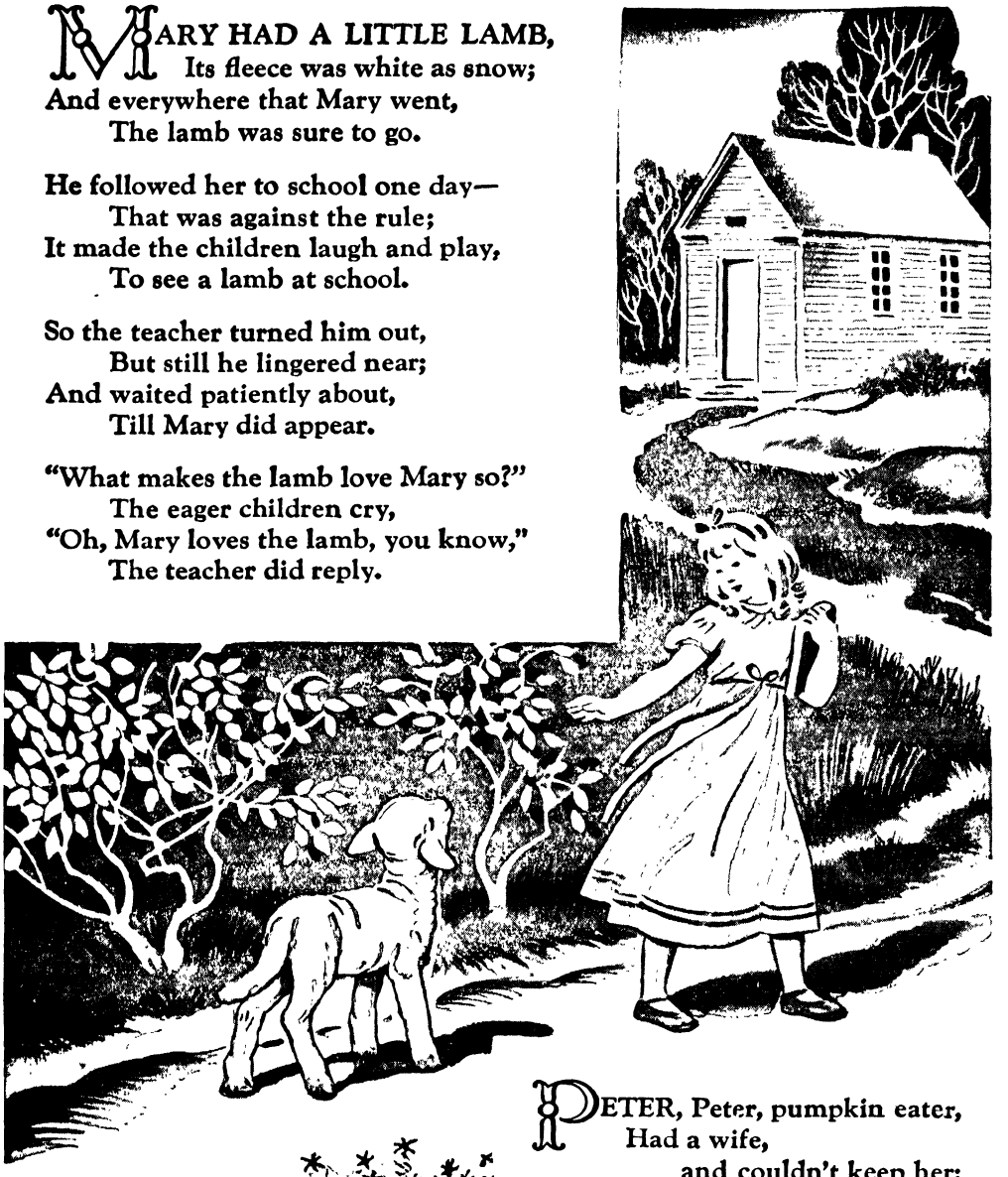
ROCK-A-BYE baby, on the tree top,
When the wind blows, the cradle will rock;
When the bough breaks, the cradle will fall;
Down will come baby, cradle and all.

MARY HAD A LITTLE LAMB,
Its fleece was white as snow;
And everywhere that Mary went,
The lamb was sure to go.

He followed her to school one day—
That was against the rule;
It made the children laugh and play,
To see a lamb at school.

So the teacher turned him out,
But still he lingered near;
And waited patiently about,
Till Mary did appear.

"What makes the lamb love Mary so?"
The eager children cry,
"Oh, Mary loves the lamb, you know,"
The teacher did reply.



PETER, Peter, pumpkin eater,
Had a wife,
and couldn't keep her;
Put her in a pumpkin shell,
And there he kept her
very well.

OH where, oh where, has my little dog gone?
Oh where, oh where, can he be?
With his ears cut short and his tail cut long,
Oh where, oh where is he?

SOME LITTLE MICE

SOME little mice sat in a barn to spin,
Pussy passed by, and she peeped in.
"What are you at, my little men?"
"Making coats for gentlemen."
"Shall I come in and bite off your threads?"
"No, no, Miss Pussy, you'll snip off our heads."
"Oh, no, I'll not, I'll help you spin."
"That may be so, but you
DON'T COME IN!"



TOM, Tom, the piper's son
Learned to play when he was young,
But the only tune that he could play
Was, "Over the Hills and Far Away."

HARK, hark, the dogs do bark,
Beggars are coming to town;
Some in rags, some in jags,
And some in velvet gowns.

THE PELICAN CHORUS

A NONSENSE POEM

By Edward Lear

KING and Queen of the Pelicans we;
No other Birds so grand we see!
None but we have feet like fins!
With lovely leathery throats and chins!
Ploffskin, Pluffskin, Pelican jee!
We think no Birds so happy as we!
Plumpskin, Ploshkin, Pelican jill!
We think so then, and we thought so still!

We live on the Nile. The Nile we love.
By night we sleep on the cliffs above;
By day we fish, and at eve we stand
On long bare islands of yellow sand.
And when the sun sinks slowly down,
And the great rock walls grow dark and brown,
Where the purple river rolls fast and dim
And the Ivory Ibis starlike skim,
Wing to wing we dance around,
Stamping our feet with a flumpy sound,
Opening our mouths as Pelicans ought;
And this is the song we nightly snort,—
Ploffskin, Pluffskin, Pelican jee!
We think no Birds so happy as we!
Plumpskin, Ploshkin, Pelican jill!
We think so then, and we thought so still!

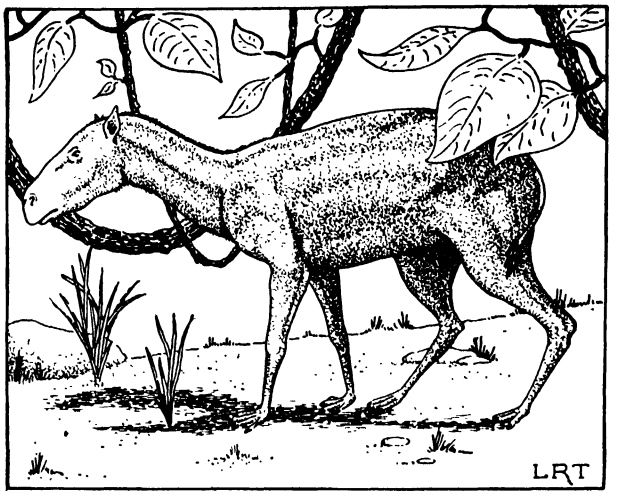
Last year came out our Daughter Dell,
And all the Birds received her well.
To do her honor a feast we made
For every bird that can swim or wade,—
Herons and Gulls, and Cormorants black,
Cranes, and Flamingoes with scarlet back,
Plovers and Storks, and Geese in clouds,
Swans and Dilberry Ducks in crowds:
Thousands of Birds in wondrous flight!
They ate and drank and danced all night,
And echoing back from the rocks you heard
Multitude-echoes from Bird and Bird,—
Ploffskin, Pluffskin, Pelican jee!
We think no Birds so happy as we!
Plumpskin, Ploshkin, Pelican jill!
We think so then, and we thought so still!

Yes, they came; and among the rest
The King of the Cranes all grandly dressed.
Such a lovely tail! Its feathers float
Between the ends of his blue dress-coat;
With pea-green trowsers all so neat,
And a delicate frill to hide his feet
(For though no one speaks of it, everyone knows
He has got no webs between his toes).
As soon as he saw our Daughter Dell,
In violent love that Crane King fell,—
On seeing her waddling form so fair,
With a wreath of shrimps in her short white hair.
And before the end of the next long day
Our Dell had given her heart away;
For the King of the Cranes had won that heart
With a Crocodile's egg and a large fish-tart.
She vowed to marry the King of the Cranes,
Leaving the Nile for stranger plains;
And away they flew in a gathering crowd
Of endless birds in a lengthening cloud.
Ploffskin, Pluffskin, Pelican jee!
We think no Birds so happy as we!
Plumpskin, Ploshkin, Pelican jill!
We think so then, and we thought so still!

And far away in the twilight sky
We heard them singing a lessening cry,—
Farther and farther, till out of sight,
And we stood alone in the silent night!
Often since, in the nights of June,
We sit on the sand and watch the moon,—
She has gone to the great Gromboolian Plain,
And we probably never shall meet again!
Oft, in the long still nights of June,
We sit on the rocks and watch the moon,—
She dwells by the streams of the Chankly Bore.
And we probably never shall see her more.
Ploffskin, Pluffskin, Pelican jee!
We think no Birds so happy as we!
Plumpskin, Ploshkin, Pelican jill!
We think so then, and we thought so still!



EOCENE, OLIGOCENE AND MIOCENE EPOCHS



Eohippus, the little four-toed ancestor of the modern horse, was hardly larger than a fox.

NO hard-and-fast line can be drawn to mark the end of one geological period and the beginning of a new one. With a few exceptions, the various periods shade gradually into one another without any very abrupt change. However, the beginning of the Eocene epoch brought about such marked changes in the appearance of the world and its plant and animal life that it seems proper to regard this epoch as the beginning of a new chapter in the history of the earth.

Tremendous geological changes took place between the laying-down of the Cretaceous and the Eocene rocks. The Cretaceous rocks, during the greater part of the Cretaceous period, were beneath the water, some of them under the deep sea. In the Eocene, however, they, with all their lagoons, estuaries, lakes and seas, were generally forced up into dry land and mountain ranges. Not only were the chalky and clayey and sandy deposits of the Cretaceous raised above the level of the surrounding sea into such masses as the chalk cliffs of southern England and northern France, but even the floors of ancient seas were forced upwards, sometimes as high as 16,000 or 17,000 feet. It must have been a stupendous although gradual upheaval of the earth's crust, for it took place all over the world.

When the Eocene deposits began to form, we find that not only was the face of the world completely changed, but its plant and animal life was unlike that of preceding periods. It is for this reason that the epoch has been called the Eocene, from the Greek word *eos*, meaning "dawn," and it has been regarded as the beginning of a new system, which has been named the Tertiary. It was the dawn of the world as we know it today.

Eocene rocks are found all over the earth. In the Old World they are found chiefly in the Pyrenees, the Alps, the Carpathians, the Caucasus, Asia Minor, northern Africa, Persia, Baluchistan, the Sulaiman Mountains, China and Japan. In eastern North America the Eocene rocks stretch along the Atlantic and all the way from New Jersey into Texas. In the interior of the continent there are large areas of Eocene rocks in Alberta, some in Saskatchewan, and in various parts of the central and western United States. There were shallow lakes and marshes and much volcanic activity in this region during the Eocene.

The vegetation of the epoch was very rich, and many of our common trees grew freely, as ashes, beeches, willows, poplars, elms and maples. Palms and bananas were also to be found. The climates of Alaska and Greenland were temperate, and luxuriant forests abounded in those regions.

The animal life of the epoch was varied. Mammals, birds, reptiles, fishes, insects and mollusks were well represented. Among the birds, snipes, seagulls, buzzards, hawks, ospreys, quails, pelicans, flamingoes and hornbills were common. But the most striking feature of the Eocene animal life was the disappearance of the huge lizards of the Jurassic period and the appearance of new and better developed mammals.

Just why the mighty race of dinosaurs died out is a mystery. The Eocene climate was cooler than that of the preceding period, and it may have been that these great

reptiles could not stand the change in temperature. Perhaps the fact that the early mammals may have fed on dinosaur eggs had much to do with the reptiles' rapid decrease in numbers and final and complete disappearance.

Two of the most extraordinary creatures living in the Eocene were the titanothere and the uintathere. The former appeared early in the Eocene as an animal no larger than a sheep, and gradually developed into a beast the size of a small elephant. The titanothere had a heavy body supported by thick legs. Two great bony lumps grew out of the front of the skull, and the brain was hardly as large as a man's fist. For all their great size, the titanotheres must have been very stupid creatures.

The uintathere has been found only in America, where it was characteristic of the Eocene epoch. It also was as large as a small elephant, and was well armed with six stout horns, four above its nose and two above its ears. In the males the upper canines were developed into two long, sabre-like tusks. Like the titanothere, the uintathere had a ridiculously small brain within its bulky body.

Other mammals appearing in the Eocene were the ancestors of the horse, rhinoceros, tapir, pig, camel and monkey.

After the Eocene came the Oligocene, an epoch not very different from the Eocene. Oligocene rocks are not common east of the Mississippi except in the Gulf region. On the Pacific coast they are more common, however, and in the interior of the continent are large areas with many interesting fossils. In general the plants were like those of the Eocene, but the climate was cooler.

THE LARGEST MAMMAL THAT EVER WALKED THE EARTH

It was during the Oligocene that baluchitherium, the largest of land mammals, lived. The bones of this great beast were discovered in the hills of Baluchistan in southern Asia. It stood from twelve to thirteen feet high at the shoulder, and by lifting its head and stretching, it could eat leaves twenty feet above the ground. It was a distant relative of the modern rhinoceros with which we are all familiar.

The Miocene followed the Oligocene. Miocene rocks are found in France, Belgium, Switzerland and in many other countries, and show a gradual progression in all forms of life, together with the production of many new forms. In western North America Miocene rocks are widespread, but they are not very thick except on the Pacific coast.

The most remarkable of the new animals were the mastodon and the dinotherium, both huge beasts of the elephant family. The tusks of the mastodon were straight; those of the dinotherium turned downward. The first mastodon was discovered in 1613, and the history of its discovery is very curious, one of the rare examples of imposture in science.

THE SURGEON WHO DECEIVED THE WORLD OF SCIENCE

The skeleton was found by some workmen in a sand quarry at Dauphiny, in France. Such bones had never been found before, and a surgeon called Mazuyer saw a chance of making a great sensation. He purchased the bones and then pretended that he had found them in a tomb thirty feet long and fifteen feet broad, built of bricks, and bearing the inscription: "Teutobocchus Rex." He also stated that he had found fifty medals of Marius in the tomb; and there seemed no reason to doubt his apparent good faith.

A barbarian king named Teutobocchus had actually invaded Gaul at the head of the Cimbri, had been defeated by the Roman Marius and led in triumph to Rome. According to tradition, Teutobocchus was so tall that he towered above all the trophies borne on the lances of the soldiers in the triumphal procession. Mazuyer's story therefore fitted in perfectly with the legend and met with general acceptance. The giant formed out of the mastodon's bones was twenty-five feet long, and the skeleton was exhibited throughout France and Germany. A great many people were rather skeptical, and a learned anatomist argued that the bones belonged to an elephant; but it was not until they were removed to the Museum of Natural History in Paris that the remains were actually identified as the skeleton of a creature like an elephant.

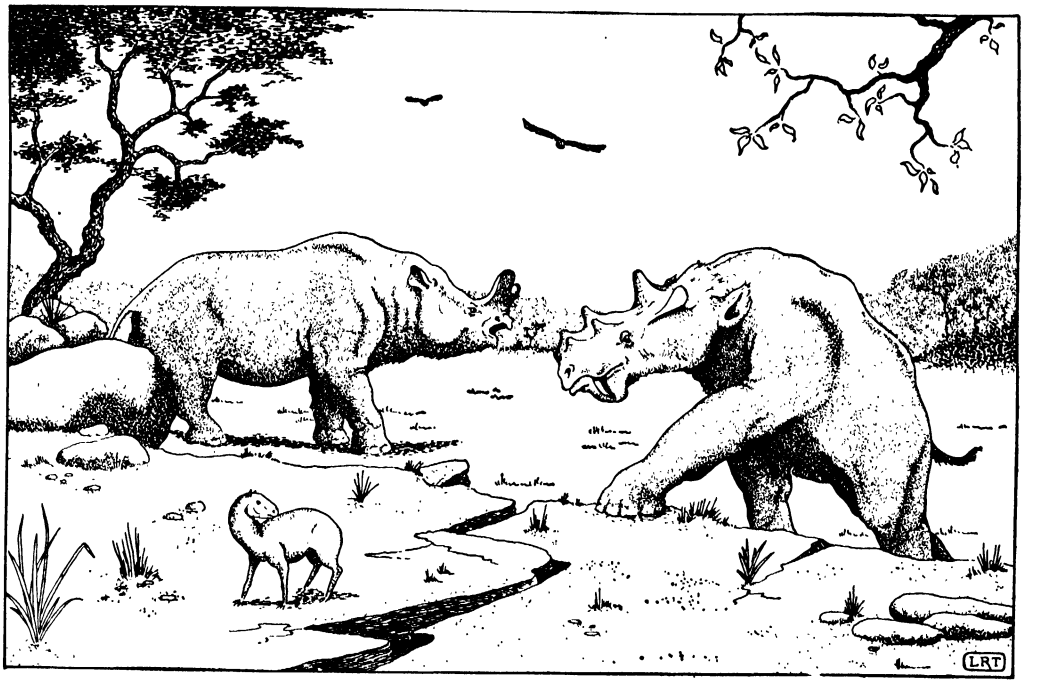
The dinotherium, found only in Europe and India, was larger than either the mastodon or the mammoth. It lived on herbage, and seems to have inhabited lakes.

In the Miocene, cats, and hogs and antelopes were also found. Wolves, panthers and sabre-tooth tigers were common.

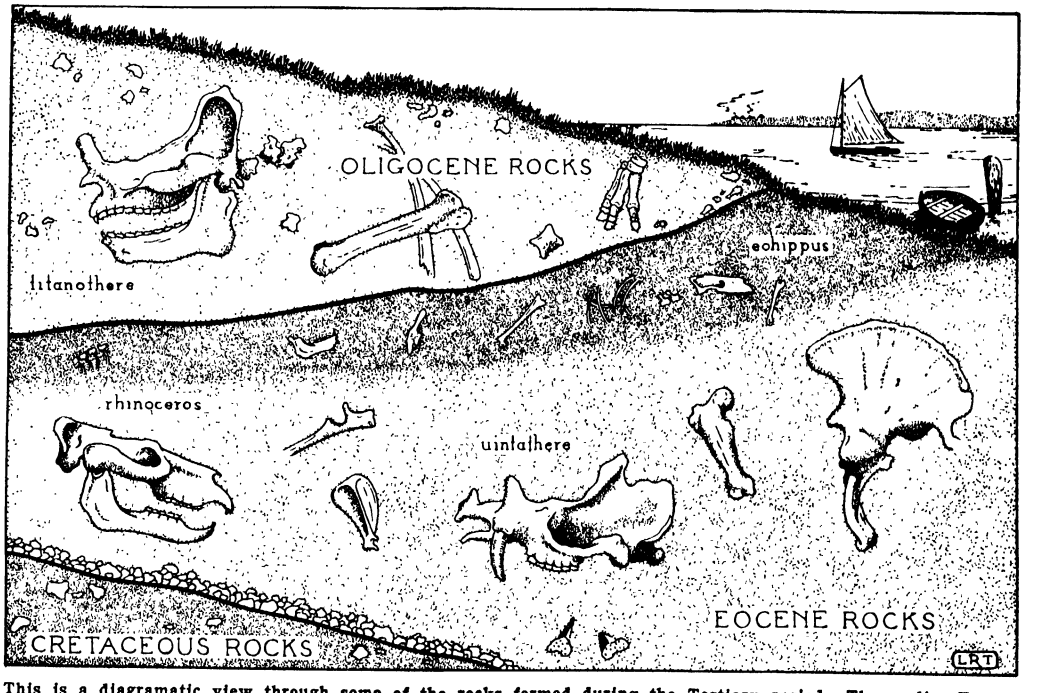
Thus we see that as the Tertiary period advanced, the mammals became more and more dominant, while the great reptiles that had roamed the earth began to disappear.

THE NEXT STORY OF THE EARTH IS ON PAGE 1925.

LIFE AND REMAINS OF THE TERTIARY



In this picture we see some of the strange beasts that roamed the world during the Tertiary period. In the foreground is eohippus, the "dawn horse" of the Eocene. To the right is uintathere, who also lived during the Eocene epoch. Titanothere, the rhinoceros-like beast of the Oligocene, stands to the left in the picture.



This is a diagramatic view through some of the rocks formed during the Tertiary period. The earlier Eocene rocks contain the remains of eohippus, the earliest horse of which we know, the many-horned uintathere and a very primitive rhinoceros. Above the Eocene rocks are those of the Oligocene, containing the bones of titanothere.

HOW THE UNITED STATES IS GOVERNED

WHEREVER people live or work together in a group, there is some form of government. The group's affairs must be managed and guided, and to do this a set of rules is necessary. This is so whether the group is a family, a tribe, a village, a city or a nation. In a family and in our personal relations with other persons, we call some of the rules good manners. In governing a city, a state or a nation the rules are called laws.

You know that a game is not very satisfactory unless the players abide by the rules. Otherwise there is confusion and quarreling. So, in the more serious business of living and working with each other, rules smooth the path. Though by agreeing to the rules we give up some of our freedom to do exactly as we please, we gain a greater freedom because we are no longer hampered by conflicts with our neighbors. By respecting the rights of others, our own rights are safeguarded, and we can live in peace and order.

Laws serve another purpose. Unhappily, some human beings are selfish and greedy and want more than their fair share of the world's good things. They would like to seize what does not belong to them or commit other harmful acts. But laws say that such deeds are crimes, and are forbidden. And if a person commits a crime, the law provides for punishing him. Thus government, through its laws, not only keeps order but protects us against evil-doers.

Government has many other important duties. For one thing, until war or the fear of war is banished forever, each national government must provide for defending its people and its land from possible outside attack.

The governments of civilized nations carry on many other activities which add to the health, the happiness, the wealth or the convenience of the people. Schools are provided for children and care for the poor, the afflicted and the mentally ill. Roads are constructed, streets paved, floods controlled and bridges built across streams.

Most countries are so large that they are divided into states or provinces, and these in turn may be divided into counties and cities. If you live in New York City, for instance, you are under four separate governments. First is the government of the United States, the Federal government; then the government of New York State; next the county of New York, and finally the city of New York. Ordinarily their work does not overlap; each one has different activities. However, it is of the first, the government of the United States, that we shall speak here. This does not mean that the other governments are not important.

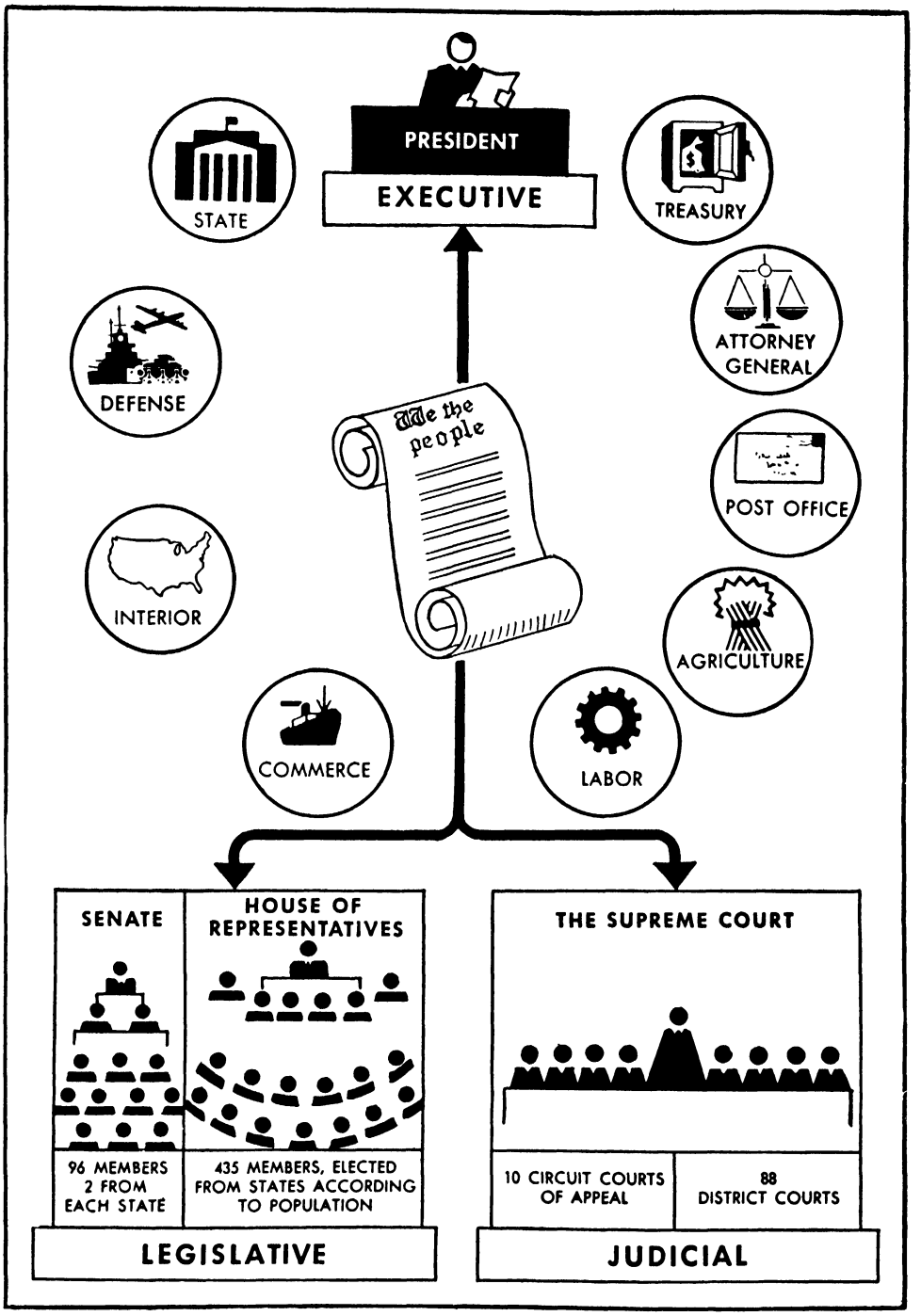
You will hear several names given to the kinds of government that exist today. The forms are often called republics or monarchies, but these terms have become a little misleading. You will see why in a moment.

If we consider governments on the basis of how much power the mass of people has, we find that governments may more accurately be divided into autocratic and popular. The word autocratic means rule of one, and in such governments one person or a small group has absolute power and the people have little or no say in how they are ruled. The most extreme form of autocratic government has a long, ugly name—totalitarianism. This is the kind of government which appeared in Italy under Mussolini, and in Germany under Hitler, and which still exists in the Soviet Union. Yet the framework of government in Italy remained a monarchy (under a monarch, or king, who had almost no power); and the Soviet Union has the outward form of a republic, with a constitution.

In popular governments, the power is in the hands of the people. They are democracies in a broad sense. Such governments also may have the form of either monarchies or republics. When they have a king, his powers are severely limited by a constitution, and most of the work of government is done by officers elected by the people. The outstanding example of this kind is the British government.

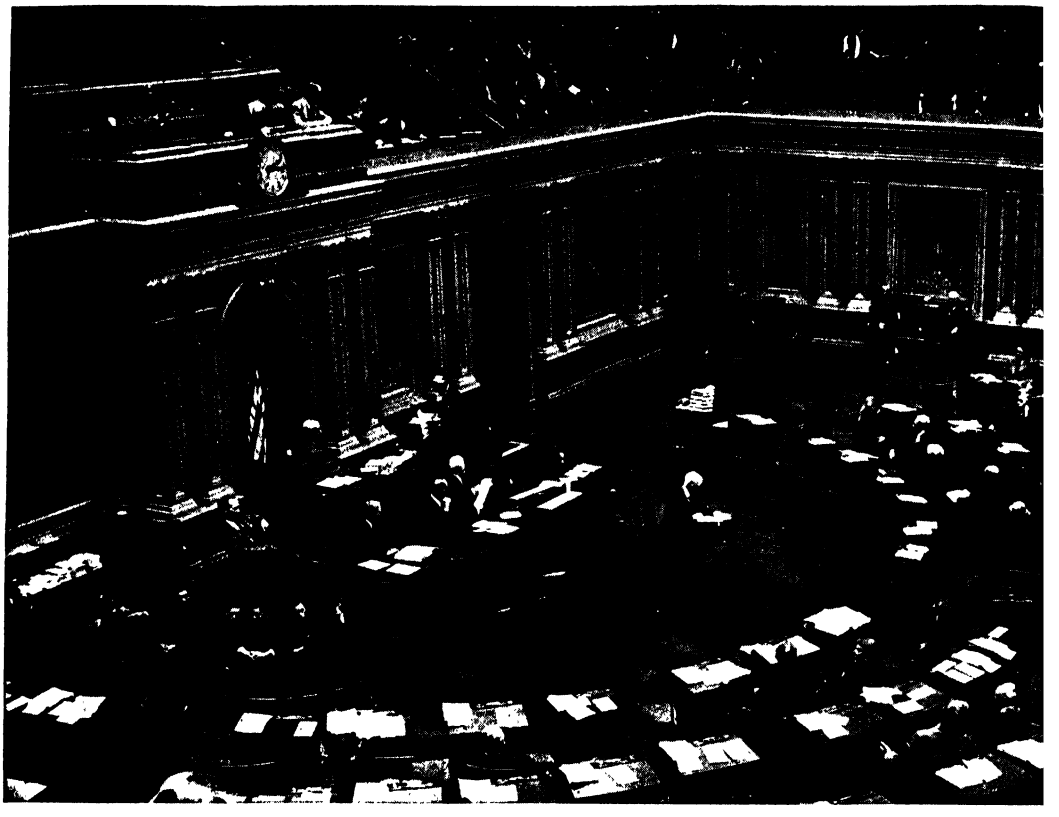
In a pure democracy every citizen would vote on every question, but this is impossible in a large country; and there are no national governments of this type today. However, you may see how pure democracy works in the town meetings of New England, when all

CONSTITUTIONAL GOVERNMENT IN THE U. S.



© Pictograph Corp.

Under the Constitution, the United States Government has three distinct arms, as this chart indicates. As the country's affairs have grown more complex, however, the executive departments have also grown. Originally there were only four, and now there are nine.



Each of the ninety-six senators has a desk in the Senate chamber. The vice-president is the presiding officer.

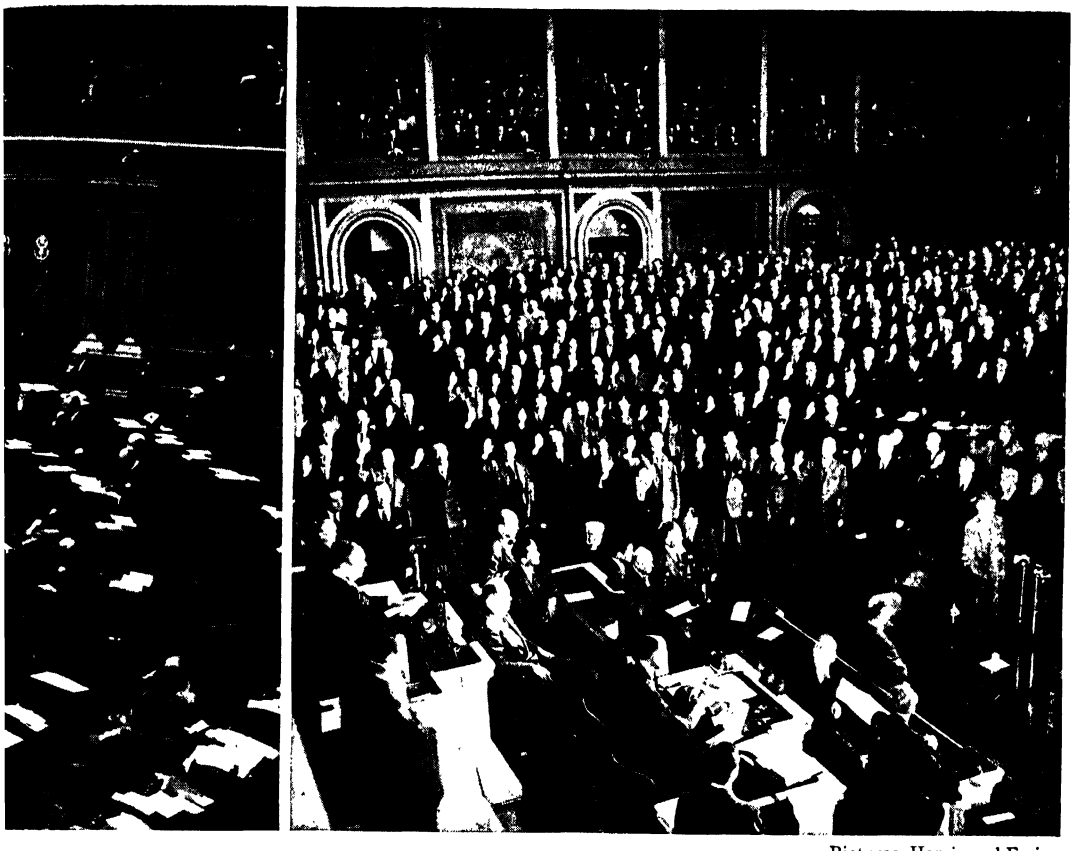
the citizens gather to vote on town affairs.

In actual practice in democracies today, the power is in the hands of the people, only they do not make or vote on the laws directly. Instead, they elect officials to do this work for them. The officials are usually elected to hold office for a short time only (seldom more than four or six years). Therefore, if a man acts unwisely or improperly he can be turned out at the next election. Another important force acting in republics, where the rights to free speech and a free press are a part of the constitution, is the power of public opinion. Newspapers, radio debates, polls on questions of the day, letters from the voters, keep the officials informed on how the people want them to act.

The United States is a republic. The plan of government is set forth in the Constitution, the supreme law of the land. This means that no other laws may be made by the nation, a state or a city which violate the Constitution. The document could not and does not lay down rules for all the details of government, and many problems have arisen in the years since it was written which could not be foreseen. Also, some of the phrases in the Constitution are not very specific, and there have been disputes from time to time as to their exact meaning.

By the Constitution the government is divided into three parts: the legislative, or law-making; the executive, which carries out the laws; and the judicial, which decides whether or not the laws have been broken. Each of these divisions is independent, to some extent, of the others, and each of them keeps the others from becoming too powerful.

The law-making power is in the hands of Congress, which is made up of two houses. In one, called the Senate, each state, large or small, has two members. A senator is elected by the people of his state, represents the whole state and serves for six years. However, the terms of all the members of the Senate do not run together; one-third are elected every two years. A senator must live in the state he represents, must be at least



Pictures, Harris and Ewing

Members of the House of Representatives are sworn in by the Speaker as Congress begins a new year.

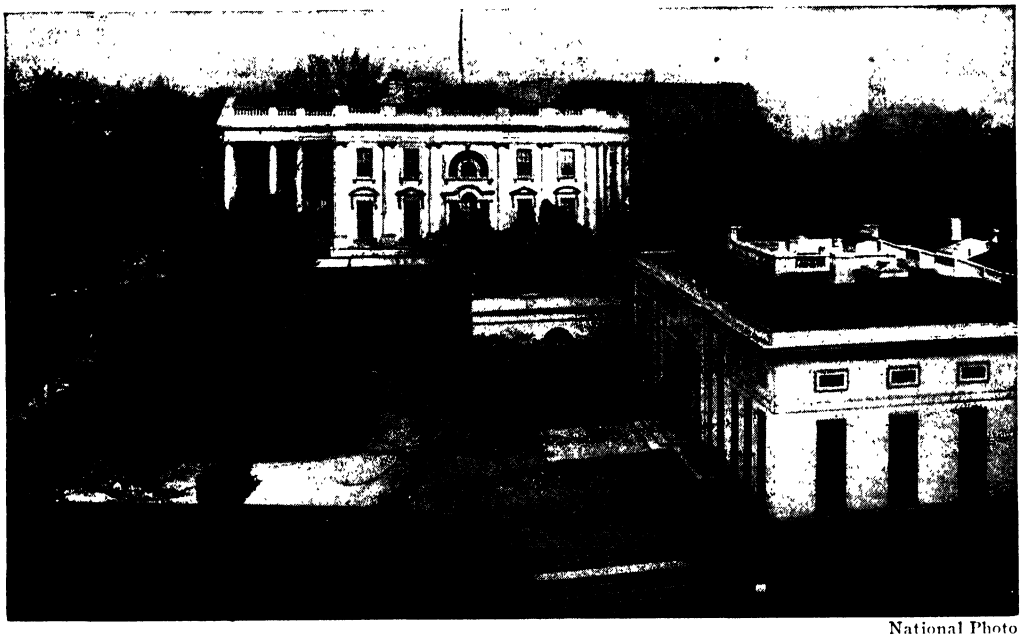
thirty years old, and, if he was born outside of the United States, must have been a citizen nine years.

The House of Representatives is made up of members elected from the states according to the population. Congress determines how many representatives there shall be in the House and then divides them among the states according to population. However, every state is entitled to at least one representative. The legislature of a state usually divides the state into as many districts (called Congressional Districts) as it has representatives, and each representative usually represents such a district. Each member is elected by the people of his district for a term of two years. A representative must live in the state he represents, but not necessarily the district, and must be at least twenty-five years old. If he was not born in the United States, he must have been a citizen at least seven years. Sometimes representatives are called congressmen, although, of course, both senators and representatives are really entitled to be called congressmen.

The duties and powers of the houses are not quite the same. The House of Representatives chooses its president, who is called the Speaker, though he does almost no speaking. The vice-president of the United States is the president of the Senate. If there is no vice-president, which happens when a president dies and the vice-president becomes president, the Senate elects a temporary president.

No law can be made unless both houses approve, but every measure which has to do with taxation must be passed by the House of Representatives first, and then sent to the Senate. This is because the writers of the Constitution believed that the representatives were closer to the people than the senators, and could more truly understand the people's needs and wishes in money matters.

The Senate has some powers which the House has not. It shares with the president of the United States the power to make treaties or other agreements with foreign



National Photo

Originally the White House served as both residence and office, and therefore the president and his family had little privacy. Now there is a separate wing, the Executive Office Building, in the front of the picture.

countries; it must approve of the persons the president appoints to high office. If a president or other high officer of the government is charged with a crime, the Senate sits as a court to try him. This is called impeachment.

The Constitution lists what kinds of laws Congress may make and what kinds are forbidden. For example, Congress may borrow money. This it does by issuing bonds, which are promises to pay a sum of money at some future time. Congress may make laws about trade, may coin money, make laws to punish imitators of this money and may establish post offices.

Congress is also given power to declare war, and to raise and support an army. Here the fear the makers of the Constitution had of a standing army caused them to say that all money voted for an army must not cover more than two years. At the end of that time the necessary funds must be voted again. Congress may also build and keep a navy, make laws for the capital city and for territories and all other laws necessary to carry out the Constitution.

The Constitution forbids Congress to tax goods sent out from any state. This clause was put in because the states were jealous of each other and each one feared that Congress would tax the goods produced by it. For the same reason, Congress is also forbidden to give the seaports of any one state any advantage over those of another.

The men who made the Constitution were afraid that some attempt might be made to create a class of people of high rank. So Congress is forbidden to grant any title of nobility, and officers of the United States are forbidden to receive presents or titles from foreign governments. Another provision of the document states that no accused person may be declared guilty of a crime without a trial. On rare occasions it has happened that an evil act was committed for which the law provided no punishment. The Constitution says that such a deed can not be punished by a law passed after it was committed.

The chief officer of the executive part of the government is the president, chosen for a term of four years. There is nothing in the Constitution to prevent the election of the same person for as many terms as the people desire, but since Washington and Jefferson each refused to serve more than eight years, it became the custom to elect no man for more than two terms. However, in 1940 and 1944, Franklin D. Roosevelt was elected for third and fourth terms.

The president and the vice-president are not voted for directly by the people. At the

time the Constitution was adopted, there were no quick ways of traveling or spreading news. There were few newspapers, and the people of one state knew so little of those in other states that it was thought impossible for the people generally to know enough about the candidates to make the best choice. So it was decided to have the people of each state elect a number of citizens equal to the total number of their senators and representatives. These men, called electors, were then to meet and choose a president and a vice-president. This same procedure is still followed; only it has been complicated by the growth of the party system, which developed after the Constitution was written. Today the electoral vote is by states, that is, each elector votes for the candidates whose party has received the most votes by the people of his state.

The president must be a "natural-born citizen of the United States," at least thirty-five years old. If he should die or become unable to serve, the vice-president takes his place; and so, of course, the same rules apply to choosing a vice-president. Congress was given power to decide who shall be president in case both president and vice-president die in the same term. For a long time it did so by making the members of the Cabinet the successors, beginning with the Secretary of State. However, in 1947 the Speaker of the House was made the successor to the vice-president.

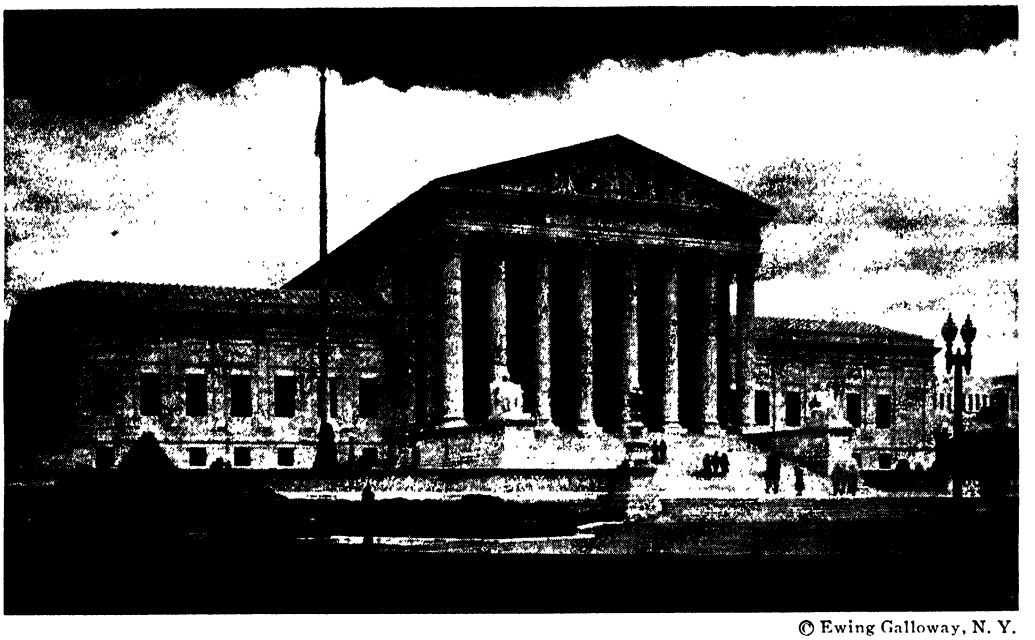
The president is commander-in-chief of the armed forces, though no president has ever taken the field in person. He appoints all the higher officers, but the Senate must approve. Lincoln always took great interest in the plans of the generals; and Franklin Roosevelt took a leading part in planning the over-all strategy of the Allies during World War II. The president also has power to grant pardons, except in cases of impeachment, if a person has been convicted of a crime against the Federal government.

The president has power to make treaties with foreign governments, but two-thirds of the members of the Senate must approve before the treaties can go into effect. With the consent of the Senate, he appoints ambassadors, ministers and consuls to represent the nation in other countries. He also ap-



Harris and Ewing

At this desk in his study in the White House the president receives guests and holds small conferences.



© Ewing Galloway, N. Y.

For a long time the Supreme Court sat in what was once the old Senate chamber in the Capitol. Now the court has this magnificent new building of its own, built of white Vermont marble, classical in design, with huge Corinthian columns. Above the front columns are the words "Equal Justice Under Law."

points United States judges and thousands of other officers not otherwise provided for; but the consent of the Senate is necessary before they can take up their duties.

The president is instructed to give to Congress every year information on the state of the Union together with his recommendations for future action.

Enough has been said to show that the president is a very powerful head of state, much more powerful than most kings. Yet there is little danger that any president will ever become a dictator or tyrant. He can not control the other parts of the government, and the people can turn him out before he becomes too strong if he should attempt to misuse his great powers; or he can be impeached by the Senate.

The Constitution says nothing about the advisers of the president, now called his Cabinet, except that he may consult with the heads of the departments. At the end of 1947 there were nine of these Cabinet officers, each the secretary of an executive department. At first Congress created only three departments, State, Treasury and War. The Department of State has charge of our relations with foreign countries; the Department of the Treasury supervises finances, collecting taxes, and so on; the Department of War, now under the Department of Defense, has to do with raising and training the army.

The Department of Justice (its head is called the Attorney General), created later, represents the United States in cases involving the Federal government. The Federal Bureau of Investigation is a part of this department. The Navy Department, also under the Department of Defense now, was created after Washington's day, to supervise and maintain a navy. The Post Office Department, which controls the transportation and delivery of mails, existed from the beginning but was not considered a department until much later.

The Department of the Interior has to do principally with the conservation of natural resources. The Department of Agriculture collects and distributes all kinds of information valuable to farmers.

The next department organized was that of Commerce and Labor; but in 1913 this was divided into separate departments of Commerce and Labor. The Department of Commerce works to encourage trade and commerce at home and abroad. The Weather Bureau, in this department, studies rainfall, winds and climate, and makes weather predictions. The Department of Labor looks after the welfare of wage-earners.

In 1947 the War and Navy departments, together with the Air Force, were combined

in the Department of Defense, with one secretary in the Cabinet.

THE SUPREME COURT IS THE HIGHEST COURT IN THE LAND

The Supreme Court is the highest court in the land. The number of judges is fixed by Congress; at present there are nine, appointed by the president. Congress also established circuit courts and district courts below the Supreme Court. They are entirely separate from the state courts, with which the Federal government has nothing to do unless the Constitution is violated. The circuit and district courts try men who have broken the Federal laws by such acts as robbing the mails, or using them for bad purposes; by making imitations, called counterfeits, of money; or by cheating the United States out of taxes.

The Federal courts also try cases between citizens of different states, cases having to do with sailors and ships, and the like. Where ambassadors are concerned, or where a state sues another state or the citizens of another state, only the Supreme Court can try the case. The Supreme Court can declare any act of Congress or of a state legislature "unconstitutional." If it does this, the act is wiped out. This is a very great power which few other courts in the world have. Both houses of Congress may pass an act, the president can sign it, and then it may be set aside by nine men, or a majority of them.

Another provision of the Constitution states that all accused persons shall be tried by a jury and that the trial shall be held in the state where the crime was committed. This rule was made because the people, while colonists, had seen their fellows tried by prejudiced judges and had known the hardships of being taken far from family and friends for trial.

No state may treat the citizens of another state differently from its own; and if a person charged with a crime flees from one state to another, the second state must yield him to the state where the act was done. No state may tax goods coming from another state, keep an army or navy, coin money, grant a title of nobility, or enter into a treaty with another state or with a foreign country.

New states may be formed by Congress, but no state may be divided, nor may two states or parts of states be joined, without the consent of their legislatures.

The United States government must see that each state has a republican form of government. Congress would prevent any man from making himself dictator of a state. The laws of Congress are above any state laws.

It was made very difficult to change the Constitution, and very few changes have been made. The first ten amendments, the Bill of Rights, are really a part of the Constitution itself and grew out of the experience of the colonies before the Revolution. Several states were unwilling to approve the Constitution until these amendments were added. One of them forbids Congress to make any law favoring or punishing any form of religion. No person may be punished for his speeches or his writings unless they are intended to injure some one. Unreasonable searches and seizures are forbidden. No man may be tried twice for the same offense; an accused person can not be compelled to testify against himself; and private property can not be taken for public use unless it is paid for.

Every accused person is entitled to a trial by jury, and has the right to hear the witnesses against him. No man may be tried in secret, nor shall excessive fines be imposed or cruel or unusual punishments be inflicted.

The eleventh amendment forbids a citizen of one state to bring suit against another state. The twelfth, adopted in 1804, changed the method of voting for president and vice-president.

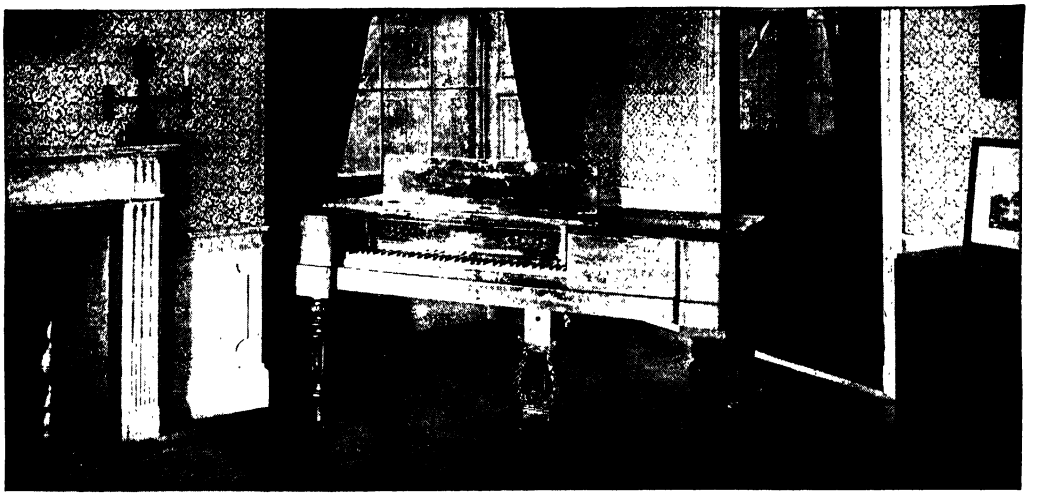
THROUGH THE YEARS IMPORTANT AMENDMENTS HAVE BEEN ADDED

In 1865, the first of the Civil War amendments, the thirteenth, abolished slavery. The fourteenth, adopted in 1868, declares that Negroes are citizens and forbids the payment of the Confederate debt or any payment for the loss of slaves. The important fifteenth amendment, of 1870, forbids any state to deny any citizen the right to vote "on account of race, color, or previous condition of servitude." This was meant to give Negroes the vote.

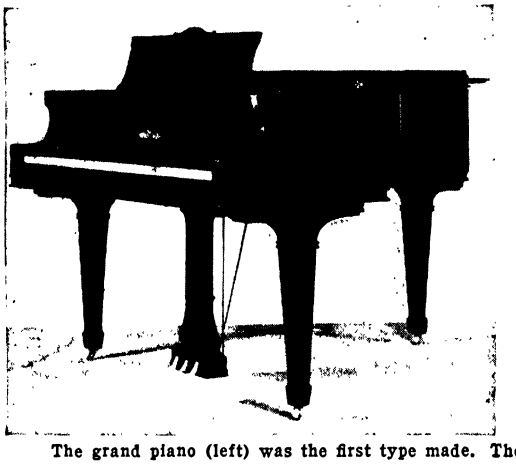
In 1912 the sixteenth amendment gave Congress permission to levy a tax on incomes. The seventeenth (1913) took the right to elect Senators from the state legislatures and gave it to the people directly. The prohibition amendment was ratified in 1919, and that giving the vote to women in 1920. The twentieth (1933) changed the date of the beginning of the terms of both Congress and the president; the twenty-first (1933) repealed the eighteenth. We give you the exact wording of the Constitution in Volume 20, beginning on page 7589.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 1905.

THE PRINCIPAL TYPES OF PIANOS

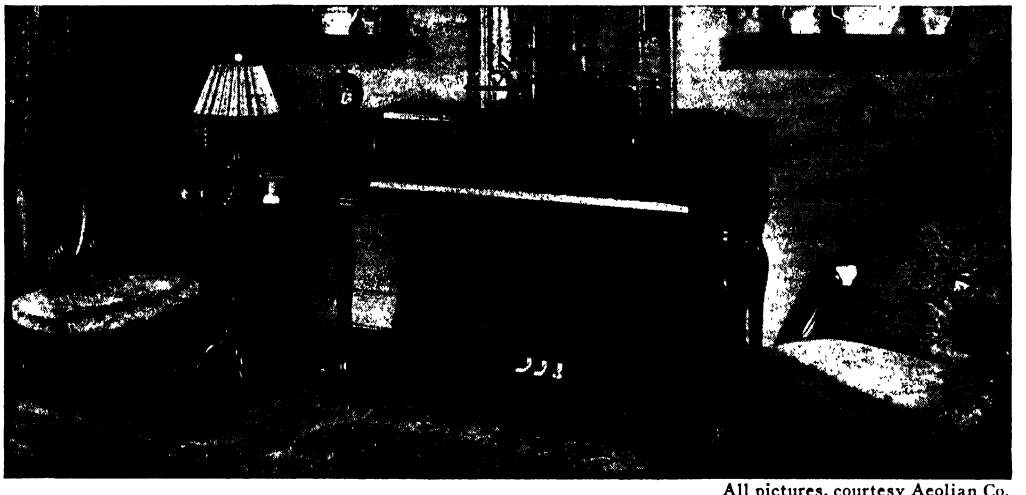


This is a fine example of the square piano, a type no longer made despite its graceful appearance.



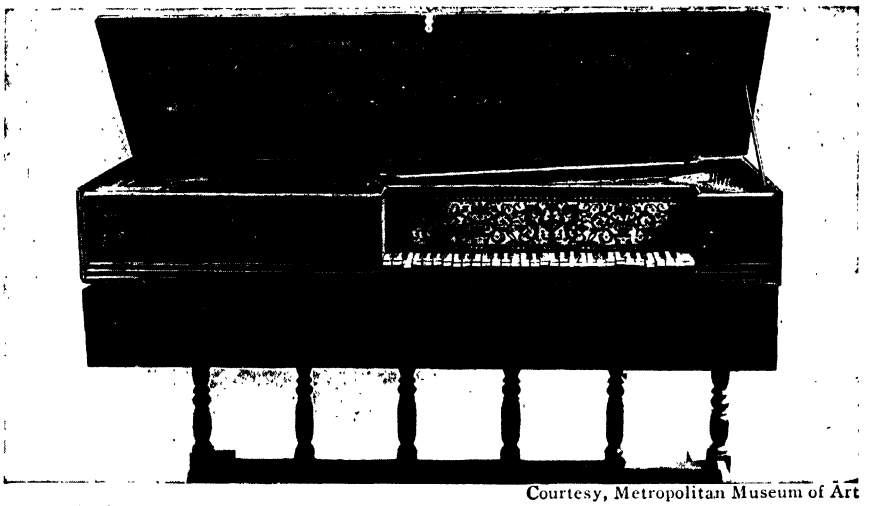


The grand piano (left) was the first type made. The upright (right) followed the square shown above.



All pictures, courtesy Aeolian Co.

This vertical piano, popular to-day, resembles the old square shown in the top picture.



Courtesy, Metropolitan Museum of Art

A clavichord, one of the instruments used before the invention of the piano.

THE VIOLIN AND THE PIANO

NEXT to the piano, the violin is the most popular of musical instruments in spite of the fact that it is rather expensive to buy and difficult to play. One reason for the violin's immense popular appeal is the quality of the sound it makes, for it has a tone as sweet and sympathetic as a beautiful human voice. Besides appealing to the ear, the violin attracts the eye by its graceful shape, delicate strength and glowing, satiny finish. The finest violins, moreover, are not only great musical instruments but precious art objects as well because of their association with the great musicians who have owned and played them.

Nobody knows exactly where the first violins came from or who made them, but man discovered long ago that strings would make music when plucked (the harp), struck (the piano) or rubbed (the violin). He also found out that if the strings were attached to something which was able to vibrate along with them, such as a hollow wooden box, much stronger and richer sounds resulted. The true violin is a very delicate and complicated instrument, but it makes music simply because its strings are stretched tightly over a hollow box and then set in motion by the friction of a bow drawn across them.

An early ancestor of the violin was the rebec, a bowed instrument used in the middle ages. It had two or three strings over a low bridge, a pear-shaped body pierced with sound-holes, and, instead of a separate neck, a narrowed portion at the upper end to provide a place to press the strings. The player used a short and clumsy bow.

A later form was called the guitar fiddle. It was furnished with five strings (one more than the violin). The lowest always played the same note, called a fixed bass.

Still later came the viol, close to the violin even in name. The double bass of the modern orchestra, though much bigger, is like the viol in shape. They both have flat backs, high bridges and deep sides.

The true violin is rounded front and back, is shallower at the sides than the viol and has a lower bridge. Its total length was long ago determined by the average reach of the human arm when in a slightly bent position to allow for free action of the muscles. The average measurements of a full-size violin are: total length, 23½ inches; greatest width, 8 13/16 inches; greatest depth, 1¼ inches.

You can make a toy violin with a cigar box, one violin string, and bits of wood (see page 3508), but great skill goes into the making of a real instrument, and the violin maker is a high type of craftsman.

Material is the first thing of importance. Of its seventy-odd parts, by far the greater

number are shaped from wood, and the violin-maker must be careful that each piece is free from defects, well seasoned, and, if possible, attractive to look at. Pine is used for the table (front), the blocks that strengthen the ribs, and for the two inside parts which help to support the bridge, called the sound-post and the bass-bar. The back, ribs, neck and bridge are made of maple or sycamore. The finger-board, tailpiece and tuning pegs are sometimes boxwood, sometimes ebony and sometimes rosewood. The latter is least subject to slipping. The right woods in the right places make a violin both good to hear and good to see. But fine wood is useless in the hands of a clumsy workman, because the body of the violin is extremely delicate. Everything must be measured to a hair's breadth, and a mistake, no matter how small, will affect the tone of the completed instrument. If the bass-bar, for instance, or the sound-post is even a tiny bit wrong in shape or position, the tone is spoiled. Some people call the sound-post the soul of the violin because its exact pressure on table and back, and the point at which it is placed in relation to the foot of the bridge, means so much.

A FINE VIOLIN IMPROVES WITH AGE

The violin-maker has one great consolation, however. If he makes a really good instrument, it will continue to improve with age and use for a very long time. Like a human being, it can grow tired from too much work and should be given a rest now and then. But rightly used, the older it is the better it is.

Just why this should be so, nobody can be sure. Some say that if the wood is right, the violin will grow better and better as time goes by. Others claim that if the varnish is right it helps the wood to improve. Still others think that the secret of making perfect varnish has been lost, so that nobody living to-day can make violins which will ever be the equals of the ones that have come down to us from the master-makers of the past.

THE GREAT FAMILIES OF VIOLIN-MAKERS

Several families of these great craftsmen lived and worked in Italy during the seventeenth and eighteenth centuries. On page 6700 you will find an account of some of the better known individual members of these families, particularly Antonio Stradivari of Cremona (1644-1737), thought by many to be the best violin-maker of all time. He is given this honor because he seems to have made more first-class violins than anybody else. Not very much is known about his life, but we do know that he gradually became a superfine craftsman. In the course of a long, industrious career, he was able to experiment and experiment until he had developed a flawless model. We should remember, too, that his brilliant work was helped by an abundance of good material, a dry and sunny climate (ideal for wood-working), and the patronage of the great men of his day, whose interest encouraged him to do his best. You will sometimes see his name written in the Latin form, Antonius Stradivarius.

Many people of Stradivari's own time were inclined to prefer the instruments of his teacher, Nicolo Amati (1596-1684), whose violins responded very readily and had a clear, sweet tone. As a result, they were easy to play and were sure to sound well in the small rooms of private houses. Others liked the power and fullness to be had from the instruments of a still earlier Italian maker, Giovanni Paolo Maggini (1580-1631?). His violins were more difficult to play because they were larger and a little stiff.

ITALIAN VIOLINS MODELS FOR ALL EUROPE

The violin-makers of northern Europe were inclined to follow Italian models, often with success. The greatest German maker was Jacob Stainer, born in 1621. He made instruments of the Amati type, as did the second Mathias Albani, (c. 1650-1680) who produced several fine violins. Among French makers, the name of Nicolas Lupot (1758-1824), is outstanding for his marvelous copies of Stradivari violins. Jacob Rayman, who is thought to have come to London from the Tyrol about 1620, is considered the father of English violin-making, but the greatest maker was Benjamin Banks of Salisbury (1727-1795). Noted American makers include John Friedrich, George Gemunder, who created a scientific model of his own, Henry Bentin, James R. Carlyle, and Joseph Collingwood. American violin-making did not acquire importance until after 1740.

The slow, careful and individual work

VIOLINS AND VIOLIN MAKERS



Picture Ewing Galloway

A FAMOUS VIOLIN

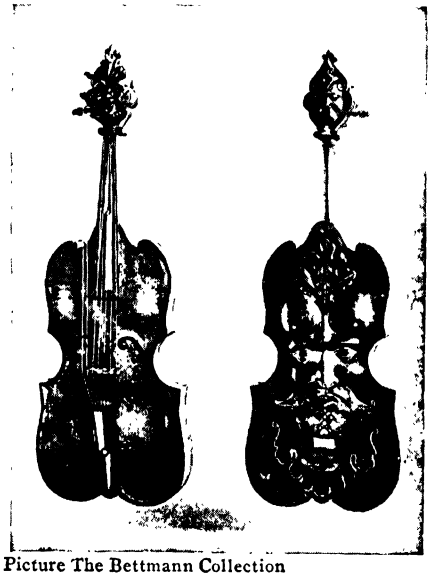
This fiddle was owned by Johann Strauss, the elder, a Viennese musician famous the world over for his dance music. Strauss owned three violins of which this was the best. If you look closely you will see that there are mirrors at the back of the case.



Picture Publisher's Photo Service

BOY PLAYING THE REBAB

The Javanese boy is playing a rebab, a crude member of the violin family. It has two strings which are played at the same time by passing the bow between them so that the near string is rubbed on its upper side, the far string on the lower side.



Picture The Bettmann Collection

LIRA DA BRACCIO

Lira da Braccio means Lyra for the Arm, to distinguish it from an instrument intended to rest on the knees or on the floor. The modern lyra is a member of the violin family, being close to the true violin in shape.



Picture The Bettmann Collection

FRENCH INSTRUMENT MAKERS

The man in the foreground is working on a violin while his companion seems to be busy with the frame of a harp. Beyond the second window you can see the body of a cello held together with clamps until the glue is dry.

of the great violin makers is in strong contrast to the methods by which cheap fiddles are made to-day. It is still impossible to turn out a complete instrument by machinery, since even a metal one requires hand work, but mass-production methods are used. In Europe the cheap violin is still produced by hand, although we should really call it by hands. A different person makes each part and the people who make the parts do not put them together. In America, machines are used, especially when certain parts are not shaped from a single piece of wood but from several layers glued and pressed together with great force.

Despite these modern developments, however, the ideal violin is still sought by the makers of the world. So far, the early Italians are generally considered to have done the best work. A few instruments by Antonio Stradivari and by another Italian maker of whom we hear less, Giuseppe Guarneri del Gesù (1687-1745?), come close to perfection. Some of them have lost a little of their original power, but they have gained, if anything, in sweetness and clarity. They produce all their notes easily and flawlessly, and many of them look as beautiful as they sound.

THE VIOLIN BOW IS IMPORTANT

Yet we never would have known what these great violins can do if it had not been for the cunning work of a Frenchman named François Tourte (1747-1835), who learned to make a bow so light, firm and elastic that it could bring out all the possibilities of the violin. The first bows were short and curved much like the archer's bow from which they came. They were coarse in workmanship and were strung with cord. Horse-hair is far better because each hair has many minute bristles pointing away from the root in such a way that with the help of rosin they act on the string like the teeth of a saw. Somewhere between 120 and 250 white horse-hairs are needed for the violin bow. The best wood is either Brazilian lance-wood or snake-wood. A great many other kinds have been tried, but they have all proved inferior. Tourte's work set a standard for the bow-makers who came after him, and his name should be remembered with gratitude because great violins need great bows to make them sing their best.

Only a few fortunate people can expect to own one of the world's great violins, yet even the beginner will want as good an instrument as he can afford. Luckily, there are violins to suit every taste and pocketbook, from the crude and shiny new fiddle at ten dollars or less to the exquisite old masterpiece at thirty thousand dollars and more.

There are small violins for children; even tiny ones for little geniuses of three or four. There are violins with a pure, light tone, easy to produce and suitable for someone who plays quietly at home for his own enjoyment. The dashing soloist can find an instrument to meet his need for something brilliant and appealing. Those who use a violin in quartets or orchestras will want one that has resonance and good blending qualities. The most difficult to satisfy are probably the master-players. Their violins must respond to the most extreme demands.

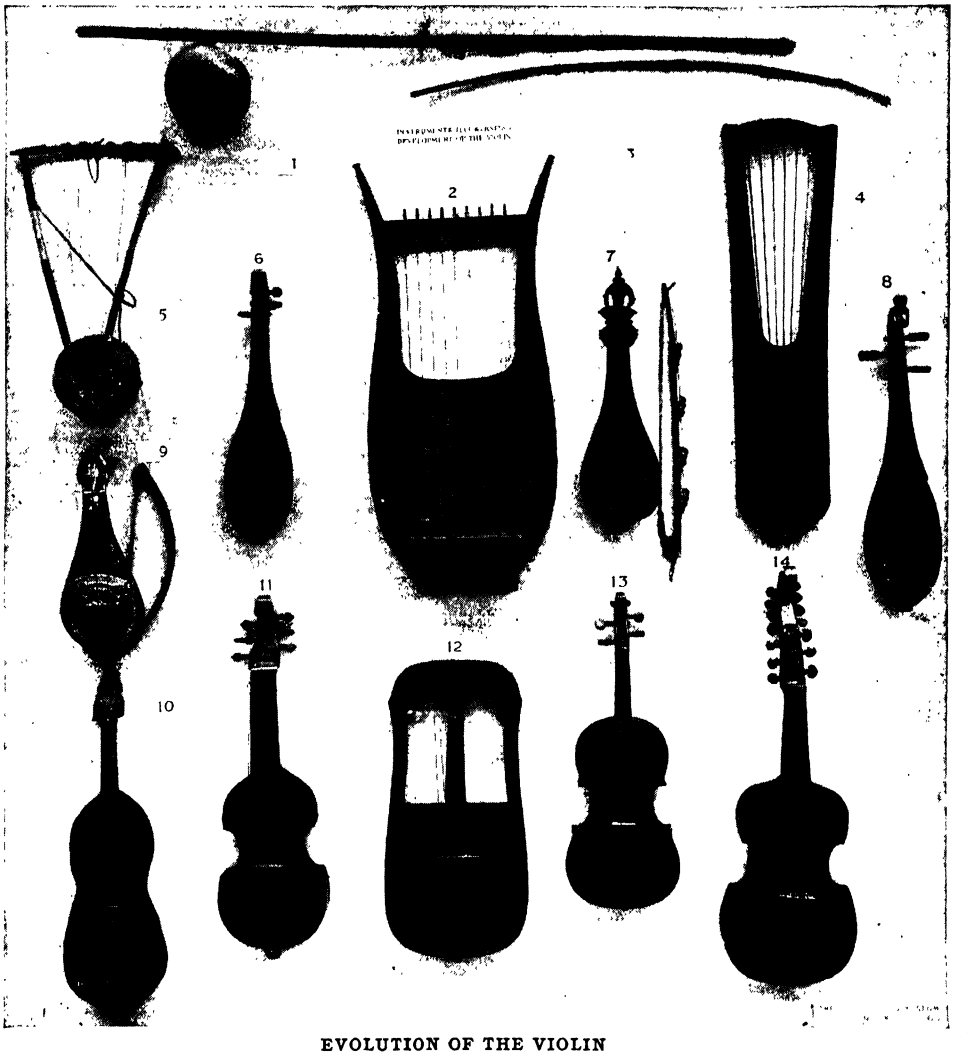
PAGANINI THE MASTER VIOLINIST

An example is Nicolo Paganini, a very famous violinist of the past, who played so marvelously that some people thought he must be more than human to have such incredible skill. He made his violin sound notes higher than any heard before, and he wrote pieces hard enough for most people to manage on all four strings, then played them himself on only one string. Sometimes he would tune his violin a half-tone higher than usual, so that the extra tightness of the strings made the tone super-brilliant. At least one of Paganini's violins, a Giuseppe Guarneri del Gesù, is in existence to-day. It is exhibited behind glass in the Municipal Palace at Genoa. Once a year it is taken out and played.

If you find in your attic an old violin, stringless, covered with dust and lacking even a bridge, is there a chance that you have discovered a Stradivarius or a Guarnerius, worth many thousands of dollars? Yes, there is a chance, but it is a very, very slim one, even though your mother tells you that the violin belonged to her father, who bought it from an old Italian, who said it had been in his family for generations.

Perhaps a neighbor volunteers the information that many rare violins have a label inside them, giving the maker's name, the place where he worked and the date. You look inside yours and,

sure enough, there is the label, written in Latin. It says the fiddle was made by Antonio Stradivari himself, at Cremona, in 1709. Then somebody locates a catalogue of rare violin prices, where you read that a Stradivarius, in good condition and with most of its original label is merely a forgery. Many of these forged labels were placed in violins made much later. If you live in a big city, go to the museum or to a reputable dealer, but remember that the chances are all against your having found one of the great Italian masterpieces.



EVOLUTION OF THE VIOLIN

1. Musical Bow With Resonator. 2. Greek Lyre. 3. Musical Bow. 4. German Rote. 5. American Lyre. 6. Moorish Rebec. 7. Cretan Lyra. 8. Medieval Rebec. 9. Arabian Fiddle. 10. Wendish Fiddle. 11. Viol. 12. Welsh Crwth. 13. Violin. 14. Viole D'Amour. Picture, courtesy the Metropolitan Museum of Art

parts still intact, was recently sold for $25,000. What next?

Take your find, just as it is, to the nearest trustworthy violin repairer, if you live in a small community, and don't be too disappointed if he tells you that the violin is old, but not valuable, since the

On the other hand, if your old violin turns out to be well made and in good condition, you will find that it can still sing; probably far, far better than that shiny new one you have been admiring in the window of the music store. The ear, not the eye, should guide your choice.

The Greeks knew much about music. They learned, perhaps from the Egyptians, how to measure the intervals of a scale on an instrument called a monochord. This was only a string stretched tightly across bridges.

THE CLAVICHORD, WHICH HAD KEYS

In the early centuries and in the Middle Ages, when no musical instruments were used in the churches, the monochord was used to give the pitch to the youths and young men who sang in the choirs of the cathedrals and monasteries. By and by its usefulness was increased by adding more strings, so that intervals of the chants could be taught also; and it is thought that the first idea for the clavichord was taken from a monochord to which more strings had been added, when, of course, it ceased to be a monochord, for that word means "one string."

Sometime, probably in the fourteenth century, someone invented the clavichord, and this was a big step toward making the piano, because the clavichord had keys. This instrument was made like a box inside of which there were a number of strings stretched across bridges. At the end of each key of the clavichord there was an upright piece of brass called a tangent. When the key was pressed, the tangent sprang up and by striking against one of the wires produced a note.

About a century after the invention of the clavichord the spinet, or virginal, came into fashion in England. This was the instrument on which Queen Elizabeth played, and was very much like the harpsichord, which came later. In both, a wooden arm set upright at the end of a key held a tiny quill which sprang up and plucked the string and then fell back again. The harpsichord was shaped very much like a grand piano. You see we are coming very near the piano, and also very near our own time. The great composers, down to Mozart and Beethoven, wrote for, and played on, the clavichord and harpsichord.

THE FIRST PIANO WAS MADE IN ITALY

The first real piano was made in Florence by an Italian named Cristofori, about the year 1709, not much more than two hundred years ago. It was called a pianoforte because it could be made to give either soft tones or loud ones, and the name has been shortened to piano, which simply means "soft." Cristofori made a number of pianos, but only two are known to be left in the world. The older of the two is in the Metropolitan Museum, and when you pay a visit to New York, you should be sure to see it. At first the new instrument was looked upon as a curiosity, but it was soon made in Germany, France and England. Many improvements were made in it in each country, and in a short time it came into general use.

THE FIRST PIANOS MADE IN AMERICA

The first pianos seen in America were made in England, but it was not long before they were made on this side of the Atlantic. In 1775 John Behrend, of Philadelphia, built the first piano ever made in America. Pianos have been built continuously since that time, and now there are many factories where excellent pianos are built, both in the United States and Canada.

At first the framework of a piano was of wood, but it was found that this was not strong enough. In 1800 an English engineer, John Isaac Hawkins, who lived in Philadelphia, built an upright piano in which he used an iron frame. In 1820 a Scotsman named Allen made a piano frame of iron tubes. This was improved on a few years later, in 1825, by Alpheus Babcock, of Boston, who made a cast-iron frame for a square piano. In 1843 Jonas Chickering, of the same city, made a full iron frame for a grand piano, thus completely solving the difficult problem of giving proper support for the great strain of the strings.

In 1855 Henry Steinway, a German who had come to live in New York, made a great improvement in the way of placing the strings in a piano. So you see that America has had a large share in producing the wonderful instrument that we know to-day. Many other inventions have been made in connection with the piano, but it is impossible to tell them all in a short space, and we have here the main outlines of this interesting story.

HOW THE SOUND IS MADE ON A PIANO

And now we want to know how it is that by simply striking the keys of a piano we can make music. Music, we know, is sound, and sound is caused by vibration. It is easy to understand the

vibration caused by drawing a bow across the strings of a violin, but the strings of the piano seem a long way off from the keys.

The answer is very interesting. Every key in the piano is a lever attached inside the case to a balanced piece of mechanism which ends in a hammer made of thick felt. This mechanism is called the action. But though this is an important part of the piano, it is only part. If we raise the cover of the piano we shall see that there is a strong iron frame shaped something like a harp. Across this steel wires are strung, stretched so tightly that if they were not immensely strong they would break; and if the frame were not immensely strong it would bend, or the pegs around which the strings are drawn would pull out.

THE DIFFERENT SIZES OF THE STRINGS

Down below the wires, or behind them in an upright piano, there is a sounding-board, and glued to the sounding-board are the bridges on which the strings rest. Some of the strings are longer than others, some of them are thicker and heavier than others. Those on the right hand—the treble side—are quite short, but they keep growing longer and longer, until the strings at the left-hand side, for the deep, low tones of the bass, seem to be too long for the case, and to find room they are stretched at another angle *across* some of the shorter strings. This is called "overstringing."

The strings are of very strong steel wire, which must be made in a particular way so that it will give a full, round tone. The strings of the very low bass are covered, or "overspun," with fine copper wire to make them vibrate more slowly. Every string belongs to a particular key, and most of the keys have three strings belonging to each of them. The low notes have only two, because they are thicker and overspun, and so can make a heavier sound.

Now let us go back to the keyboard, and strike a note, let us say middle C. Immediately its hammer springs up and strikes the three strings that have been tuned to sound this note in unison. The strings begin to vibrate. The bridge vibrates in unison with them. The sound is carried by the bridge down to the sounding-board, and the air all around is filled with waves of sound. That is how music is made on the piano. The beautiful story of waves of sound—how they are started and how they are carried to the ear—is told in the part of the Book of Our Own Life beginning on page 3305.

The pianos of today have reached a very advanced stage of development. From the huge concert grand, with its sensitive action and great range of power, to the tiny vertical type piano, a toy to look at and more or less of a toy to hear, there is an instrument for every purpose.



Photo, courtesy Metropolitan Museum of Art

Two keyboards, for soft and loud music, were not unusual in a harpsichord, the instrument we see here. The harpsichord was a forerunner of the piano. Its music was sweet, though tinkly.

Large grands are probably the best pianos in existence when it comes to playing qualities, but they are out of place in anything but a large room. The present need to fit a piano into a small space has been met by the vertical piano, an instrument half way between the square and the upright, itself a space saver in years gone by. (See page 1794.)

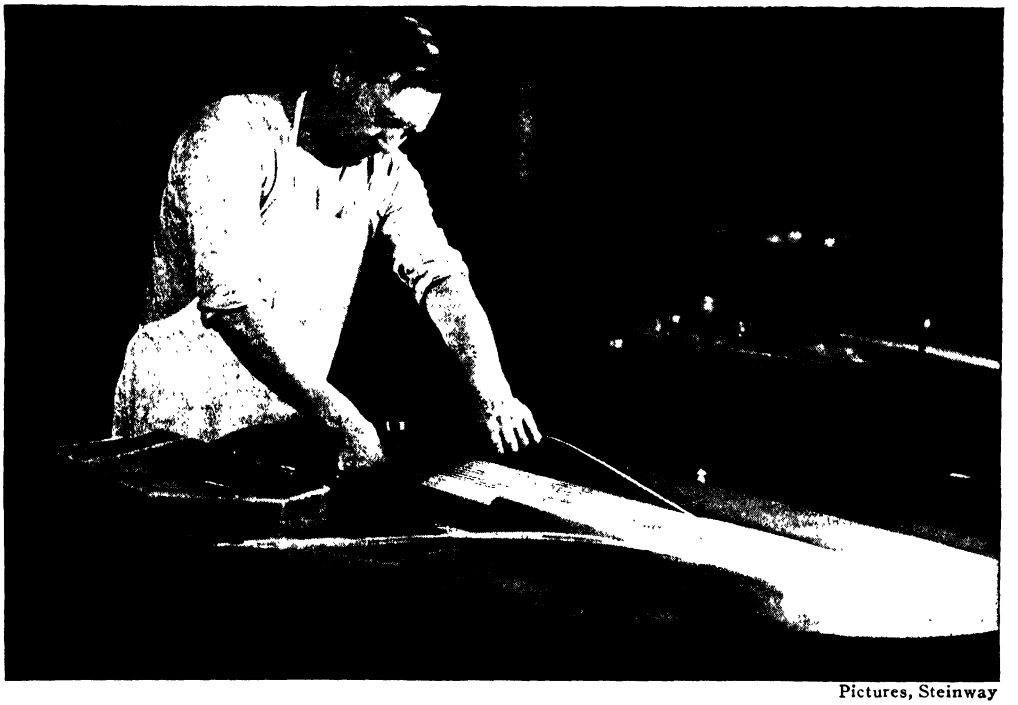
Formerly many "player pianos" were produced under special names, but the general principle remained the same. Holes corresponding to the notes in musical selections were cut in rolls of tough paper which were then inserted in the instrument. Air pouring through the holes lifted hammers as the roll turned.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 1873.

PIANO MAKERS AT WORK



The quality of piano tone is affected by the hardness or softness of the felt-tipped hammers that strike the strings. Here the hammers are being pricked with a needle to soften them.



Pictures, Steinway

A bass string is going into its place. Such strings are composed of a central wire around which another wire is closely wound. Wound strings are heavier than unwound ones and give a lower note for their length.

THE COVERING OF OUR BODIES

OUR SKIN, NAILS AND HAIR

WE usually think of the skin as the material that covers our bodies. It is far more than just a covering, however, for it serves us in other ways as well. For instance, it is one of the instruments by which the brain is made acquainted with the outside world.

We know that if we do not have enough light, growth is interfered with, and the blood becomes pale. We know, too, that we breathe more deeply under the influence of light; and that in a fixed time animals take in more oxygen and give out more carbon dioxide in the light than in darkness. This is due to the effect of the light on the brain; but it is not a direct effect, for the brain itself lives in darkness. It is due to the way in which certain nerves running to the brain are affected by light. These are the nerves of the eyes and the nerves of the skin in general.

The action of the skin in using sunlight is not yet fully understood, but we have learned a good deal about this during our study of vitamins. Vitamin D is called the sunshine vitamin; and the best way to secure enough vitamin D is to let the full, open rays of the sun shine upon the skin. Somehow the skin puts the ultraviolet rays to work; and many parts of the body benefit. Bones need the services of vitamin D, if they are to grow strong; and our teeth, nerves, heart and general health seem to depend on this vitamin's aid. Vitamin D can be taken in food, as well as by way of the skin. We tell you more about the good work of vitamin D elsewhere in our book. (See Index.)

Now let us look at the way skin is made. One of the first things we note is that it is beautifully elastic. Pull up the skin from the back of either hand. See how quickly it goes back from its stretched position. Every time we move, the skin is stretched somewhere, and then, by its elasticity, returns to its first position.



Harold M. Lambert, Philadelphia

This little boy, playing on the beach in the sunshine, is getting plenty of the vitamin D his body needs.

Even the most elastic thing in the world, however, has limits to its power, and this is true of the skin. As the years pass, the skin of the face begins to show lines and folds according to the way in which it has been moved. The bright and happy person shows his feelings by moving the skin of his face in a particular way; so does the person who is always thinking; so does the person who is gloomy. In the course of time lasting marks are made in the skin of the face, telling us something about the character of the person. In extremely old people the wrinkles that used to be present in the face often disappear, and the skin becomes thin and smooth.

The skin is waterproof—in one direction. That is, the skin can take water from the blood and allow it to escape, but water can not enter through the skin, not even through the little channels through which perspiration comes out.

The skin seems to be very thin, yet it has two layers, an outer and an inner layer. The inner layer is called the true skin, or dermis (after the Greek word for

skin, *derma*). The outer layer is called the epidermis (*epi*, in Greek, means upon). The true skin is alive. The epidermis is not alive; it has no nerves and no blood vessels. We rub bits of it off every time we wash, and we can prick it with a needle without feeling pain—only we must be sure not to let the needle pierce the dermis. It is the epidermis that forms over the base of the fingernails and toenails.

Though we rub off some of the epidermis every day, more is constantly being made by the true skin, as you notice at the base of your nails. The epidermis does not grow; for it is not alive and can not grow. It is pushed from behind by the new cells which the true skin is always forming.

The whole skin is made of cells—both the true skin and the outer skin, or epidermis. The cells of the true skin are alive, and when they grow to a certain point they divide into two, and make new cells. This goes on continually in the deep layers of the skin; and so it happens that the cells which have been already made are pushed upward and outward toward the surface by the young cells formed beneath them. After a time the old cells die; they become thin and flat and horny, and they form the epidermis, or outer skin. They protect the true skin and the whole of the rest of the body. Dirt from outside soaks into them, but soon they are rubbed away, and other dead cells take their places. In this way we are able to keep the surface of the body clean from day to day.

The color of the skin depends mostly on a substance called melanin, which is a pigment or coloring matter. Melanin is dark brown and is scattered in fine grains in the deepest layer of the epidermis. The more pigment the skin has, the darker the color. Thus the skin of the Negro is the darkest of any of the races because it has the most melanin.

THE IMPORTANT WORK THAT IS DONE BY THE GLANDS OF THE SKIN

Any part of the body that has the business of making special fluids is called a gland; glands in the stomach, for instance, making the digestive juices. Now, we find that the true skin contains a large number of glands that have a special purpose; they are called sweat-glands. Each one consists simply of a long coiled tube the end of which passes through the epidermis to the surface of the skin.

These tubes are lined with cells, and outside them, in the true skin, is a rich supply of capillary blood vessels. In every part of the true skin we find these sweat-glands, and they are working nearly all the time. We can see beads, or drops, of perspiration standing on the skin when the sweat-glands are very active at work. But even during an ordinary day, when you do not notice that you are perspiring, the skin discharges about twenty-five ounces of sweat. The sweat is 99 per cent water; the remaining one per cent is made up of a number of things, including common salt. Sweat is slightly acid when it is produced.

HOW THE SWEAT-GLANDS HELP TO KEEP US HEALTHY

In course of time the watery part of sweat passes into the air as water vapor, but the solid part is left upon the skin, as the salts of sea water are left in the sea when the water passes into the air. Even the cleanest skin contains many microbes, and some of these act on the solids that are left from the sweat, so that they are changed into something else that is unpleasant. This is one of the chief reasons for keeping the skin clean.

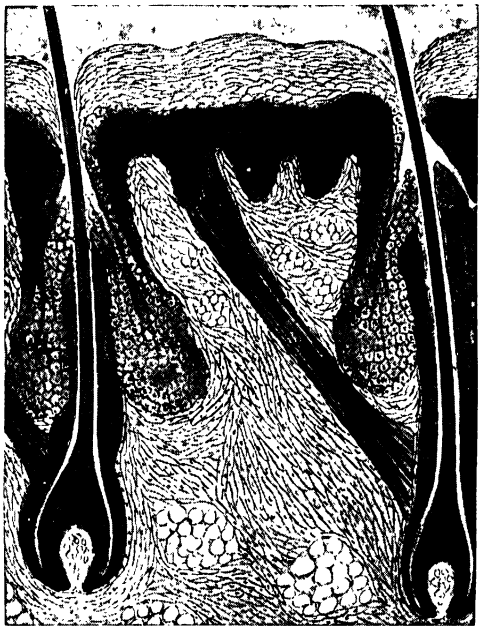
The production of sweat is one of the most useful things the skin does. Some of the solids of sweat are harmful substances the body needs to be rid of. The skin, through its sweat-glands, is one of the channels by which we dispose of waste products. How about the water in the sweat? It helps to dissolve and carry away things we do not want; and it has another use of great importance.

It is necessary for our health that the temperature of the body should be kept at a fixed point, summer and winter, day and night. The sweat is very useful in regulating the temperature. In very hot weather the body must lose heat, or its temperature will rise above the fixed point necessary for our health. So we produce a great deal of sweat, as everyone knows, and when the water in it leaves the skin it takes away a great deal of heat from our bodies. If, when you wash your hands, you dry only one of them, you soon find that what we call the evaporation of the water from the wet hand makes it much cooler than the other. Then, on a very cold day, when we need to keep all the heat we can, we perspire very slightly. Thus, the figure quoted above—twenty-five ounces a day—is only an average figure. The amount of sweat produced depends chiefly upon the body's need for heat.

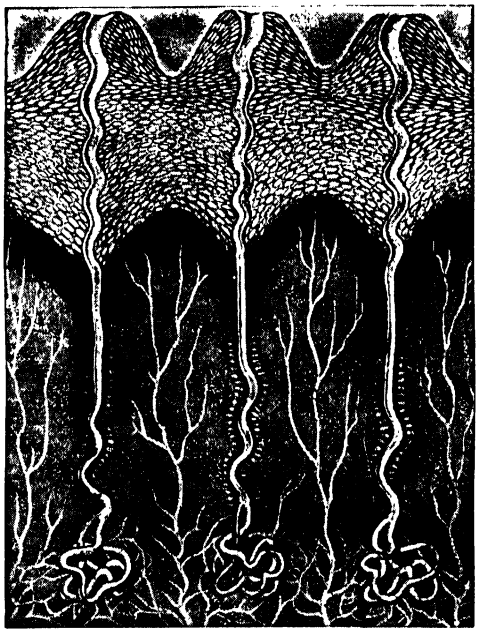
You must have noticed a dog lying panting, with its mouth wide open, on a very

hot day. The dog has sweat-glands only on the skin of the pads of its feet, and so it can not use our method of keeping cool on a hot day. That is why it suffers so much from the heat, and has to breathe quickly to get rid of as much water as possible by its lungs.

Then, again, you must have noticed how uncomfortably hot you become when the weather is what we call "close." On another day the temperature may be higher, yet we do not feel oppressed at all. The reason is that on the days which we call close, or muggy, there is a great deal of water already in the air. Now, the more water there is in the air, the more slowly can it take up any extra water. Indeed, the air may be so full of water that it will practically take up no more. This means that the sweat can not evaporate from the skin, and so our bodies are not cooled in this way. We are as badly off for the time as the dog, which can scarcely sweat at all. But on other days, though the air around us may be just as hot, yet it may contain only a little moisture, and so our sweat evaporates quickly and keeps us cool.



The layers of the skin—the horny layer, or epidermis, above, the true skin below. Piercing the cuticle, an other word for the epidermis, are the hairs, shown here with their glands and their muscles.



The sweat-glands begin in twisted coils down inside the true skin. They are continued as long tubes piercing the cuticle, and end in pores up at the top of the papillae, tiny elevations in the skin.

The sweat-glands are controlled from a "center," or station, in the lower part of the brain. From it proceed nerves which carry its orders to the millions of sweat-glands in the skin. So, when the blood becomes too hot, the sweat-center in the brain which has the hot blood passing through it gives an order, and the sweat-glands are set in vigorous action. There are various other ways in which the sweat-center may be disturbed; for instance, a man may sweat in great fear, even though he is quite cold.

But sometimes illness affects the sweat-center and it does not act properly. For instance, during fever the blood is too hot, and it is very desirable that we should sweat; yet the skin is both hot and dry. There are many drugs known which prevent sweating, and some which produce sweating. The most remarkable of these comes from an African plant, and a mere fraction of a grain of it will make the skin simply run with perspiration. A still smaller dose of another drug which comes from the plant called deadly nightshade will prevent all sweating for many hours. In both cases these doses are so small that they could not possibly act as they do if they had to be spread over all the sweat-glands. But they act on the tiny sweat-center in the brain, and that is why so little can produce such powerful results.

The skin is one of the great sense organs, particularly touch. However, we are rather

apt to confuse the various kinds of sensation that our skin gives us, as if they were all varieties of the same thing, but they are not. There is, first of all, the pressure sense, that is, the sense of touch. This is quite different from the sense of pain, or the sense of temperature.

THE NERVE-ENDS THAT GIVE US OUR SENSE OF TOUCH

If we examine the true skin, especially in the tips of the fingers and toes, we find special structures in it which are there for the purpose of touch. Nerves run to them, and the ends of the nerves spread out within them. Now, wherever these little nerve endings are most numerous, there our sense of touch is most responsive. There are many of them in the tips of the fingers. Many are found also in the skin of the lips, and they occur also in the tip of the tongue.

The sense of heat and cold is quite distinct from the sense of touch, and has a special set of nerves for itself. If you take a cold thing, like a key, and pass it over your cheek, you will find that it feels colder at some spots than at others, and the same is true of anything hot. The skin seems to be made up of a host of little spots—pressure spots sensitive to pressure or touch, cold spots sensitive to cold and not feeling heat at all, and hot spots that are sensitive to heat and do not feel cold at all.

Finally, there is the pain sense. Different parts of the body are differently sensitive to pain, and the skin is far more sensitive in general than the inside of the body. The pain sense has a special set of nerves, and in people who have something the matter with these nerves, so that the nerves can not act, the skin of the hand will appreciate heat and cold and touch, but pins can be run into it, or it can be pinched, without feeling pain at all.

HOW THE SKIN CONTRIBUTES TO OUR SENSE OF POSITION

So we must think of the skin as the organ for three senses—pressure, temperature and pain. Probably, too, we are helped to know the position of our body—where our hands and feet are, and so on—by the stretching of the skin in one part, or loosening of it in another part, which helps the brain to know when any change in the position of the parts of the body takes place. So the skin contributes to our sense of position.

In many parts of the skin there are special cells with the power of making certain outgrowths. Our skin does not produce so many of these as does the skin of some animals, but at any rate it produces two kinds of outgrowth—hair and nails. Our nails correspond to the claws of a cat and to the hoofs of a horse.

For many creatures these outgrowths of the skin at the ends of their fingers and toes are extremely important. Perhaps they catch their prey by them, or walk upon them, or climb by them. But for us they are far less important.

THE NAILS ARE A SPECIAL OUTGROWTH PRODUCED BY THE SKIN

Nails grow from below, and can be completely removed without destroying the cells which make them. If a nail is banged hard, it turns blue. That means that a blood vessel has been injured, and there has been some bleeding under the nail. A new nail gradually grows, and in time the old nail comes off. But if damage has been done to the special cells which have the power of making the nail, no new nail can ever be formed again.

Hair is another thing our skin produces. The part of the hair showing above the skin is made of much the same kind of material as the epidermis, or outer skin, which is also very much the same as the material that the nails are made of.

THE WONDERFUL WAY IN WHICH THE HAIR GROWS

Each hair grows from a special place in the true skin. The places from which the hairs grow are very complicated and beautifully made. Every hair really consists of six layers, all of which are made by the cells of the little hair-bulb from which the hair grows. There are special glands—usually two to each hair—which produce a kind of oil that keeps the hair soft and pliable, and prevents it from cracking. Also every hair has a muscle attached to its root, and when this tiny muscle contracts, it pulls on the hair and makes it stand upright. Sometimes we read stories of people whose hair stood on end. Such a thing really could happen, though it is not common.

We rarely use these little muscles, and no one can use them by his own will. A cat has them, and everyone who keeps a cat has seen its hair stand on end. The cat with its hair standing on end looks much bigger and more alarming than when its hair lies flat. It is probable that this is of use to animals in helping them to frighten their enemies and thus protect themselves.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 1929.



Cross from Monkmeyer

WHAT MAKES A DIMPLE?

IN ORDER to understand a dimple we should know the structure of the skin and what lies underneath it. In most parts of the body the skin, with its outer horny layer and the inner living layer, which carries nerves and blood vessels and makes the horny layer afresh from day to day, lies very loosely upon the layer of tissue beneath it. This is a loose layer, containing a certain number of fibers running in all directions, with fat cells lying between them in healthy people—except under the skin of the eyelids, where fat is never found even in the fattest people. A few of these fibers are attached to the under-surface of the skin, so that, though we can move the skin about very freely over what lies beneath it, there is a limit to this movement.

But where there are dimples, as on the face, and often round such joints as the knee and the elbow, the number of fibers attached to the under-surface of the skin is much

increased, and they are rather short, so that the skin is depressed, or dimpled, at these points. We see what is really the same thing produced accidentally in the case of many scars, which are often a little depressed below the general level of the skin because they are tacked down in the same way. But a scar differs from a dimple, as the skin over a scar has been lost, and is replaced by a new thing called scar tissue, while the skin over a dimple is true skin, without blemish.



Standard Oil Co. (N. J.) photo by Bubley

WHY ARE SOME PEOPLE DARK AND SOME FAIR?

If we examine with a microscope the structure of the skin of animals or human beings, we find that it is made up of numbers of cells arranged in layers. Among these cells is found coloring matter, or pigments, as the artists call it; and it is the quantity of this coloring matter present in any individual which causes the complexion to be called fair or dark. In very fair people there is very little pigment; in very dark people, with brown eyes and black hair, there is often a great deal of pigment; while others with a medium amount of pigment are neither very fair nor very dark. Hair color is also a matter of pigments. Hair pigment continues to be produced for many years; but when it ceases the hair becomes gray.

IF OUR SKIN IS WATERPROOF, HOW DOES MOISTURE PENETRATE IT?

The skin is truly waterproof and will let nothing from outside get through it. But it is pierced almost everywhere by tiny tubes that run out through the waterproof layer to the surface, from the true skin that lies underneath it. These tubes carry the sweat made by the little glands in the true skin. Water could, perhaps, get into these tubes, so that the skin would not be waterproof, if it were not that the sweat, coming out of them, forces back anything that might enter. If anything did enter, it could not get far, for it would find itself in an exceedingly tiny blind alley—the inside of the sweat-gland. If we rub into the skin very hard something such as cod-liver oil, which the sweat-glands are willing to take up into themselves and give to the blood, we can succeed in making it pass inward through the skin. Also, by means of electricity we can make liquid things pass in through the skin. But otherwise it is truly waterproof—in one direction. The skin can not, therefore, be nourished by any substance rubbed on the surface. Nourishment must come from the blood.

Pigment makes the difference in the coloring of the children at the left and the little girl below.

Standard Oil Co. (N. J.) photo by Vachon



WHAT IS IT THAT MAKES WRINKLES IN OLD PEOPLE'S FACES?

The wrinkles of elderly people are due mainly to the great elasticity of the outer layers of the skin, but also to a slow process of wasting. The skin is made up of several layers. The under layers are fatty and fairly thick; the outer layers are much thinner and more elastic, and stretch tightly over the muscles of the face. In older people the elastic tissues of the outer skin stretch too much and fall into folds or wrinkles. But also we notice wrinkles in people who have become rather thin. This means that a great deal of fat has disappeared from under the skin, so that it is too loose for the body and falls into wrinkles. In extremely old people the skin often becomes so thin that the wrinkles disappear.

WHY IS THE SKIN OF THE NEGRO RACE BLACK?

Nobody knows the complete answer to a question like this, because the origin of the races of mankind is lost in ancient history. We know that we find black people living in the hottest parts of the earth, in many places where white men find it extremely uncomfortable or unhealthy to live. Evidently the black races have developed some power of resisting the climate and the diseases peculiar to that part of the world.

As a result of this it would come about that only those who were black could live and survive there. In course of time there would be nobody except black people in such places, a black race thus being produced by nature's selecting the blackest people as those best fitted to survive there. The blackness is probably the result of the continued exposure to the great heat of the sun in the tropical countries. Some people have thought that black was the original color of the human race and that the white races have arisen from them. Whatever is the reason, the color of the skin evidently results from certain powers of human beings to adapt themselves to the conditions of climate in which they live.

WHAT IS AN ALBINO?

In the plant and animal worlds certain cells contain coloring matter which is called pigment. Humans have, for instance, varying pigments in the skin, so that we have white, black, red, yellow and brown-skinned people. Pigment in the hair cells determines the color of hair, and in the iris of the eye



Wrinkles often tell a story of gentleness and love.

it is also present so that we have black and brown and blue and gray and even green-eyed persons, thus giving a pleasant variety.

Actually, the color of the skin depends on three things: the material of the skin cells, which is mostly yellow; the layer of blood vessels beneath, which gives it a reddish tinge; and the skin pigment, which gives various shades of brown.

Occasionally a baby is born who lacks pigment. In such a person the skin is of a peculiar milky white, and the hair also; but the eyes are pink. This is because the iris is so transparent that the blood in the tiny capillaries shines through. We call such people albinos. The word comes from the Latin *albus,* white.

Albinism has been noted often among American Indians, and explorers have found whole tribes of albinos in Africa. Partial albinism is more frequent than complete lack of color.

The phenomenon is seen to be a protective device of nature in hares, ermines, foxes and some birds which change from dark to white in the winter. In such cases, however, the eyes retain their coloring, which is a good thing for the animals, because the glare of light on the snow and ice would be harmful to sensitive eyes not provided with dark-shaded coloring.

White mice and white rabbits with pink eyes are albinos. There are also albino plants.



WHY DOES HAIR GROW AFTER THE BODY HAS STOPPED GROWING?

Certain parts of the body grow into certain shapes and sizes and no farther. Other parts of the body have the capacity to keep on growing as long as the body itself is alive. These structures that are meant to protect the body, such as the skin and hair, are constantly being worn away, and are reproduced as quickly as they are lost.

WHY DO HUMAN BEINGS HAVE FINGERNAILS AND TOENAILS?

The nails on our fingers and toes give a certain protection and added power to the ends of those digits. They are made of about the same material as the claws and hoofs of animals. The cat family needs strong, sharp claws for holding and tearing its food. The horse family needs strong hoofs for pounding over the ground. The ancestors of the horse had five fingers and toes and a nail on each. All these digits except the middle ones on each foot have shrunk, until we can find on the horse only one great toe on the ground, with a large nail, or hoof, and the remains of two other toes, one on each side of the hoof. Like our fingernails, the horse's hoofs and the cat's claws can be cut without pain.

WHY DO SOME PEOPLE LOSE THEIR HAIR?

There are three main reasons for the loss of hair. Disease is one of them, particularly disease of the scalp. The wearing of tight hats is another. Men's hats fit closely, so that the blood does not circulate freely and nourish the hairs.

The most important reason for baldness is probably heredity. Baldness is a family trait, and little can be done to prevent loss of hair if the trait runs in a family. Men are more apt to be bald than women.

WHY DOES THE CHAMELEON CHANGE ITS COLOR?

The chameleon changes color to look like its surroundings and so conceal itself from enemies. This ability the chameleon shares with many other lizards, and they are able to change because they possess within the skin a great number of small cells closely packed together, filled with small granules. This causes a white color by reflecting light. Other cells are full of oil drops and appear yellow; others contain brown or reddish pigment; and the changes in color are brought about by contraction of different parts of the skin, and the movement of the different pigments.

Thus, when all the pigment is forced toward the surface, the animal looks quite dark. When the pigment is not so near the surface the color is changed to green, and where there is no pigment the skin appears yellow. These changes appear to be under the control of the chameleon, but such conditions as heat or cold also cause changes in the color.

WHAT ARE THE SPOTS THAT WE CALL FRECKLES?

What we usually speak of as freckles are spots of a yellowish brown color that sometimes appear on the skin, especially after exposure to strong sunshine. They occur chiefly on the face, neck and hands. Some people are much more likely than others to freckle, and in some it disappears quickly, while in others it lasts a long time.

In all these cases the freckles are the result of the action of the sun on certain cells of the skin, which causes them to produce more pigment than usual. There are cases, however, in which freckles do not appear to be caused by hot sunshine or exposure, but come naturally, just as the skin is fair or dark.





Why Does It Not Hurt When We Cut Our Hair?

We feel pain when we suffer from any kind of injury because almost every part of the body has innumerable small nerves in it, which carry to the brain the sensation of pain. It follows that if there were no nerves there would be no pain; and, as a matter of fact, when a doctor wishes to do anything to a patient which would be very painful, he uses some means to deaden the endings of the nerves in the skin. It happens that our hair, like our nails, has no nerves, and therefore may be cut off in nearly every case without causing any pain.

THE NEXT WONDER QUESTIONS ARE ON PAGE 1933.









Pedro do Valdez, one of the leaders of the Spanish Invincible Armada, surrenders to Sir Francis Drake.

THE STORY OF ENGLAND

III. HENRY VII TO THE CORONATION OF JAMES I

HENRY TUDOR, of the House of Lancaster (1457-1509), mounted the throne of England in 1485 as Henry VII. The country was heartily sick of the wars between the houses of Lancaster and York. Henry provided a welcome solution by marrying Elizabeth of York, sister of those young princes whom Richard III had caused to be murdered in the Tower two years previously. The marriage between the two rival houses was popular with the people and with the nobles, and so Henry's reign started well.

Henry's first task, to insure peace in the land, was to make the position of king more secure. To do this he must weaken the power of the nobles so that they could no longer take up arms against the throne whenever the whim seized them. Henry promptly punished barons who showed signs of disloyalty, bringing them to trial and inflicting the death penalty on some, as an example to the others.

A special court, known as the Court of the Star Chamber, was created to try persons who kept large bodies of armed troops, bribed or threatened sheriffs, or took part in riots or unlawful gatherings. There was no jury in these Star Chamber trials. Luckless indeed were the men who were haled before the judges. But the measures worked. By the end of Henry's reign, both the nobles and Commons in Parliament were of less importance than the ruler; and peace was maintained.

Henry was a good business man. He realized that a ruler lost power if he had to depend upon either Parliament or the wealthy subjects for money. With this in mind he reorganized the finances of his kingdom. From lands owned by the Crown, from custom duties and grants made by Parliament, the King drew a large income. In addition to this, wealthy nobles were expected to make generous contributions to the private purse of the Monarch. Other funds were raised by imposing large fines upon rich barons who had displeased the King and by threatening wealthy men with misfortune if they were not willing to share their wealth with the King. By these and other devices, Henry VII piled up a fortune.

The strong measures which Henry took with the nobles insured peace at home. In his dealings with foreign nations, Henry

showed an equal wisdom. He married his oldest son, Arthur, to Catherine, a princess of Spain. When Arthur died, the King invited Catherine to remain in England as the future bride of his younger son and namesake, Henry. His daughter Margaret was married to the King of Scotland, thus creating a bond with that country.

Years of peace gave the people of England an opportunity to advance in many ways. English traders were encouraged and given preference over foreign traders, and the foundations of the commercial greatness of England were laid. Christopher Columbus, in a ship flying the Spanish flag, discovered the New World in 1492. All Europe began to dream of riches to be had from across the ocean. Henry VII shared the bright dream, and in 1497 and 1498 John Cabot discovered what was probably Cape Breton Island, Newfoundland and Labrador; and he sailed down along the coast as far as Maryland. He claimed for England the lands he found.

The Renaissance, or Revival of Learning, reached England during the reign of Henry VII. We tell you about the Renaissance on page 5088. Think of it as a wave of enthusiasm for learning and for artistic and literary improvement—a wave that rolled westward, reaching England after it had passed through Italy and France and had spread its fringes through Germany and Spain. Great paintings and sculptures were produced, literature flourished, magnificent buildings were erected, learning in general took a long step forward; and a few of the greatest Renaissance minds turned to the study of human welfare. For lack of a better title, we call those men by the homely name of Humanists. The Humanists were students and reformers who wanted to spread education and improve schools, stop wars and get rid of unjust and unwise laws.

There was a group of Humanists in England, several of them teaching at Oxford; John Colet, Linacre and others. To them went the Dutchman Erasmus and the English youth Thomas More, who was to surpass them all. If we think of the Renaissance as a wave, let us remember that it crept slowly upon England in Henry the Seventh's reign. Not until the time of Henry's granddaughter, Elizabeth, did the wave sweep the nation in a glorious flood.



Culver Service
Henry VII.

HENRY VIII, SON OF HENRY VII, BECOMES KING AT THE AGE OF EIGHTEEN

Henry VII died in 1509 and his son became king, Henry VIII. This Henry was born in 1491 and died in 1547. The new king was only eighteen years old when he ascended the throne, but he was well prepared for his position. He was a large, strong, handsome young man, good-humored, jolly and fond of all kinds of sports. His open, hearty manner made him extremely popular with his people and he was known affectionately throughout his kingdom as "Bluff King Hal." Henry VII had left him a fortune. In accordance with the plans of his father, Henry VIII had married the Spanish Catherine, his brother's widow.

During the first fifteen years of his reign Henry VIII took little interest in the affairs of his kingdom, but, like his father, he chose able ministers to represent him. His chief adviser was Thomas Wolsey, a brilliant statesman. Although a commoner, Wolsey became so valuable to the King as an adviser that he was made Lord Chancellor, Archbishop of York and finally Cardinal. Wolsey remained the power behind the throne for twenty years. His wealth came to rival that of the King.

Henry VIII and Cardinal Wolsey were not successful in keeping the nation at peace. France and Spain were continually at war during this period and because of the King's Spanish marriage and alliance, England was drawn into the wars. For the first time since the Hundred Years' War, Englishmen fought on French soil. They acquired a little more territory around Calais, the only remaining French possession of the English, but the wars were costly and the government became deep in debt. Once more men with money were called upon to contribute to the financing of the government.

One of the most spectacular events of this period was a meeting of Henry VIII and Francis I of France near Guisnes, France. So magnificent was the camp that it was called the Field of the Cloth of Gold. This conference was arranged with the hope that a friendship between the two kings might prevent further wars. All the important members of the courts of both nations attended the meeting. Elaborate entertainments were held and costly banquets were given by both kings. Although many promises were made, the meeting did not result in a lasting friendship between the two nations. They were soon to be further divided on the question of religion.



Catherine of Aragon.



Anne Boleyn.



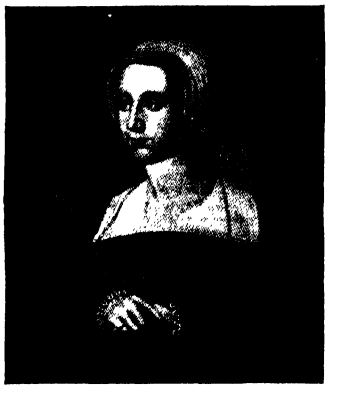
Jane Seymour.



Anne of Cleves.



Katherine Howard.



Catharine Parr.

The most important event of the reign of Henry VIII was the break between England and the Roman Catholic Church. This came about as a result of Henry's desire to divorce Catherine. According to the laws of the Church, a man could not marry his brother's widow. The pope could, however, grant permission for such a marriage, and before Henry married Catherine this permission had been granted. During their marriage, Catherine had had several children, but only one, a girl, had lived. Henry was anxious to have a son. He convinced himself that he was being punished for having married Catherine. He also fell in love with a young woman of the court, Anne Boleyn. For these reasons, Henry felt that he should win his freedom from Catherine. Divorce is strictly against the laws of the Church; but Henry applied to the Pope for annulment of the marriage, on the grounds that Catherine was his brother's widow. Since the Church had made this marriage valid, the Pope refused now to say that it had not been valid after all. Henry was determined to get his own way.

Cardinal Wolsey, the King's minister, was intrusted with the task of gaining the Pope's consent to an annulment or a divorce. As the years went by and the divorce was not

granted, Wolsey lost favor with the King and Thomas More, now Sir Thomas More, was made Lord Chancellor against his will. Still the Pope refused to grant Henry's request.

After many attempts had failed to induce the Pope to carry out his wishes, Henry took matters into his own hands. He called a session of Parliament and instructed them to pass certain laws known as the Reformation Acts. One of these acts provided that no money from the church possessions in England could be sent to the pope. Another declared that church problems must be settled in English courts and not in the papal court in Rome. Still another act gave the king the power to appoint the bishops without consulting the pope. The most important law, known as the Act of Supremacy, declared that the king, not the pope, was the supreme head of the Church of England.

This desire of the King for a divorce was only one reason for England's breaking away from the Church of Rome. In older times when the nobles had been divided into groups fighting among themselves, the united bishops had made the Church stronger than the government. Since the time of Henry VII, however, the king had been growing in power, and with the nobles on his side a monarch could do about as he pleased. The English had become very patriotic and proud of their country. They did not like to have foreigners, such as the Pope and the church officials he appointed, controlling any of their affairs. Finally, this was a period of change and many people wanted to change some things about the Church. These people were called Protestants (they protested certain things); and this break from the Church at Rome is called the Reformation.

Soon after breaking away from the Roman Catholic Church, Henry VIII, through his chief minister, Thomas Cromwell, closed the monasteries in England on the ground that although in former times the monasteries had done a great deal for the people, they were no longer very useful. Henry VIII's father had left a fortune, but the son was not a good manager or a thrifty man. He was always in need of money, and by closing the monasteries and seizing the property for the Crown, he increased his rents.

Using various excuses, Thomas Cromwell did this work for the King. Monks and nuns were forced to leave the monasteries and convents, and the land and treasures were turned over to the Crown. Henry gave some of the church lands to nobles whom he wished to reward for their services or their friendship. Not all the influential men in England approved of this and some, including Sir Thomas More and Fisher, the Bishop of Rochester, were executed for objecting to the measures.

Breaking away from the Church of Rome had a number of important effects. The BIBLE was translated into English and read at church services. Other parts of the church service were conducted in English instead of in Latin. The form of worship became much simpler and many of the beliefs of the Roman Catholic Church were no longer accepted.

THE SIX WIVES OF HENRY VIII

1. Catherine of Aragon, daughter of Ferdinand and Isabella, monarchs of Spain. Divorced. Her daughter, Mary Tudor, became queen of England after Edward VI died.
2. Anne Boleyn. Beheaded. Her daughter, Elizabeth, became queen of England after Mary Tudor died.
3. Jane Seymour. Died. Her son became king, Edward VI.
4. Anne of Cleves. Divorced.
5. Katherine Howard. Beheaded.
6. Catharine Parr. Outlived the King.

The last years of the reign of Henry VIII were not very happy. The King was married six times and had only three children from all these marriages. His oldest daughter, Mary, was the child of Catherine; Elizabeth was the child of Anne Boleyn; and his only son, Edward, was the son of Jane Seymour. In order to prevent quarreling over the throne after Henry's death, Parliament passed a bill permitting Henry to decide in his will who would reign after him. According to the will, his son Edward was to become king. If Edward died without heirs, Mary was to rule; and if Mary died without heirs, the throne was to go to Elizabeth.

EDWARD VI, SON OF HENRY VIII AND JANE SEYMOUR, SUCCEEDS HIS FATHER

When Henry died in 1547, Edward VI (1537-1553) was a boy of ten. The government was controlled first by the young king's uncle, the Duke of Somerset, and later by the Duke of Northumberland. Both these men were Protestants and wanted to make the Church strongly Protestant. A new prayer book was written entirely in English and its use was required in all churches. Crucifixes,

images and other decorations were removed from the churches. The clergy no longer wore elaborate robes at church services; and they were allowed to marry.

The reign of Edward VI was a time of great hardship and suffering for the lower classes in England. Many farmers lost their homes when the land they had formerly rented was taken for sheep raising. The cities were filled with beggars, and vagabonds wandered over the country. Unsettled conditions abroad disturbed trade.

Edward VI died in 1553 at the age of sixteen. According to the will of Henry VIII, Edward was to be succeeded by his sister Mary. This was not according to the wishes of the Duke of Northumberland, the head of Edward's government. Before Edward's death the ambitious Duke arranged a marriage between his own son and Lady Jane Grey, a great-granddaughter of Henry VII. Then Northumberland had the dying king declare Lady Jane to be heir to the throne. As soon as Edward VI died, Lady Jane Grey was taken to London and proclaimed queen.

However, Mary Tudor, daughter of Henry VIII and the legal heir to the crown, was not willing to give up her claim to the throne. Many nobles supported her. The troops refused to obey Northumberland's orders to seize Mary and bring her to the Tower. After nine days Mary became queen. A few months later Lady Jane Grey and her husband were executed for high treason.

QUEEN MARY, WHO CAUSED ENGLAND TO ENTER THE CATHOLIC CHURCH AGAIN

Mary Tudor (1516-1558) was an unhappy and unlucky queen. In the early part of her reign there were several revolts against her. Mary was an ardent Catholic, and she became convinced that these revolts were caused by those who opposed the Catholic Church. She adopted a harsh and cruel policy toward Protestants. So many Protestants were put to death (some burned at the stake as heretics) that she is sometimes called Bloody Mary. She succeeded in having Parliament repeal the Act of Supremacy and England again entered the Roman Catholic Church. In order to strengthen the cause of the Catholics, Mary married a Spanish prince, Philip, who later became Philip II, king of Spain. Numbers of Englishmen resented this Spanish marriage. One result of it was that England was again drawn into war with France; and before the war was over England had lost Calais,



Thomas, Cardinal Wolsey at the height of his power as the Lord Chancellor of England in the reign of Henry VIII.

her last possession on the mainland of France. When Mary died in 1558, the English people hoped for better things under the reign of her younger half-sister, Elizabeth.

THE REIGN OF QUEEN ELIZABETH WAS A GREAT PERIOD IN ENGLISH HISTORY

Queen Elizabeth (1533-1603) reigned from 1558 to 1603, more than forty-five years. This long reign was one of the greatest periods of English history. The new queen was young, intelligent and well educated. She chose her advisers wisely and she was willing to listen to advice even though she did not always follow it. Elizabeth's one great concern throughout her life was the welfare of England and her people.



Mary Tudor.

Since the time of Henry VIII religion had been an important political problem. This was one of the first questions settled in Elizabeth's reign. Parliament passed the Act of Supremacy which made the ruler the head of the Church and the Act of Uniformity which made legal the beliefs established during the reign of Edward VI. The form of worship and the kind of church services to be held were defined by law and all people were required to belong to the Church and to attend the Sunday services regularly. Although this settlement satisfied most of the people, the Roman Catholics and some of the stricter Protestants, known as Puritans, were not satisfied.

From the beginning of her reign, Elizabeth's foreign policy was to keep England out of wars on the continent. One of the important reasons for the greatness of England during this period was her success in carrying out that policy. One of her first acts as queen was to start arrangements for peace with France.

England really needed years without war. The English navy was small and in poor condition, and the army had only a few, poorly equipped troops. The fortifications of the island were in bad repair, and the treasury was almost empty. Peace with Spain was especially necessary because Spain ruled over the Netherlands to which the English shipped most of the goods which they manufactured. War with France would have been dangerous because France was allied to Scotland and could use Scottish ports to land invasion armies.

Avoiding war with these countries was a difficult matter. Spain resented the fact that England had again withdrawn from the Catholic Church; and Philip II, widower of Mary Tudor, felt that he had some interest in England still. The French situation was dangerous because Mary of Scotland, a rival for the throne of England, was married to the French king.

Elizabeth used many schemes to remain at peace with these two nations. One of the most successful was her pretended willingness to marry an important noble of either country. So long as either the French or the Spanish could hope for an alliance through marriage, they would not declare war on England. Actually, Elizabeth never married. She became known as the Virgin Queen.

Another method used by Elizabeth for keeping England out of war was encouraging quarrels between France and Spain. She also gave secret aid to the enemies of the two countries. In such manner Elizabeth managed to keep her country at peace, and during these years of peace England grew strong and wealthy.

The condition of the poorer people in England had become steadily worse during the reigns of Edward VI and Mary. The closing of the monasteries and the development of sheep raising, which had taken many small farmers from the land they had rented, had forced large numbers of people to wander around the country looking for work. Since there wasn't enough work for all, the city streets were filled with wretched beggars, and the highways and villages contained many tramps. Some of these organized into bands of outlaws who made the roads unsafe for travel. Elizabeth tried to relieve this situation by having Parliament pass a law requiring the prosperous people in each community to contribute to a fund to care for the paupers. Begging was prohibited.

MARY QUEEN OF SCOTS HAD A STRONG CLAIM TO THE THRONE OF ENGLAND

Mary Queen of Scots had a claim to the throne through her grandmother, Margaret, who was the sister of Henry VIII. Although she was a Scot, Mary had been raised in the French court. For about a year and a half she had been Queen of France, wife of the king, Francis II. Mary was a Catholic and the Catholic nobles in England who wished to make her queen claimed that since Henry's divorce from Catherine had never been recognized by the Church, Elizabeth was not the legal heir.

After Mary's husband, the king of France, died, Mary returned to her own kingdom of Scotland. There she was very unhappy. The Scottish court was dull and uninteresting to her after the excitement of France. Most of the people of Scotland were Protestants, and Mary found her position as Catholic queen of a Protestant nation difficult. Thus she was willing to listen to the plots of the English nobles who wished to make her queen of England. Mary married Lord Darnley, one of the few Catholic nobles in Scotland. (He was her cousin, and half English.) They had a son.

The marriage was not a happy one, and Darnley was murdered; Mary's subjects suspected her of having helped to plan the murder. Shortly after Darnley's death, Mary married the Earl of Bothwell, who undoubtedly had been connected with Darnley's murder. Though Bothwell was a Protestant, the Scots rebelled against this marriage; and Mary was forced to abdicate (give up the crown). Her young son James was crowned king of Scotland.

Mary escaped from Scotland to England and begged Elizabeth to lend her an army to regain her kingdom. Elizabeth did not think it would be wise to help her rival and refused Mary's request. For the next nineteen years Mary of Scotland remained in England. During much of that time she was actually a prisoner in the castle of Fotheringay, where Elizabeth allowed her to live.



A meeting in England between beautiful ill-fated Mary Queen of Scots (in heart-shaped bonnet) and her powerful cousin, Queen Elizabeth.

All during the time Mary lived in England she was a constant threat to Elizabeth. Several plots to kill Elizabeth and place Mary on the throne were discovered. There was always the danger that France or Spain, both strong Catholic nations, would join Mary's followers in an effort to overthrow Elizabeth. Finally, in 1586, the Queen's ministers learned of another plot. Six members of Elizabeth's court had sworn to murder Elizabeth and free Mary. There was evidence to prove that Mary herself knew of this plot. She was brought to trial. The commission which tried her found Mary guilty of plotting to kill Elizabeth and she was condemned to death. After much hesitation Elizabeth signed the death warrant and Mary was executed in 1587.

During all this time the people of England were becoming more prosperous. The



Mary Queen of Scots being led to execution. She had been condemned to death by a commission which found her guilty of plotting to kill Queen Elizabeth. Mary is one of the most tragic figures in all history.

country was developing into a great industrial and commercial nation. Many skilled workers from the Continent came to England and brought new trades with them. These new industries produced more goods for export. English merchant ships sailed to all the important ports of France, Spain, Germany, the Netherlands and the Mediterranean Sea. Adventurous mariners sailed northward and opened trade with Russia. A growing interest in the New World led to several unsuccessful attempts to start colonies in America. Sir Walter Raleigh tried three times to establish a colony in Virginia, but no attempt succeeded. He it was who introduced tobacco and potatoes to the English.

DARING ENGLISH SEA CAPTAINS WHO SOMETIMES BEHAVED LIKE PIRATES

Daring captains sailed to Africa and then crossed the Atlantic to trade with the Spanish West Indies. For Spanish colonies to trade with the English, or with any foreigners, was against the Spanish law; and many a time the English sea-rovers had to fight it out with the Spanish when their ships met. Many a time also the English sea captains behaved like pirates, raiding Spanish ships and colonies and seizing valuable treasure. The most famous sea-rover was Sir Francis Drake, who sailed around South America, seizing over $4,000,000 in gold and jewels, and continued across the Pacific and around the world. He was the first Englishman to sail around the globe. After this exploit the Queen conferred knighthood upon him.

The activities of these sea-rovers finally angered Spain to the point of going to war with England. Other causes of the war were the English aid to the Netherlands rebellion, and the desire of Philip to restore England to the Catholic Church. In the spring of 1588 a large fleet, called by the Spanish the Invincible Armada, prepared for an invasion of England.

When the news reached England that such an armada was being made ready, frantic plans to meet the invasion were made. The militia was called out and great signal fires were laid along the coast to give warning of the approach of the Spanish. The navy was assembled and famous admirals such as Drake and Hawkins made ready to defend their country. Other ships, privately owned, joined in the defense.

On July 30, 1588, the Spanish ships sailed up the English Channel. As they passed, smaller, more easily managed English ships attacked from the rear. When the large Spanish vessels were crowded together in the

narrowest part of the Channel between Dover and Calais, the English navy attacked fiercely and destroyed many Spanish vessels. A great storm came up and blew the heavy Spanish ships into the shallow waters off the coast of France and Flanders, where more of them were destroyed. The disordered Spanish fleet then fled through the North Sea.



The Spanish built a great fleet of armed ships, which they said was invincible. But the Invincible Armada suffered defeat when it came up against the English.

The last years of Elizabeth's reign were a time of peace and prosperity. There were more wealthy men in England than ever before. They lived in beautiful, comfortable mansions. Dress was elaborate; both men and women wore silks and velvets and laces and ornaments of gold, silver and precious jewels. The plain people enjoyed more comfort than in former times. Prosperous farmers and merchants had chimneys and glass windows in their houses; they slept on mattresses and pillows instead of straw mats and blocks of wood as formerly; they had a pleasant variety of food and ate from pewter plates instead of wooden ones. Poor laws provided work for many unable to find employment; food and shelter were given to the poor who were unable to work.

The Age of Elizabeth produced many important writers. Among the poets were Sir Philip Sidney, and Edmund Spenser, who wrote THE FAERIE QUEEN. Sir Walter Raleigh, the famous courtier, and Sir Francis Bacon were writers of note. One of the most popular forms of entertainment during this time was the drama; and there were many important writers of plays including Christopher Marlowe, Robert Greene, Ben Jonson and William Shakespeare. Shakespeare was the greatest English writer who ever lived, perhaps the greatest in any language. His works are still read by educated people; his plays are still often produced on the stage. Moving pictures have been made of some of them. Several have been made into operas.

We speak of the Humanists on another page. Thomas More, the most steadfast and brilliant of them all, wrote in Latin a book which is still one of the world's treasures. He wrote it in Latin in 1516, during Henry VIII's reign. He called it UTOPIA (No Place). It is a romantic account of a happy state where all men have equal rights and equal duties; and where human dignity is respected. The author, who had for a time Henry's highest favor, and later was beheaded at Henry's orders, became in 1935 a saint in the Roman Catholic Church. During Elizabeth's reign UTOPIA was translated from Latin into English.

The bright wave of the Renaissance was in full flood over England during the reign of Elizabeth. Even today, almost 350 years later, when we speak of this time as "the days of the Good Queen Bess," "the Golden Age" or "the Elizabethan Age," we call to mind a happy time of spacious dreams, great adventure and accomplishments in art, literature and science. The story of the Renaissance, which begins on page 5088; and the article on Scientists of the Renaissance, beginning on page 641, will tell you more about this period.

Queen Elizabeth died in March, 1603, at the age of seventy, after having ruled England for almost forty-six years. Before her death she named as her heir James, the son of Mary Queen of Scots. The government agreed, and thus James VI of Scotland became also James I of England. The two countries were at last on the way to union; at least, the same man was king of both.

By FLORENCE V. GEEHR.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 1934.

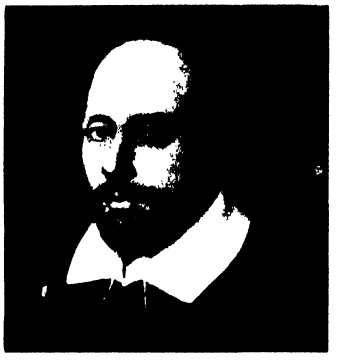
GREAT FIGURES IN TUDOR DAYS



FRANCIS BACON



LORD BURGHLEY



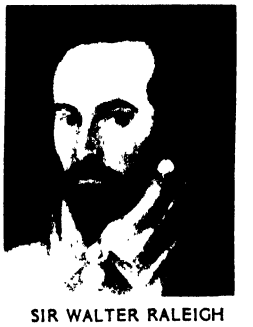
WILLIAM SHAKESPEARE



EARL OF ESSEX



QUEEN ELIZABETH, BY ZUCCHERO



SIR WALTER RALEIGH



SIR FRANCIS DRAKE



EARL OF LEICESTER



MARY QUEEN OF SCOTS



THOMAS CRANMER



ANNE BOLEYN



HOLBEIN'S FAMOUS PORTRAIT OF HENRY VIII



THE BOY KING, EDWARD VI, BY HOLBEIN



QUEEN ELIZABETH SIGNS THE DEATH WARRANT OF MARY QUEEN OF SCOTS, BY JULIUS SCHRADER



THE LAST HOURS OF QUEEN ELIZABETH. FROM THE PAINTING BY PAUL DELAROCHE



QUEEN ELIZABETH MAKES MERRY WHILE RALEIGH LANGUISHES IN THE TOWER



THE FOUNDATION OF ST. PAUL'S SCHOOL BY KING HENRY VIII



Chicago Natural History Museum

A group of tapirs in their natural surroundings. They are strange-looking animals, with clumsy bodies and long noses.

THE TAPIRS and THE RHINOCEROSES

AMONG the hoofed animals, or ungulates, there are some with an odd number of toes. The horse family belongs to this group, as you will see in a later chapter. Such animals make up the order Perissodactyla, or odd-toed ungulates. In this article we shall tell you about two families of the order, the tapirs and the rhinoceroses.

The tapirs, in much the same form as they are today, once inhabited a greater territory than they do now. Their fossil remains have been found in Asia, including China; in Europe, including England; and in the United States. This will explain how it is possible to connect the distant ranges of the existing tapirs. Tapirs today are found only in Central and South America and in the Malayan region of southern Asia. At one time these ranges, so far apart, were connected by other tapirs now long extinct.

The tapirs are peculiar-looking animals. Their bodies are heavy and ungainly. On their forefeet they have four toes, but there are only three toes on their hind feet. At the end of each toe is a small hoof. The eyes are small; the ears are erect and of moderate size; and the noses are drawn out into a short trunk. The tails are very short. The bodies are covered with short hair.

The Malay tapir is a large animal, standing about three and one-half feet at the shoulder; the back may be six inches higher. The head, limbs and front part of the body are dark brown or black, while the body behind the shoulders is grayish white, giving the beast the appearance of a black animal with a white blanket placed over its back. The baby tapir, until it is six months old, is blackish brown with long streaks and spots of yellow and white along the sides of the body, head and legs. The hair of the young animal is longer than that of the adults.

The Malay tapir lives in the forests of Tenasserim, Lower Burma, the Malay Pen-

insula and the island of Sumatra. Tapirs are at home in the deepest jungles, along rivers. They like swampy country where they can wallow in the mud and water. They love to swim and will often seek safety in deep water. They are said to be capable of walking along on the bottom of a river for a considerable distance.

The tapir feeds chiefly on leaves, twigs and other vegetation. It is very shy and is consequently seldom seen in its wild state, but when captured young and brought up in captivity it becomes very tame. While visiting a small private zoo in Singapore, I saw a pair of these animals which were liberated every morning so they might stroll down to the river for a swim. After about an hour's time they would, of their own accord, come back to their pen to be fed.

MOST TAPIRS HUNT FOR FOOD AT NIGHT, SO THEY ARE RARELY SEEN

The tapirs of Central and South America differ from the Malay tapir in being of a dark brown color, without a white blanket. The common tapir is the smallest, and ranges from northern South America south to Argentina, Bolivia and Paraguay. It is common in the forests of Venezuela, the Guianas and Brazil, where it prefers the banks of rivers and swampy country. When disturbed, it generally runs to the river for safety. Like other tapirs, it usually looks for its food at night and, on account of this habit and because of the thick forest in which it lives, is very seldom seen. Natives often hunt the tapir with the help of trained dogs, which track the animal and then worry it until the hunter arrives. If, however, the tapir can reach the deep water of a river or a lake, it will generally escape. Tapirs are sometimes seen along the banks of a river by persons in boats or canoes.

THE MOUNTAIN TAPIR'S WARM COAT PROTECTS HIM FROM COLD IN THE UPLANDS

The food of these tapirs consists of reeds and other water plants, as well as twigs, leaves and vegetation. All species of tapirs have but a single young, which is marked with white or yellowish stripes and spots. The stripes disappear during the first year of the young one's life.

In the Andes Mountains of Ecuador, Colombia and Peru, there is found a larger tapir known as the mountain tapir. As you might expect, the hair of this animal is longer than that of the common tapir, to give the



N. Y. Zoological Society

Two South American tapirs have their picture taken. As baby grows up, his spots and stripes disappear.

animal warmth in the chilly uplands.

The large tapirs live in the forests of Central America. Baird's tapir is found from Panama northward to Mexico and is still a fairly common animal near the Panama Canal. In parts of its range it lives in the mountain forests and has been noted at an altitude of five thousand feet. It forms distinct trails along the mountain sides that resemble cattle trails, and it is able to climb up and down steep slopes without difficulty. It is shy and seldom ventures out of the dense forest.

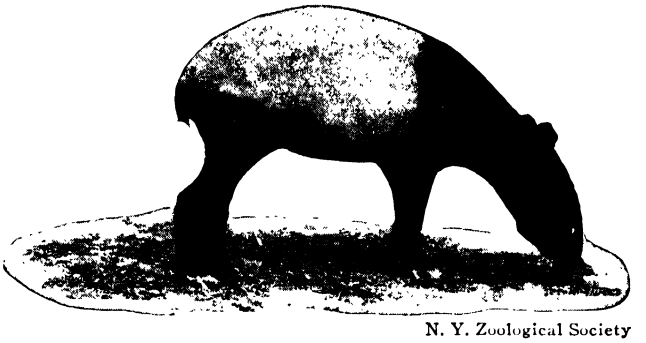
Dow's tapir, a close relative of Baird's tapir, is found in a restricted area in Nicaragua, Honduras, Guatemala and Costa Rica. Its habits are similar to those of the Baird's tapir.

The rhinoceroses remind a person of some animal of bygone days; there is something about its odd head, thick skin and horn that makes one think of the prehistoric dinosaurs. Fossil remains of many different kinds of rhinoceroses have been found in Europe, Asia and North America, showing that at one time years and years ago, there were many more forms of rhinoceroses inhabiting this earth than there are today. The best known of these fossils is the woolly rhinoceros. This animal inhabited the colder climates of Europe and Asia, and entire animals have been discovered in a frozen state in Siberia. These animals were covered with a woolly hair, quite different from the coat of any of the existing species. Rhinoceroses are now found only in southern Asia and Africa.

The horn, or horns, on the nose are the most distinguishing mark of the rhino. This horn is really made up of compact hair and has no connection with the skull. When the skin is removed from the head, this horn may be removed with it. Rhinoceroses have three toes on both the front and the hind feet, with a rounded hoof on the end of each toe. There are five different kinds of rhinos today.

The Indian rhinoceros is the largest of the three Asiatic forms. A large male may stand over five feet at the shoulder. Thick hide is laid over its body in a series of folds and is covered with great numbers of round tubercles (bumps) which look like rivet heads. This animal is sometimes called the iron-plated rhinoceros, which is a good name for it. The skin is dark gray in color. There is a fringe of hair on the ears and at the end of the tail. This rhino has but one horn, which seldom grows to be over a foot long. Although in former years this animal lived throughout much of the peninsula of India, it is now found in a very restricted area in northwestern Assam and eastern Nepal, northern India.

The home of the Indian rhinoceros is on the plains where giant grass grows to the height of fifteen or twenty feet. Through this grass the beast forms tunnels, and the only way to hunt it or to force it out into the clear is with the aid of elephants. Like all the other rhinoceroses, this one enjoys a bath in the mud, which helps rid it of biting insects, for in spite of that tough-looking, armor-like hide, ticks and flies bother the rhino.



N. Y. Zoological Society

The Malay tapir is at home in swamps and seeks safety in rivers.

In all the Asiatic rhinoceroses, the lower front teeth, the incisors, are two sharply pointed tusks. They are small and invisible when the animal's mouth is closed, but with these teeth the Asiatic rhino does its fighting. It is capable of inflicting deep wounds with these tusks, very much in the manner of a wild boar.

In olden days drinking cups made of rhino horn were in great demand, for it was believed that when poisoned wine was poured into one of these cups the poison could be instantly detected. Of course there is no truth in this belief.

The Javan rhinoceros looks like a small Indian rhino. Like that animal, it has but one horn and heavy skin folds. The position of these folds differs somewhat from that of the Indian rhino. In the Javan the folds of the skin about the neck are less developed and the body fold on the shoulders continues across the back, whereas in the Indian rhino the body fold bends toward the rear and



American Museum of Natural History

These prehistoric ancestors of the rhinoceros roamed the steppes many ages ago. Although they were covered with hair and had longer and sharper horns, these woolly rhinoceroses look much like those of Africa and Asia today.

stops on the shoulders. The skin of both these rhinos is much the same color, but the Javan rhino lacks the "rivet heads." Fine cracks in the skin form a mosaic-like pattern. The horn in the Javan female is often very small, and sometimes absent, while the female Indian rhino generally carries a good horn.

At one time the Javan rhino had a very extensive range, from Burma and Assam and eastern India south through the Malay Peninsula to the islands of Sumatra and Java. Now this animal is the rarest of the Asiatic rhinoceroses and has become extinct over much of its former range. Probably more are left in Burma, and a few may still be found in isolated spots in the Malay Peninsula. The species is still found in limited numbers in Sumatra, chiefly on game reserves, and a few still occur in Java, mostly on a reserve on the westerly tip of that island. The Javan is now one of the rarest of all animals and unless it receives protection it may entirely disappear.

THE ASIATIC RHINOS ARE HIGHLY PRIZED BY THE CHINESE AS MEDICINE

All the Asiatic rhinoceroses are killed by natives whenever possible, as the Chinese value them very highly for medicine. Not only the horn, but the blood, bones and skin are used for this purpose; and the Chinese pay a high price for a dead rhino. Therefore they have been killed in large numbers until few remain.

The Javan rhinoceros is an animal that lives in thick jungle. It prefers swampy ground but will often ascend into the mountain forests. It spends much of its time wallowing in the mud and often forms deep mud holes which are used for this purpose for generations. In hunting, natives take advantage of this habit and either dig pits for the animal to fall into, in the numerous trails leading to the wallows, or wait at a well-used wallow, knowing that sooner or later the rhino will return.

SO MANY SUMATRAN RHINOS HAVE BEEN KILLED THAT THE SPECIES IS ALMOST EXTINCT

The Sumatran, or Asiatic two-horned, rhinoceros is the smallest of all the rhinoceroses and also the most hairy, although in the adult the hair is often difficult to see but can easily be felt when the skin is stroked by the hand. The baby rhino is covered with dark brown hair, and sometimes the tips of the ears have a prominent tuft; but as the animal grows older much of this hair disappears. The skin is a very dark brown, or black in some specimens, and the folds are not so prominent as in the other Asiatic rhinoceroses. This animal reaches a height of four and a half feet. As a rule the horns are not large and a front horn which measures over ten inches in length and a rear horn of five inches are exceptional. The females' horns are generally smaller than the males', and in the female the rear horn is often very poorly developed.

The former range of the Sumatran rhino was very much the same as the range of the Javan rhino except that it was found on Borneo and not on Java. Like the Javan rhinoceros, it has been killed in such great numbers that it has become extinct over most

of its former home. It still exists in limited numbers in the Malay Peninsula and on Sumatra and Borneo, but unless the laws for its protection are enforced, it, too, will become an animal of the past. Wouldn't it be unfortunate if such interesting animals as the Asiatic rhinoceroses should become extinct? Then the only rhinoceroses future generations could see would be an occasional stuffed animal in a museum, or a picture.

RHINOS HAVE KEEN SENSES OF SMELL AND HEARING, BUT THEIR EYESIGHT IS POOR

The habits of the Sumatran rhino are very much like those of the Javan. It lives in thick forests, often preferring steep mountain slopes, where it wears well-worn trails. It generally travels and lives alone, except that a mother and her young one will travel together. Like the other rhinos, it is hunted for the horns which are used as medicine by the Chinese and natives. The blood and bones are also believed to make good medicine. Sumatran rhinos are very difficult animals to hunt as they live in the dense forest and can travel through the bamboo and thorny brush much more easily than a man. Their eyesight is poor but their sense of smell and their hearing are remarkable, and they rely on these for protection so that they are seldom seen. They must frequently bathe in the mud wallows to protect their skin, and these wallows are numerous where the animals are found. The natives generally dig pits in the runways leading to the wallows, and in this way the animals are captured.

In Africa there are two kinds of rhinoceroses, the black and the white, both of which have two horns.

FREQUENT DUST AND MUD BATHS HELP TO RID THE RHINO OF TORMENTING INSECTS

The black rhinoceros is the most common of all the rhinoceroses and the one most frequently seen in our zoos. It formerly ranged over most of Africa, where the country was to its liking, south of the Sahara Desert. It has now been exterminated in South Africa but is still common in East Africa. These rhinos seem to prefer dry country where there are open plains and thornbush, but they are found in the forested mountain sides as well. Even on the dry plains they are never found far from water for it is necessary that they drink frequently. Like the other rhinos, they are fond of wallowing in mud holes and of dusting themselves in dust baths. They feed chiefly in the morning or late afternoon, but may feed at any time, day or night. They are browsers; that is, they feed on the leaves and twigs of bushes and trees. They are generally found alone, but a mother may be accompanied by her calf, and occasionally two or three may be found together.

THE RHINO'S CHARGE THAT MAY BE ONLY A CLUMSY STUMBLE

Like all the rhinos, the black rhino has very poor eyesight, but a very keen sense of smell and depends upon this to discover its enemies. It is the most pugnacious of the rhinos and will, on rare occasions, charge for no good reason. It may happen in this way. The rhino becomes aware of something it does not understand, and as it can not depend upon eyesight to explain what the object may be, it must depend upon its nose. So it will run to and fro trying to get the wind of the object. When doing this, just as likely as not the rhino may come directly at the object, and this by many hunters would be called a charge. But as soon as the man-scent reaches the nose of the rhino, it then understands the danger and will beat a hasty retreat, although there are exceptions to the rule. I just want to bring in this fact to show that many hunters' stories leave the reader with the wrong impression of the animals they are telling about. The hunters do not tell about the hundreds of times the animal runs away, but only about the one time it charged. All the same, it is best to give the black rhinoceros plenty of room and to take no liberties with it, especially if it happens to be a mother with her young one.

THE BLACK RHINO IS SOMETIMES CALLED THE HOOK-LIPPED RHINOCEROS

In color the black rhinoceros is really blackish brown, and a large male stands a little under five feet at the shoulder. The upper lip comes to a point, and its flexibility enables the animal to pull into its mouth the leaves and other vegetation upon which it feeds. This peculiar lip has given this rhino one of its popular names, the hook-lipped rhinoceros.

Both the black and the white rhinoceroses lack the two incisor tusks characteristic of the Asiatic rhinos, and so they depend on their horns for protection.

The horns of the black rhinoceros vary greatly in size, the first horn being the longer. A horn of fifty-three and a half inches has been recorded, but a horn of half that length is considered a large one. Both sexes of the African rhinoceros carry horns, the females' in many cases being longer than the males'.

Like all the rhinoceroses, the black rhino

gives birth to a single young or calf, and another is not born to this same mother until a number of years later. The young at birth weigh about seventy-five pounds, while an old animal may be as heavy as three thousand pounds. Rhinos, if allowed to live their allotted number of years, reach a ripe old age. One individual is said to have lived in captivity for forty-seven years.

THE WHITE RHINOS GO ABOUT IN GROUPS AND FEED ON GRASS

The white rhinoceros, like the black rhino, has two horns and is a native of Africa, but it is a larger animal with a much longer head and square lips and is of a smoky gray color, slightly lighter than the black rhino.

Much discussion has arisen about the names of black and white rhino. These are indeed poor descriptive names, as neither is black nor white; the black, however, is darker in color than the white. The color of the animal is very often the color of the soil found in their habitat, for both love to roll in the mud and to take dust baths.

The horns of the white rhino average a greater length than the black's, and the white rhino is a grazer, or feeds on grass, whereas the black is a browser, feeding on leaves and twigs. The white rhino is more inclined to go about in company, five or six often being found together. Being grazers, they are found on the great grassy plains and do not enter the forests.

A century ago the southern white rhinoceros, also known as Burchell's rhinoceros, was a common animal on the grassy plains between the Orange and Zambezi rivers in South Africa. Travelers reported seeing as many as eighty in one day, while many of the old-time hunters boasted that they had killed as many as sixty in one season. Large numbers were slaughtered in this way and then the climax came in 1880, when a great demand arose for rhino horns. Traders supplied the natives with guns for the express purpose of killing rhinos. Hundreds were killed. Rhinoceroses are very slow breeders and are easily killed, consequently they were unable to withstand this slaughter. By 1899 the southern white rhino had become extinct except for a few individuals in Mashonaland and Zululand. At the present time the southern white rhinoceros is reduced to less than one hundred animals in a small reserve in Zululand.

Strangely enough, in 1900, when the white rhino was passing from the picture in South Africa, it was discovered to be existing on the grassy plains on the west side of the Nile River in the corner where the Sudan, Uganda and the Belgian Congo meet. This region is some 1,500 miles to the north. It is indeed strange that this animal should be found in two such remote parts of Africa so many miles apart. Undoubtedly there were white rhinos at one time in the intervening country but, if so, it was many years ago and all traces of them have been lost. The northern animal differs from the southern white rhino only in minor ways; and the habits of the two are very similar.



N. Y. Zoological Society

The Indian rhinoceros looks like a prehistoric monster. This one has lost his horn.

The white rhinoceros is the second largest land animal. Only the elephant exceeds it in size. A large male will stand from five and a half to six feet at the shoulder. It is a rather dull-witted animal with very poor eyesight and is not too difficult to approach if the wind is favorable, so that the shooting of one is a very

easy matter. However, it has a very keen sense of smell and hearing, and it will generally make off if it smells a human. For, like many other animals, it prefers to go peacefully about its own affairs. In spite of its great size and fierce-looking horns, the white rhinoceros is harmless and inoffensive, and not so likely to charge as the black rhinoceros. It prefers to spend its day sleeping in the shade, either standing or lying down, and has the peculiar habit of sometimes sitting on its haunches like a dog. In the late afternoon, as the weather cools, the rhinos begin grazing. They always carry their heads low, with the nose close to the ground.



N. Y. Zoological Society

Two sharp horns give the black rhino a fierce look; and an unfriendly beast he is.



Chicago Natural History Museum

The white rhino, which is not white at all, but smoky gray, has become quite rare. Only a few hundred of these beasts remain, in Zululand.

Tick birds—brown birds with red bills, a little smaller than the American robin—are often in attendance. They climb all over the rhino, feeding on the ticks and other insects that infest the skin; and occasionally a bird will disappear into a rhino's ear in its search. These birds also act as lookouts. On the approach of danger they become restless and noisy, and when the danger comes too near they will fly away with warning chatter. Not only the rhinoceroses but most of the larger antelopes, buffalos and cattle are hosts of these beneficial birds.

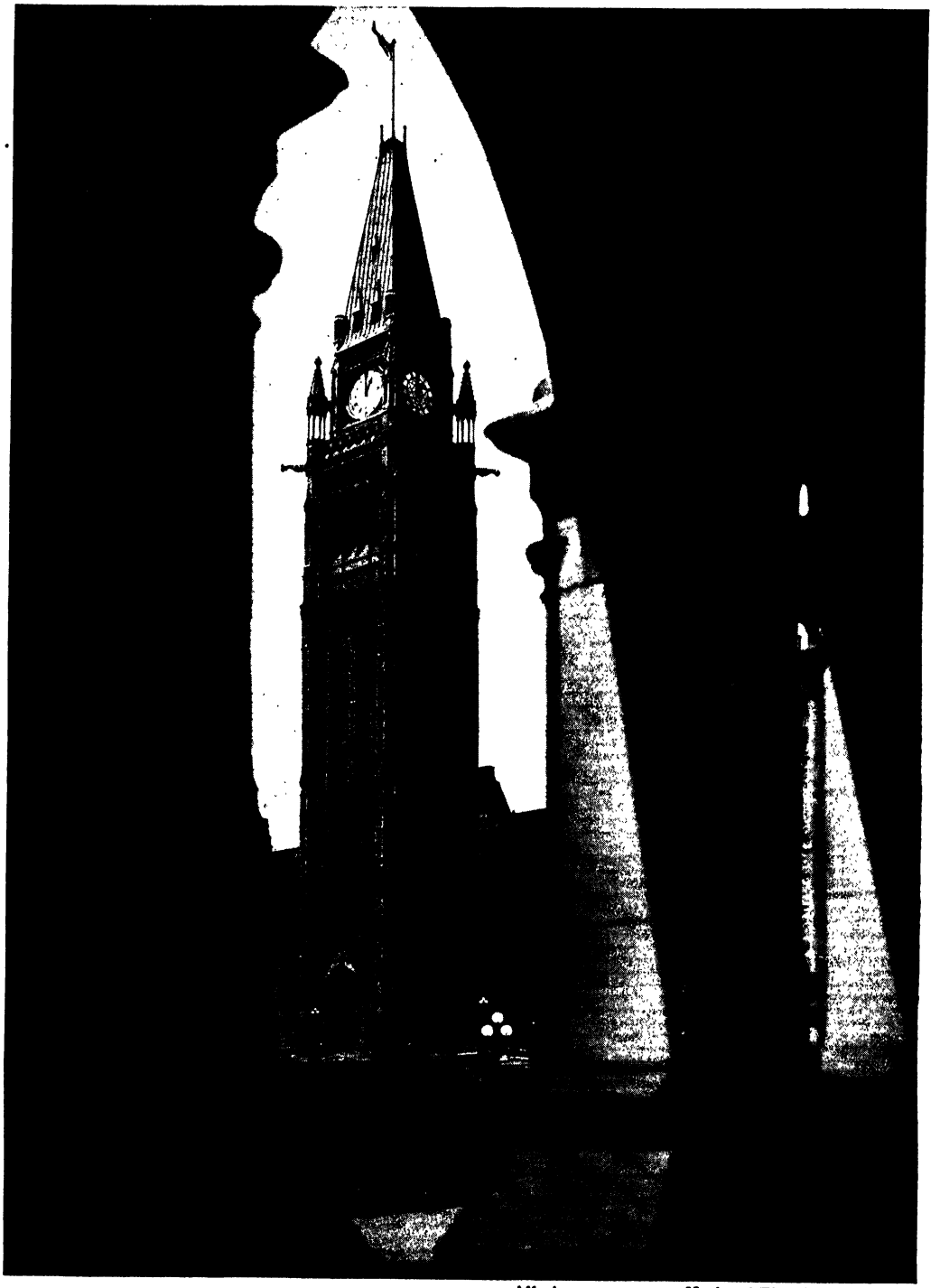
When frightened the rhino trots off at a rate of speed which will quickly outdistance a man on foot. If hard pressed, it will break into a clumsy gallop but can be overtaken by a man on horseback after a short distance. Its speed is astonishing for an animal so ungainly in appearance.

The white rhinoceros is one of the few large animals that has never been exhibited in a zoological garden. It is hoped that before long this odd and interesting animal will be placed on view.

By T. DONALD CARTER.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 1954.

A FAMOUS CANADIAN PATRIOTIC SHRINE



All pictures courtesy, National Film Board, Ottawa

The Peace Tower in Ottawa, seen through the portico of the Governor-General's entrance to the East Block of the Federal Houses of Parliament. This stately tower crowns the Centre Block of the Parliament Buildings. Dedicated in 1927, on the anniversary of Confederation, it contains the tomb of Canada's Unknown Soldier.



The Parliament and administrative buildings in Ottawa, with Wellington Street on the left.

HOW CANADA IS GOVERNED

WHEN we study the government of Canada, we must consider three elements—people, places and laws. The people are: the Governor-General, who is the personal representative of the King; the Prime Minister and the members of the Cabinet, who are the executive heads of the departments, or ministries, of the government; the members of Parliament who make the laws; the officers of government who carry out the laws; and the people of Canada who vote in elections and pay the taxes, and for whom the government is carried on.

The places are: Ottawa, the capital of the federal government; the capital cities of each of the ten provinces which are the centers of provincial government; and, throughout the land, a host of offices, large and small, wherever customs duties are collected or postage stamps are sold, or other government business is carried on.

Finally, the government of Canada is made up of laws: acts passed by both Houses of Parliament and printed in the statute books; opinions handed down by the highest courts, explaining or modifying the law; Orders in Council passed by the Government of the day; and numbers of regulations, which have the force of law, made by agencies of the government.

All of this organization of government is based upon a simple fact—the elected representatives of the people pass in Parliament the laws which govern the whole of the country. The Ministers of the Crown—the Minister of Justice, the Minister of National Defence, the Minister of Finance, and ten or a dozen others—are chosen by the Prime Minister from these elected representatives. This group of Ministers is called the Cabinet. All of the Ministers are responsible to Parliament. It is Parliament also which grants the authority under which taxes are levied for raising money to carry on the government and under which, also, the money (public revenue) may be spent for public needs—health, roads, postal services, radio and a multitude of other uses. In wartime Parliament grants broad powers to the Cabinet; and an Order in Council, passed by the Cabinet, has the effect of a law. But, even so, all the members of the Cabinet have a responsibility for any official act of this kind, and any or all of the Ministers may have to answer for it in Parliament.

Since Parliament is the most important part of this system of government, it will be of interest to see what it is, what it does, and what it looks like in action. Let us suppose that you are in Ottawa on a day when Parliament is in session, which frequently extends from late in January until midsummer. As you walk up the broad approach to the Centre Block on Parliament Hill, the



The Centre Block of the Parliament Buildings, with its soaring Peace Tower. Here are the stately chambers where the House of Commons and the Senate meet to make the laws and carry on the government of the Dominion.

clock in the Peace Tower chimes out three. By the time you have reached the door of the gallery of the House of Commons, prayers will be over; and as you are shown to a seat, the usher will perhaps mention that the House is dealing with "orders of the day." You will notice that certain members are rising to ask questions, which are being answered by other members in the front row on one side of the floor below. Those who are answering are the Ministers of Agriculture, Post Office, Public Works, Transport or some other "portfolio."

While questions are proceeding, you will perhaps look about to notice the proportions and arrangement of the House of Commons chamber—sometimes called the Green Chamber, to distinguish it from the Red Chamber, which is the Senate.

At the far end of the Green Chamber, facing the main entrance, sits the Speaker in his throne-like chair. He wears a black gown, and his three-cornered black hat is beside him. He is the presiding officer of the House, and the chief guardian of the rights and dignities of Parliament. In Canada these rights and dignities have much in common with those of the British House of Commons at Westminster. Canadian parliamentary usages have followed those of "the mother of Parliaments" for over a century and a half. The Speaker is himself an elected member of the House, chosen to preside, usually at the beginning of each Parliament, by the other members. A custom has grown up that the office of Speaker should alternate between French-speaking and English-speaking members. You will hear both languages spoken, for both are official languages in Parliament. Many members, especially those who come from the province of Quebec, are equally at home in either language. If the ordinary language of the Speaker is English, it is customary to choose as Deputy Speaker a member whose usual language is French, and the other way around. The Deputy Speaker, as we shall see, presides in the absence of the Speaker, and he is also the Chairman in Committee of the House.

The members who sit at Mr. Speaker's right are the supporters of the Government of the day. Generally all of them are members of the political party which won a majority of the seats at the last general election. In the two front rows towards the upper end (as we have already noticed) sit the Ministers, headed by the Prime Minister.

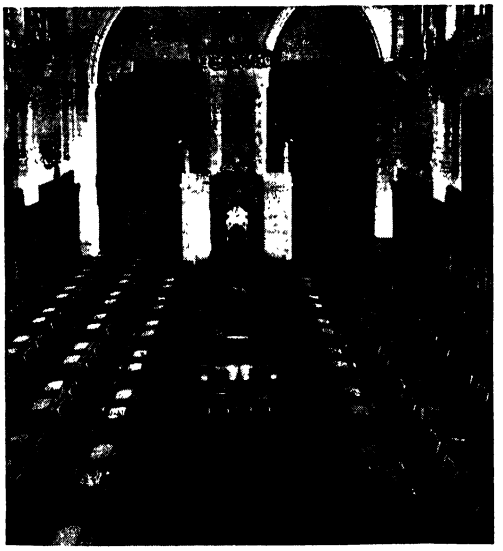
Behind the Prime Minister sits the Chief Whip, who in Parliament is the link between the Prime Minister as leader of his party, and all the other members of that party in the House.

At the Speaker's left sit the members of "His Majesty's Loyal Opposition"—members of the party or parties which opposed the policies of the present Government in the last general election. In earlier days there were but two recognized political parties, Liberal and Conservative, both of which existed before there was a Dominion of Canada. In recent years two other political groups have been recognized, the Co-operative Commonwealth Federation (generally known by its initials, CCF) and the New Democracy (or social credit) group. They are called groups rather than parties because their numbers in the House are relatively small. There may also be a handful of members described by other names, Independent, for example, who do not undertake to support any party or group.

The leader of the largest opposition group occupies a recognized position as Leader of the Opposition. In addition to the annual indemnity of $4,000 which is paid to all members of the House of Commons, he also receives a salary of $10,000 (equal to that of Ministers) payable by law. Frequently he is the chief critic of the Government on questions both of policy and of practice, and it is one of his main duties to call attention to conditions in which he feels that the administration of the government business has not been diligent or efficient. It is true that decisions in Parliament are taken by vote of the majority; but wide publicity may be given, especially through the newspapers, to anything which is said in Parliament, and any Government which persistently and obstinately refused to pay attention to the views held strongly by numbers of the people would find itself in difficulties. Let us see how. The Government of the day is entitled to remain in office only so long as it has the confidence of a majority of the members of the House of Commons. A member of the majority party will ordinarily vote for that party's stand; but if the people of his district, who elected him, feel strongly enough on a certain question, he may feel obliged to comply with their wishes and to vote against the stand of the party. It has happened that where the two largest groups in the House are fairly evenly matched, the independent members may hold a balance of power, by which their votes might either keep in office, or defeat, the Government.



The Speaker's Chair in the House of Commons is exactly like the one in the British House of Commons.



The richly decorated Senate Chamber, with the viceregal throne for the King's Representative.

Let us return to the scene in the House, where questions are still being asked. Perhaps the Minister of Justice will lay on the Table of the House—a large table in the aisle below the Speaker—the annual report of some branch in his department. Then the next "order" called may be a resolution, standing in the name of the Minister of Trade and Commerce, to bring in a bill to amend

the Precious Metals Marketing Act, which is administered by his department. The Minister explains that the purpose of this bill, which we have taken as an example, is to put back into the Act a subsection which was taken out by error at the previous session of Parliament. The actual words of the subsection described the fineness of the gold content of certain manufactured articles. As there is no objection, the resolution to bring in a bill (to replace these words in the Act) is *passed* and *reported.* The Minister then introduces the bill, which has a number, and it is then *read a first time,* which is usually a formality since in the case of a lengthy bill the text is not read at all. Where the bill is not likely to be objected to (as in this case) it is frequently *read a second time* immediately after, and when it is a short bill, in this case only two paragraphs, the Minister may ask for permission to have it considered in Committee at once, and move accordingly.

HOW THE HOUSE GOES INTO COMMITTEE TO CONSIDER A BILL

The second reading of any bill is usually taken as approval of the principle of the legislation. The Committee stage is to provide for consideration in detail, section by section. When the motion to go into Committee is carried, Mr. Speaker steps down from his chair. The Sergeant-at-Arms advances from his desk at the outer door near the Bar of the House, and removes the Mace from the Table of the House. The Deputy Speaker (or in his absence some senior member acting for him) takes his place at the head of the Table, and asks if each section shall carry. Sometimes debate on a single section may last a whole day, or longer, in which case the Committee at the end of a sitting simply "reports progress and asks leave to sit again," probably at the next sitting of the House.

Let us suppose that our bill provokes only one question from the opposition side, an assurance that certain words are merely being put back into the Act, which the Minister agrees is so. The two sections are agreed to. The Speaker resumes his chair, the Sergeant-at-Arms replaces the Mace on the Table and the Bill is *reported* to the Speaker by the Deputy Speaker.

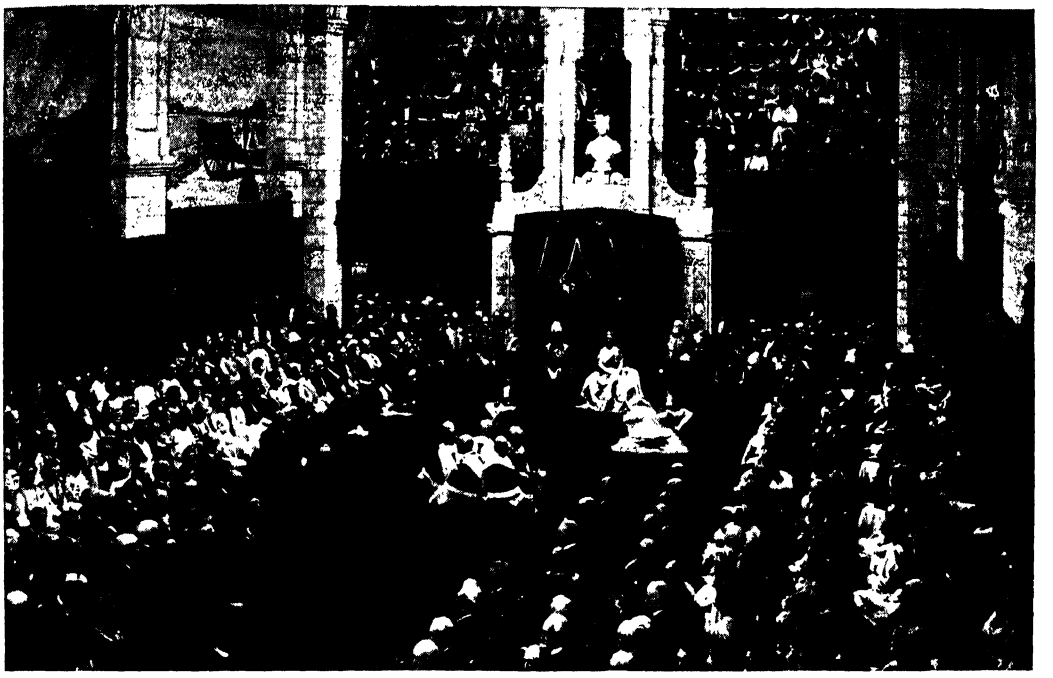
As there is no objection the Bill will then be *read a third time* and *passed* by the House. Meanwhile, it is also considered and passed by the Senate. Technically, it does not have the force of law until it has received the *Royal Assent*—signifying that the law has the approval of His Majesty, and that the King directs it to be carried into effect. The ceremony of Royal Assent is held in the Senate Chamber, which is in the other wing of the Centre Block. The assent is given by the Governor-General acting as the King's representative or, occasionally, by one of the Judges of the Supreme Court of Canada, acting as Deputy of the Governor-General. On these occasions the members of the House of Commons, headed by their Speaker, attend in a body at the Bar of the Senate, and after the proceedings are concluded, they return to the House of Commons.

THE GOVERNOR-GENERAL IS THE KING'S REPRESENTATIVE

The Governor-General comes to the Senate at the beginning of each session of Parliament to read the Speech from the Throne, a document outlining conditions in the country and various measures recommended for consideration by Parliament. Although the Speech is read by the King's representative, it represents the policy of the Government of the day. Some of the first business taken up at each session is the debate on the Speech from the Throne and on the Address in Reply, a formal document delivered to the Governor-General after the general proposals of the Government have been agreed to by both Houses of Parliament. The debate on the address, which is *moved* and *seconded* by two members on the Government side, may continue for several days. Sometimes the motion will be carried without a recorded *division;* at other times there may be a formal *division* of the House, when Mr. Speaker says "Call in the Members." The division bells ring for several minutes; after they stop ringing no one may then be admitted. Then the voting begins. Members rise in turn, and their names are called out and are entered on the records of the House.

There is also a Speech from the Throne at the end of each session when Parliament is *prorogued.* In this speech a review is given of the legislation passed during the session, and members of the House of Commons are thanked for having made "financial provision for the public service."

It is a carefully guarded custom that "money bills" should be introduced in the House of Commons, and not in the Senate. In contrast, there are certain kinds of bills which are first passed in the Senate and are then sent to the Commons for approval. In case the two chambers should be in disagree-



The Senate Chamber, May 19, 1939, when Their Majesties King George VI and Queen Elizabeth were present.

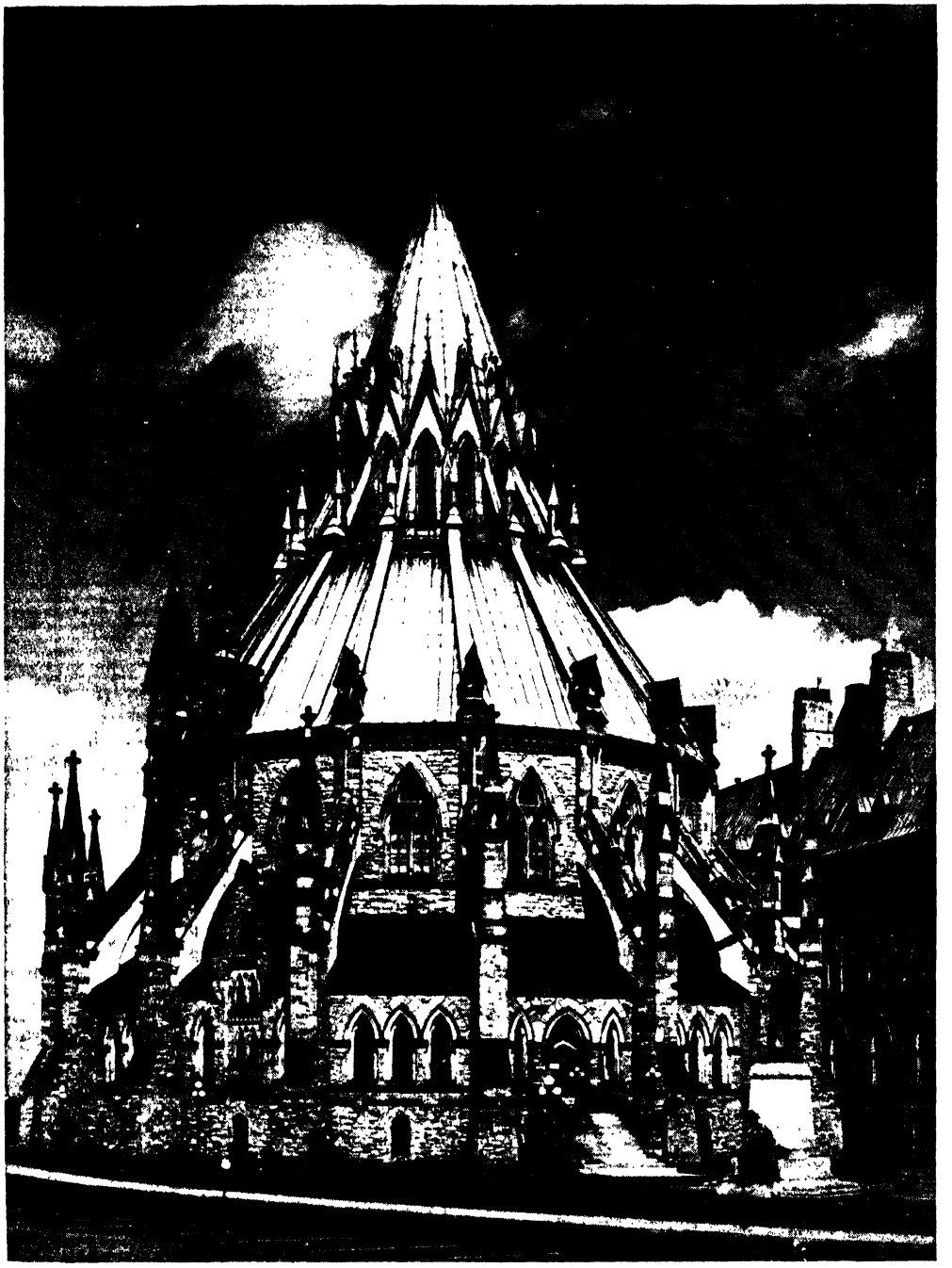
ment, *managers* are chosen from each of them to work out an agreeable settlement.

Possibly the most interesting of all Speeches from the Throne was that given by King George VI on May 19, 1939, when, accompanied by Queen Elizabeth, he came to the Senate Chamber and personally gave his assent to certain acts of Parliament. If, on that day, you had chanced to be in the galleries of the House of Commons, you would have heard a sharp rap at the outer door—rapping by the sword hilt of the Gentleman Usher of the Black Rod, who is in the Senate what the Sergeant-at-Arms is in the House of Commons. When the Gentleman Usher was admitted "with a Message from His Majesty the King," he announced that His Majesty "required the immediate presence of this House" in the Senate Chamber. So a procession formed; the Sergeant-at-Arms went first, bearing the Mace on his shoulder; then the Speaker; then the Clerk of the House; and then the members, two by two, pairing from opposite sides. This day was a vivid reminder that all the business of Parliament is conducted in the King's name, and that where the King's business is concerned, there must be equal justice.

When Parliament has been *prorogued,* it means that a new session will be called by a Royal Proclamation, published in the Canada Gazette. Sometimes Parliament will *adjourn* (hold no meetings) for a specified number of days or weeks. In this case it will re-assemble, without further notice, on the appointed day. The duration of any one Parliament may not exceed five years from the first day on which that Parliament meets, and thus at intervals there is a *dissolution* of Parliament. When Parliament is dissolved, a new Parliament is chosen by means of a *general election.*

While you watched from the gallery of the House, you may have wondered how the various members got there. Most of them were elected in the last general election. A few, who were not candidates at that election, may have been elected at a later by-election, required through the death or resignation of the previous member for a certain seat. The Dominion of Canada is divided into electoral districts, or constituencies, from which 262 members of Parliament come to Ottawa. Representation is on a basis of population, and is revised at intervals of ten years. The province of Quebec returns 65 members, a number fixed by the original British North America Act. On this basis, Ontario, the only province with a larger population, sends 82 members to Ottawa; British Columbia, as another example, sends 16. The smallest province, Prince Edward

THE LIBRARY OF PARLIAMENT, OTTAWA



This fascinating Gothic building is the Library of Parliament. It is a part of the group called the Centre Block, but it was saved from the fire that destroyed the rest of the original Centre Block in 1916. The interior of the library is exceedingly beautiful and it contains more than 500,000 books, including almost everything that has ever been written about Canada. This remarkable collection comprises books in both of the official languages of the Dominion, English and French. These books are intended especially for the use of Parliament, but the public may also use the library for reference. The building has sixteen sides. Note the bridge-like flying buttresses that help to support the central mass of the building. There are sixteen, one at each angle.



The entrance to the National Gallery of Canada, which occupies the east wing of the Victoria Memorial Museum. The gallery contains a fine collection of paintings and sculpture. The collection of Canadian art is famous.

Island, actually has a larger representation than its population alone would call for. When the island entered the Dominion in 1873, it was provided that representation in the House should never be less than representation in the Senate, and as there were four Senators, there have always been at least four members from that province. A new province has been added to the Dominion in Newfoundland, which has seven representatives in the House of Commons, although this number, too, is subject to revision.

When a general election has been announced, a day will be fixed for *nominations*, and another day, usually a week later, for *polling*. Each of the major parties may have a candidate in almost every constituency; the smaller groups will try to win seats within certain areas only. In some constituencies, especially in the larger cities, there may be seven or eight candidates. In such cases, those at the bottom of the poll are almost certain to lose the deposit of $200 which by law they are required to pay down. The candidates who receive at least one-half of the votes have their deposits returned.

The party whose candidates carry the greatest number of seats forms the new Government. If the last previous party in power again wins a majority of the seats, the Prime Minister and many of his Ministers may continue in office. If the party should not win a majority of the seats, it is the duty of the Prime Minister to advise the Governor-General to send for the leader of the party with the largest number of members. The Prime Minister and his Cabinet then submit their resignations to the Governor-General, and after the resignations have been accepted the new Cabinet will be sworn into office. The new Ministry will ask for a vote of confidence at the first opportunity after the new Parliament meets.

The members of the Senate are not elected, but are appointed for life. The addition of six Senators from the new province of Newfoundland brings the total number to 102. Of this number, 24 come from Quebec, 24 from Ontario, 24 from the western provinces, and 24 from Prince Edward Island, Nova Scotia and New Brunswick.

The organization of the House of Commons is followed quite closely in the Legislatures of each of the provinces, which are smaller bodies, ranging from 30 members in Prince Edward Island to 90 in Ontario. In Quebec Province, in addition to the Legislative Assembly, there is also a Legislative Council of 24 members appointed for life. No other province now has a second chamber in the Legislature.

The general organization of the govern-



The National War Memorial, unveiled by the King in 1939, commemorates Canada's part in World War I.

ment of Canada is defined in the British North America Act, 1867, by which the four original provinces of Ontario, Quebec, New Brunswick and Nova Scotia were joined in the Dominion of Canada. This Act was an act of the Parliament of the United Kingdom, and consequently the various amending acts of what might be called the constitution of Canada have also been passed by the Parliament at Westminster. Since 1931 there has been a clear understanding that any legislation applying to Canada passed by the United Kingdom Parliament will be introduced only at the express request of the Canadian Government. This understanding is set out in the Statute of Westminster, which also removed the last of the remaining restrictions upon the power of the Parliament of Canada to make laws without regard to the existing laws of the United Kingdom.

The British North America Act also defines the relationships between the Government of Canada and each of the provincial governments. In Canada, what are described as the *defined* (or restricted) powers are given to the provinces, while the *residuary* powers (that is, the powers not specially defined) remain with the federal government. This division of powers is the opposite of the legislative system of the United States, where the powers of the federal government are carefully defined and limited, and those of the state governments extend to everything not so defined.

The defined powers of the provincial administrations cover property and civil rights and the administration of justice within the province, and, generally speaking, "all matters of a merely local or private nature in the province." The legislative authority of the Parliament of Canada extends to everything not so defined, and in particular to such matters of nation-wide importance as the public debt, taxation, postal services, defense, fisheries, the currency and coinage of Canada, banking, weights and measures, patents and copyrights, and the criminal law of Canada. The civil law varies somewhat among the provinces, notably in Quebec, where it follows French rather than British models, but the criminal law of Canada is uniform and applies throughout the whole Dominion.

In any system of definition of powers there are bound to be cases of dispute, or differences as to interpretation. The final appeal in cases of a civil nature (such as constitutional points) is to the Judicial Committee of the Privy Council in England. In criminal cases an appeal may be taken to the Supreme Court of Canada, but not further. In some matters, such as the control of marketing of certain products in certain areas in which both the Dominion and the provinces were interested, there have been lengthy hearings both in Canada and in London. The day may come when differences of this kind will be settled in Canada, though at the moment the Judicial Committee is still recognized as the highest authority.

We have spoken previously of the Governor-General, who is appointed by the King, on the advice of His Majesty's Government in Canada, to be his personal representative. The appointment is actually "during pleasure," but in practice has been usually for five years. The annual salary is £10,000 sterling. In the discharge of his executive duties—the summoning, proroguing and dissolving of Parliament, and assenting to legislation—the Governor-General acts under and with the advice of the Ministry. Until July 1, 1927, all communication between the Government of Canada and the United Kingdom had been by way of the Governor-General. He reported to London regularly upon legislation, proceedings of Parliament and other matters of interest. Since July 1, 1927, there has been direct communication between officers of the two governments.

Brier Rose or Sleeping Beauty

ONCE upon a time there lived a king and queen who had no children, and this was a great sorrow to them. But one day as the queen was walking by the side of the river, a little fish lifted his head out of the water and said, "Your wish shall be fulfilled; you shall have a daughter."

What the little fish had foretold soon came to pass, and the queen had a little girl whom they called Brier Rose. She was so beautiful that the king, in great joy, determined to hold a feast. He invited not only his relations, friends, and neighbors, but also all the fairies that they might be good to his little daughter.

Now there were thirteen fairies in his kingdom, and he had only twelve golden dishes, so he was obliged to leave one of the fairies without an invitation. The rest came, and after the feast was over, they gave their gifts to the little princess. One gave her virtue, another beauty, another wisdom, and so on till she had all that was excellent in the world.

But just as the eleventh fairy had done blessing her, a great noise was heard at the door, and the thirteenth fairy stormed in, very angry that she had not been invited. "Here is my gift!" she cried. "The princess shall in her fifteenth year be wounded by a spindle and fall down dead!" Then she rushed out again, not knowing that the twelfth fairy had not yet spoken.

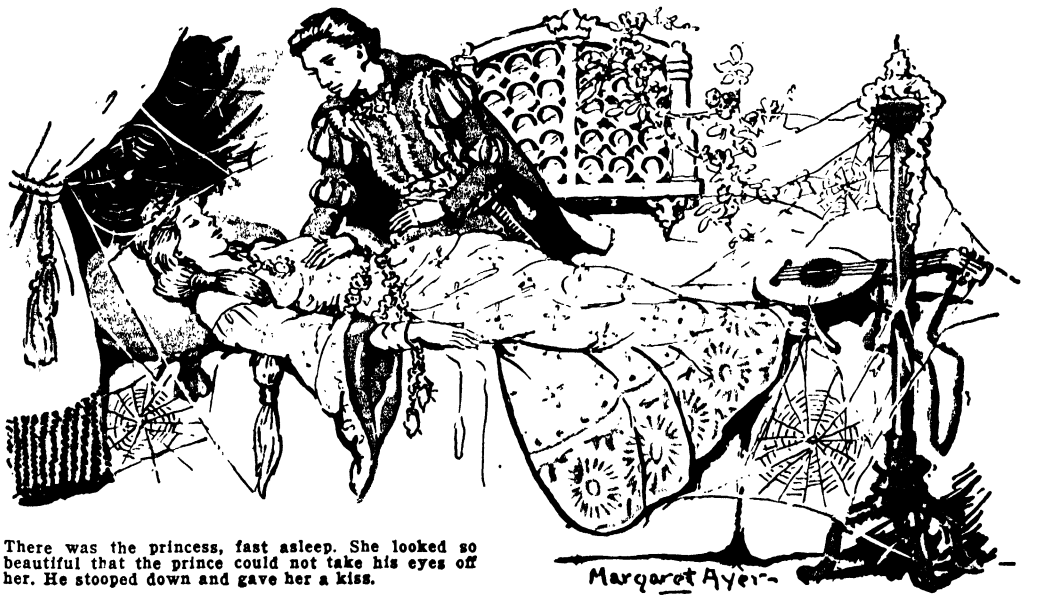
Now the twelfth fairy came forward and soothed the weeping queen.

"I can not promise that the wish of the thirteenth fairy shall not be fulfilled," she said, "but I can soften it. Your daughter shall not die, but will fall asleep for a hundred years."

But the queen would not be comforted. "Only say that we may sleep with her!" she begged. And the twelfth fairy said this might be done.

The king called all his soldiers to him. "Search the kingdom," he ordered. "Buy up and destroy every spindle. Let not a single one be left in all the land." And he commanded that the princess be guarded day and night, so that never, till she passed her fifteenth birthday, should a spindle come near her.

As the years passed, the fairies' gifts were all fulfilled. The princess was so beautiful,



There was the princess, fast asleep. She looked so beautiful that the prince could not take his eyes off her. He stooped down and gave her a kiss.

well-behaved, amiable and wise that everyone loved her.

Now it happened that on the eve of the day Brier Rose was fifteen years old, a birthday feast was prepared for her, with great rejoicing in all the land, for the king and queen felt that the danger was now over. Everyone was busy hanging garlands in the palace or preparing the feast, and for a few minutes in the afternoon no one was with the princess. She roved about, well pleased to be alone, and she came at last to an old tower to which there was a narrow staircase. Upstairs there sat an old woman spinning away busily.

"How now, good mother," said the princess, "what are you doing there?"

"Spinning," said the old woman.

"How prettily that little thing turns around!" said the princess. "I wish I might try it."

"Take it then," said the old woman.

The princess sat down and took the spindle and began to spin. But scarcely had she touched it when she fell down on the floor as though dead.

However, she was not dead, but had only fallen into a deep sleep.

Immediately the king and queen fell asleep too. And the horses slept in the stables, and the dogs in the court, the pigeons on the housetop and flies on the walls. Even the fire on the hearth left off blazing and went to sleep, and the meat that was roasting stood still.



The cook, who was at the moment pulling the kitchen-boy by the hair to give him a box on the ear for something he had done amiss, let him go, and both fell asleep. And so everything stood still, and slept soundly.

A large hedge of thorns soon grew round the palace, and every year it became higher and thicker till at last the whole palace was surrounded and hid, so that not even the roof or the chimneys could be seen. But there went a report through all the land of the beautiful sleeping princess, so that from time to time several king's sons came and tried to break through the thicket into the palace. This they could never do, for the thorns and bushes laid hold of them as if with hands, and there they stuck fast.

Now on the day that the hundred years were completed, a prince came to the thicket. He saw no thorns, as he had expected; he saw nothing but beautiful roses and flowering shrubs, through which he passed with ease, and they closed after him as firm as ever. He came at last to the palace, and there in the court lay the dogs asleep, and the horses in the stables, and on the roof sat the pigeons fast asleep with their heads under their wings. And when he came inside the palace, the flies slept on the walls, and the cook in the kitchen was still holding up her hand as if she would box the ears of the kitchen-boy, and the maid sat with a black

fowl in her hand ready to be plucked.

Then he went on still farther, and all was so still that he could hear every breath he drew; till at last he came to the old tower and opened the door of the room in which the princess lay. There she was, fast asleep. She looked so beautiful that he could not take his eyes off her, and he stooped down and gave her a kiss. The moment he kissed her, she opened her eyes and smiled upon him.

Then the king and queen awoke, and all the court. The horses got up and shook themselves, and the dogs jumped about and barked; the pigeons took their heads from under their wings and looked about and flew into the fields; the flies on the walls buzzed away; the fire in the kitchen blazed up and cooked the dinner, and the roasting meat turned again. The cook gave the boy the box on his ear so that he cried out, and the maid went on plucking the fowl.

And then was the wedding of the prince and the princess celebrated, and they lived happily together all their lives long.

Sindbad the Sailor

As Sindbad the Sailor was sitting in the mansion which he had built in the city of Bagdad, he heard a poor porter say: "Men are not rewarded according to their merit. I have worked harder than Sindbad, and yet he lives in splendor and I live in misery."

Sindbad was moved by the porter's complaint and invited him to come in and listen to the story of his adventures.

"Perhaps when you have learned by what sufferings I won my wealth," said Sindbad, "you will be more contented with your own lot in life.

"Look at my white hair and worn face! I seem an old man. But how young and strong I was when I sailed away to make my fortune by trading in strange countries! Soon after we departed, our ship was becalmed near a small island, but when we landed to look at the place, we found that what we had taken for land was only the green back of a great beast, a sort of ocean cow, called a whale.

"No sooner had we landed than it began to sway to and fro, and then it plunged beneath the waves and left us struggling in the sea. Clinging to a large piece of wood, I was washed ashore on a desert island.

"Here I thought I should have starved. But on wandering about I found a clump of fruit trees and hidden among them a great white ball about fifty feet in size. By this time I was very weary, and so when I had eaten some of the fruit I crept beneath the ball and lay down to sleep. Just as I was closing my eyes I looked up and saw that the sky was darkened by the wings of a gigantic bird.



"'Good heavens!' I exclaimed. 'This great white ball is the egg of the monstrous bird that sailors call a roc.'

"And so it was. The roc settled on the egg under which I was lying, and one of its claws, which was as big as the trunk of a tree, caught my dress.

"At daybreak the roc flew up into the air and carried me to such a height that I could not see the earth. Then it descended with such speed that I nearly lost my senses. As it alighted I freed my dress and found myself in a deep valley cut off from the world by a circle of high, steep mountains.

"It was the Valley of Diamonds! The ground was covered with precious stones. Full of joy, I began to fill my pockets with them, but my joy was soon turned to terror. The valley was haunted by great serpents, and I could find no means of escape.

"I crept into a cave and blocked up the opening with a large stone, but all night I was kept awake by the hissing of the serpents. At daybreak they retired, as they were afraid of the roc that used then to visit the valley in search of food. Then I stole out of the cave, only to be knocked over by something that came tumbling down the mountain side. It



was a great piece of fresh meat. As it rolled along, the diamonds on the ground stuck to it. Looking up, I saw on the mountains a band of men, who were preparing to roll another piece of meat into the valley.

" 'I have heard of this means of getting diamonds,' I said to myself. 'It strikes me that it is also a good means of getting away.'

"So I tied myself to the piece of meat and hid beneath it, and presently an eagle swooped down and seized the meat and carried it to its nest on the top of the mountains. The band of men drove the eagle away, and turned the meat over to pick off the diamonds that had stuck to it, and found me tied to it.

"When they had all the diamonds they needed, we sailed for home. But on passing the desert island my companions landed with an ax and broke open the great white ball. A terrible scream rang through the sky. The roc had seen them. They rushed back to the ship, and we quickly sailed away; but the roc followed us, bearing in its claws a great piece of granite. This it dropped on our ship, and down we all went into the sea. Holding on to a fragment of wreckage with one hand, and swimming with the other, as the sea was calm, I managed to reach another island.

"It was a delicious spot! Sparkling streams ran between vineyards full of grapes and orchards full of fruit. There I met a strange old man, who made signs to me to carry him over one of the streams. As soon as I hoisted him on my back, the old man threw his legs over my neck and squeezed my throat so that I fainted. When I came to, he was still fixed on my shoulders. And there he remained.

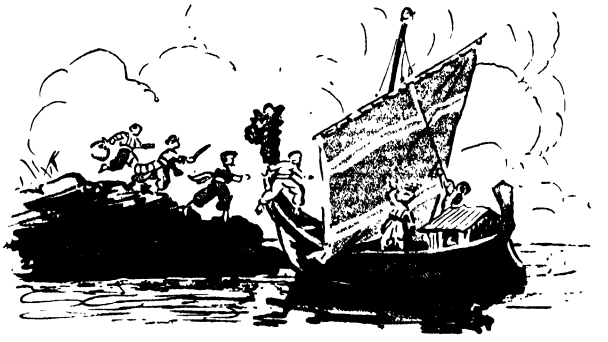
"He made me his slave. When, in order to keep up my strength, I made some wine out of the grapes, he took it from me and drank it all up. Happily, it was too strong for him, and releasing his hold of my neck, he fell to the ground, and I killed him.

"By the shore I met some sailors, with whom I returned to Bagdad.

" 'That was the Old Man of the Sea', they said to me. 'You are the first person that has escaped from being at last strangled by him.'

"Now don't you think," said Sindbad to the porter, "that I have earned all the riches that I brought away from the Valley of Diamonds?" The porter agreed that he had.

THE NEXT STORIES ARE ON PAGE 1964.



SCIENCE

HOW HEAT WORKS FOR US

WE have learned that there are three methods for transferring heat energy, namely: *conduction,* which takes place mainly in solids; *convection,* which takes place mainly in fluids, either gases or liquids; and *radiation,* which applies to the transfer of energy through space.

CONDUCTION

The knowledge of these principles and the application of them are very important to our everyday life. In heating and cooling our homes, offices and factories, and in cooking food, we are interested in methods of transferring heat from one place to another. In other cases, such as in the use of refrigerators, we are mainly interested in preventing a transfer of heat. In other words, we control the transfer of heat so that we can get it to a place where it is needed or keep it out of places where it is not needed.

You already know that if you hold one end of a poker while the other end is placed in a bed of live coals, within a few minutes the entire poker becomes hot. The molecules of the hot coals are in very rapid vibration. The molecules of the iron poker which are near the coals receive some of this energy of vibration and in turn transmit this vibration to their less active neighbors. These transmit energy to the next molecules and so on, until the whole poker is heated. In no case does one molecule from the live bed of coals move along the poker to your hand; the molecules of a solid are held in the same positions with respect to one another. Only the vibrations are communicated along the poker.

Silver is the best conductor of heat known, copper is next, and gold and aluminum are not very far behind. Metals are much better conductors than other substances.

Feathers, fur, straw, wool and cork are poor conductors of heat. Liquids and gases in general are very poor conductors. A very poor conductor is called an insulator. The poor conductivity of such things as wool, fur and so on, is chiefly due to the fact that they contain such large air spaces. Substances which contain a large number of small air spaces are in general poor conductors.

We see therefore that substances differ widely in their ability to conduct heat. The



This drawing shows us various ways in which heat energy is transferred. The heat from the fire is transferred to the coffee in the pot because the metal of which the pot is made is a good conductor. Heat is being radiated from the fire in waves. The warm air heated by the fire is being forced upward by colder, heavier air (convection). The radiant heat from the sun is reflected from the white dress and is absorbed by the black dress.

following simple experiment will prove this point. Twist the ends of two thick wires of iron and copper together. Place some wax on the end of each wire and heat the twisted part in a flame. In a few minutes you will notice that the wax at the end of the copper wire will melt first. This proves the superior conducting power of copper.

If you have ever stood barefooted on a tile floor, you know that your feet feel much colder than when you stand on a rug in the same room. Heat from your feet is quickly conducted to the tile. This proves that the tile is a better conductor of heat than the rug. You probably know that most modern cooking utensils are made of copper or aluminum; and now you know the reason why. They conduct well the heat from the stove to the food that is to be cooked.

INSULATORS

Many materials are useful, not because they are good conductors, but because they are poor conductors. Our woolen winter clothing, for instance. Air is a much poorer conductor of heat than wool and since there are many air spaces in wool, this material is one of the best heat insulators known. Wool clothing does not actually give us any warmth in winter; it prevents the heat of the body from escaping. Clothing made from the poorest conductors is "warmest." Several light sweaters are warmer than one heavy sweater because there is a layer of non-conducting air between each two. The warmth of a fur coat is much appreciated by women, but its beauty is apparently appreciated more. If it were not so, fur coats would be worn with the fur on the inside instead of on the outside. Linen and cotton conduct heat twice as fast as wool and are therefore more suitable for summer clothing. On cold winter nights fowls on the roost spread their feathers to increase the size of the air spaces. A pad of flannel is good for lifting hot pans, and a wooden handle is put on a soldering iron because flannel and wood are poor conductors. Glass is also a poor conductor of heat. When hot tea is poured into a glass it is liable to crack because the inside of the glass gets heated first and expands, while the outside has not yet been heated—unless a good conductor, such as a metal spoon, is put into the glass to conduct the heat away.

The walls and doors of your refrigerator contain materials which are poor conductors of heat, such as sawdust and cork. They keep the heat of the room from being conducted into the refrigerator. While we are on the subject of refrigerators, it may be interesting to point out that they were an important part of the equipment of polar explorers. Can you tell why?

Furnaces and hot-water pipes are covered with asbestos or magnesia prepared in a form so as to contain a great number of air spaces. These substances will withstand high temperatures and are poor conductors of heat; so the heat is not wasted by leaking out through the walls of the furnace, or the pipes. Houses are built with double walls and sometimes with double roofs and double windows. The air spaces between the walls keep the heat from escaping in winter and the outside heat from coming in during the hot weather. Thus the house is warmer in winter and cooler in summer. We say such a house is well insulated. A well-insulated house needs less fuel than one that is not insulated.

Advertisements in newspapers and magazines now call your attention to many kinds of insulating materials that are used in the construction of houses.

CONVECTION

We often warm our hands by holding them over a radiator or stove. Heat is carried from the stove or radiator to the hands by a stream of air. Thus we see that warm air is streaming *upward* from the source of heat to some colder place. The reason for this is that substances expand when heated, and their density is correspondingly decreased. This means that air over a heated surface is less dense than the surrounding air. The colder, heavier air will displace this lighter air and push it upward. Such *convection currents* may be produced in either liquids or gases. Ordinary ventilation depends upon convection. Air which is exhaled (breathed out) from your lungs is warmer and lighter than the cold air in a room. If the window is open at the top, this warm, used air will escape out the window, pushed up by the colder air which comes in from nearer the floor.

The hot gases in a chimney are lighter than the air outside and the effect we call the draft is due to the greater pressure exerted by colder air. The speed with which the air is forced up the chimney depends in part on the difference in weight between the column of hot gases in the chimney and a column of outside air of the same height and cross section. The hotter the gases and the taller the chimney, the greater the draft.

This accounts for the tall chimneys constructed for factories. A stack built for smelting copper ores in Montana is 580 feet high.

A cheap and convenient heating system for a house is found in the hot-air furnace. This system consists of a stove with a jacket about it from the top of which pipes lead to the rooms to be heated. Through the pipes air is pushed up by convection currents. Cold air is led into the base of the jacket where it is heated, in turn, and pushed up into the pipes by the colder air behind it. The cold air in each room is forced out through openings near the floors. In many of the more modern homes convection alone is not relied upon for the circulation of warm air. An electrically operated fan or blower circulates the air by pushing it through. In such cases the air is made to pass through a pad of loosely woven felt or other fibrous material to take out dust and smoke. Such systems contribute a great deal to general comfort and health.

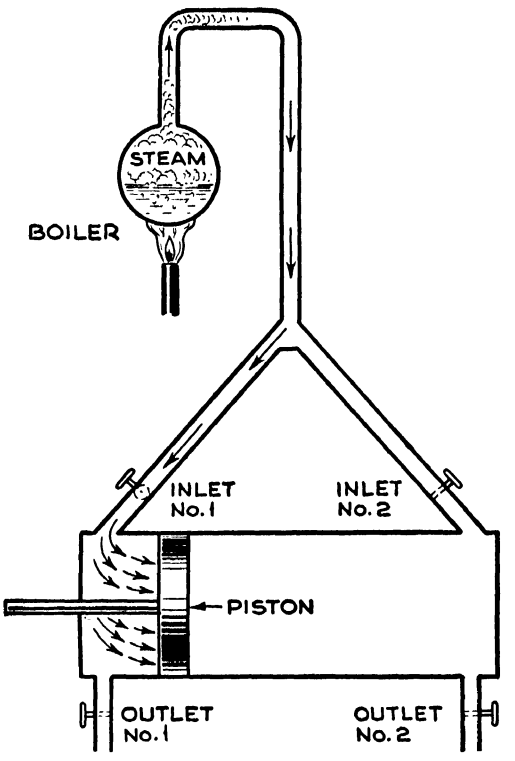


Diagram 1. The simplified steam engine illustrated above shows just what happens when we convert heat energy into mechanical energy—that is, when we make heat perform work. We explain on page 1849 how the engine works. It would not be a practical sort of machine, since all the inlets and outlets would have to be opened and shut by hand.

Land and sea breezes are also caused by convection. The land has a lower specific heat than the water. In other words, the land heats up more quickly than the water but it also loses its heat more quickly. Therefore during the daytime the land has a higher temperature than the water. The air over the land is pushed upward by the cooler air from the sea. About noon a cool sea breeze begins to blow toward the land. At night, the reverse is true; that is, the land cools more quickly, going below the temperature of the water. The warmer air over the water is forced upward and the winds consequently blow offshore, from the land toward the water. This is commonly known as a land breeze. For these reasons fishermen along the coast go to sea at night with the land breeze and return in the forenoon with the sea breeze.

In steam-heating systems, water is heated to boiling and the steam, which occupies about 1,600 times as much volume as the water had occupied, expands through the pipes and into the radiators. It is distributed by its own pressure throughout the system. When the steam reaches a radiator in a room, the cooler air outside the radiator causes the steam to condense, because heat must flow from a higher heat-level to a lower heat-level—from a hotter thing to a cooler thing. As enough heat leaves the steam, the steam becomes water; it condenses. As the steam condenses in the radiator, each gram sets free 540 calories of heat; this much heat was added to the gram of boiling water in order to convert it to steam. The heat from the radiators is distributed to the room by convection and by radiation. After condensation the water at a temperature below 100 degrees Centigrade returns to the boiler, usually through the same pipe. This process is repeated as long as the boiler produces steam.

RADIATION

We have already spoken briefly about the process of transmission of energy without the aid of intervening molecules—radiation. If you stand before an open fire you are heated. Since the air is a non-conductor, you do not receive this heat by conduction. Since convection carries the heated air upward, you do not get the heat by convection. The energy must be transmitted to you by some other method. Heat comes to us from the sun across millions of miles of space where there is no material in which conduc-

tion or convection can take place. In such cases the heat is called radiant heat. Radiant heat may pass through objects without heating them. Energy, or radiant heat, from the sun passes through the upper layers of the earth's atmosphere without heating them. Glass permits short waves of radiant energy from the sun to penetrate, but not longer waves like those of a flame. If a pane of glass be held before a gas flame, it will transmit only a little of the heat and will become very hot because it has absorbed much of this heat. The reason is that the flame emits long waves. The sun's heat, however, passes readily through a glass-enclosed greenhouse; yet the heat from inside the greenhouse can not escape through the glass. Heat comes from the sun through the atmosphere without heating it. The short waves from the sun can penetrate the atmosphere, but when they strike the earth they are absorbed and warm it up. The earth radiates longer waves which are mostly absorbed by the surrounding atmosphere. If the atmosphere were not present, we would burn to death during the day and freeze to death at night. This is one of the reasons why life can not be maintained on the moon, which does not have a thick blanket of atmosphere. Orange-growers in Florida and California protect their crop from sudden frost by burning smudge pots. These smoky fires are built for the purpose of providing a layer of smoke which absorbs radiation from the earth, and thus provides a sort of extra blanket.

ABSORPTION AND REFLECTION OF HEAT

Have you ever wondered why light-colored clothes are worn in summer, or why the Arabian horses are white? Surfaces differ in their ability to absorb radiant heat. Polished materials are good reflectors of heat; hence they are poor absorbers. Clean snow is a good reflector; hence it will not absorb much heat. This accounts for the fact that the snow in the country does not melt so rapidly as the snow in the city. In the city the snow gets dirty more rapidly and it melts faster. All black substances are found to be good absorbers of heat. Lay a black cloth and a white cloth in the sun on a cold day. In a short time you will find that more snow has melted under the black cloth than under the white cloth. The black cloth has absorbed more heat, and has, in turn, radiated more heat, and so melted the snow more quickly. Can you now see why light-colored clothes are worn in the summer? The Arabians use white horses because in that hot country dark-colored horses would more easily be exhausted from heat. *A good absorber of heat is also a good radiator of heat; and a poor absorber of heat is a poor radiator of heat.*

REFRIGERATION

In many homes a gas flame is used directly to produce ice in a refrigerator while in others an electrical motor is used. In either type of refrigerator we have one of the most interesting examples of repeated transmissions of energy. In the second type, the electric refrigerator, the energy of burning fuel is transformed into electrical energy at the power house; this energy is changed by means of a motor to mechanical energy by operating a pump which in turn compresses a gas until it liquefies. The heat produced when this gas is compressed is carried away by running water or by the circulation of air. We choose a gas which liquefies easily such as sulphur dioxide or the new commercial preparation "freon." The cooled liquid then evaporates through a valve with a small opening into coils of pipe in the compartment of the refrigerator where the ice cubes are kept. The pressure in these pipes is kept very low by the pump which acts both as an exhaust pump and as a compressor. In order to evaporate in the coils the liquid must have heat energy supplied to it. The only place heat energy can come from is the food and if the food gives up this heat energy, it will be cooled. Thus we see that to evaporate, the liquid must take heat from the food.

Most of us are familiar with the cooling effect of evaporation. You have often heard swimmers say that it is warmer in the water than out of it. This should not be surprising to us if we understand the principles of evaporation. When you come out of the water, your body is wet and water evaporates from it. The heat necessary to vaporize the water is taken from the body, leaving the body cool. Some liquids evaporate even faster than water. If a little alcohol or ether is poured on the hand and allowed to evaporate, your hand will become cooled. Every molecule that evaporates from your hand must take enough heat away from it to give it sufficient energy to leave your hand. Only the fast-moving alcohol molecules will escape, leaving the slower ones behind. As you already know, slow-moving molecules in a liquid mean low temperature. In the summer-

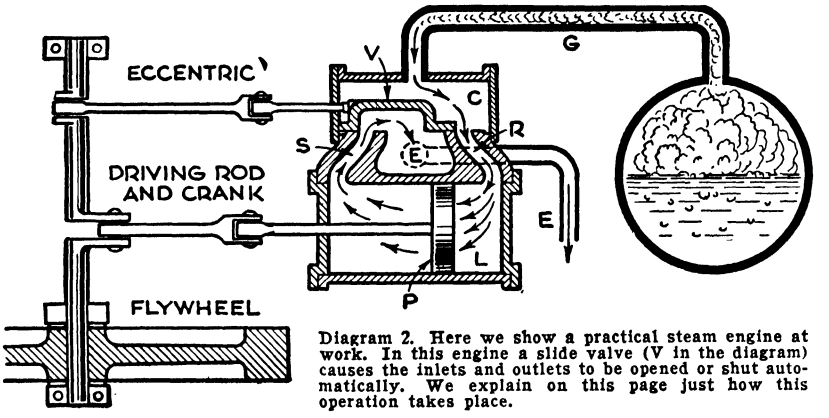


Diagram 2. Here we show a practical steam engine at work. In this engine a slide valve (V in the diagram) causes the inlets and outlets to be opened or shut automatically. We explain on this page just how this operation takes place.

time people use electric fans for the sole purpose of evaporating the moisture from their bodies at a faster rate. This evaporation takes heat from their bodies.

CONVERTING HEAT TO WORK

Heat energy can be converted into mechanical energy by means of a machine called a heat engine. For example, if we boil water in a covered pot, we may notice the cover moving up and down. When sufficient heat energy is added to the water molecules they are converted into a gas—steam—and the pressure of the steam against the cover is sufficient to raise it. This is a crude but simple example of how we convert heat energy into mechanical energy. With this principle in mind let us devise a simple ideal steam engine just for the sake of understanding the principle of operation. Watt, the inventor of the steam engine, probably went through the same reasoning process. If we allow steam from the boiler to enter inlet 1, it will enter the cylinder and push the piston to the right as shown in diagram 1. Now if we close inlet 1 and open inlet number 2, the expanding steam will drive the piston to the left provided that outlet 1 is open for the spent steam to escape. If now inlet 2 is closed and inlet 1 is open, the steam will expand against the piston and drive it to the right provided that outlet 2 is open. Outlet 1 must, of course, be closed, otherwise a pressure will not be built up against the piston. In this ideal model of steam engine everything would work fine if all the inlets and outlets were opened and closed at the right time. In a real steam engine the opening and closing of the inlets and outlets, called valves, is entirely automatic.

The principle of the modern steam engine is based on the ideal engine we have just described and is shown in diagram 2. The steam chest, C, contains an ingenious device called a slide valve, V, that slides from one end of the box to the other. Its purpose is to uncover the inlets, or *ports*, which allow steam to pass either to the right-hand or left-hand side of the piston, P. (The piston slides in the cylinder, L.) Since the slide valve, V, must move left and right, it is connected to an *eccentric* on the shaft of the flywheel through a rod. Steam flows from the boiler through the pipe, G, into the cylinder, L, and exerts a force, pushing the piston, P, to the left. As the piston moves, it turns the shaft by means of the driving rod and a crank. This in turn moves the eccentric rod which causes the slide valve to move to the right. When the piston has moved about one-third of its stroke, the slide valve closes the port R. The steam is now trapped in the cylinder and continues to expand, driving the piston forward. When the piston reaches the left end, the slide valve has moved far enough to the right to admit fresh steam through port S and to open the right end of the cylinder through to the exhaust port E.

The piston is then pushed back toward the right, which in turn forces the cool steam in the right end out of the exhaust port. As the piston moves back and forth, the slide valve also moves back and forth. First it admits steam into one side of the cylinder and then into the other, at the same time opening one exhaust port, and then the other. This back-and-forth motion of the piston, known as reciprocating motion, is changed to a rotary motion of the shaft by a connecting rod and crank. Actually the inlet ports opening to the steam chest are shut off before the piston reaches the end of the stroke, and the piston is driven the remainder of the way by the expansion of the steam trapped in the cylinder. The inertia of the heavy flywheel steadies the motion of the crankshaft and insures constant speed of rotation.

By SIMON WEISSMAN.

THE NEXT STORY OF SCIENCE IS ON PAGE 1969.

SEVEN GREAT CEREALS GROWN FOR FOOD



Oats



Barley



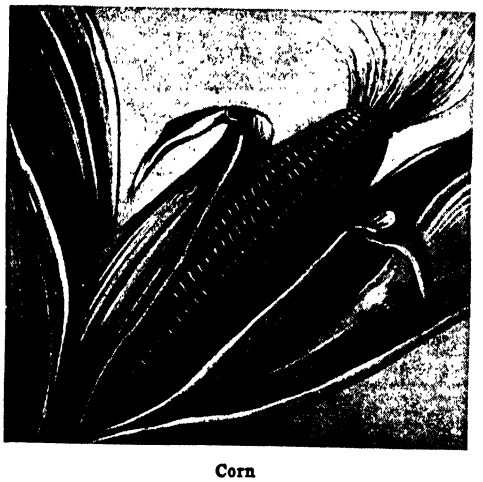
Rice



Sorghum



Rye



Corn



Millet

Of all food plants the cereals are the most useful, and of all cereals wheat has the greatest value. Other cereals or cultivated grasses are grown, and here are the seven most important cereals after wheat.

THE GREAT CEREALS

WHEAT, as we have seen, is the most valuable food plant that is grown by man, but there are several other cereals, or edible grain plants, of great importance, which form the principal food of millions of people in many parts of the world. Chief among these cereals are corn and rice, oats, barley and rye.

Corn, or maize, one of the great gifts of the Western Hemisphere to the world, is of the greatest interest to the boys and girls who like to eat its golden grains, and who benefit in various ways from the many valuable by-products of the plant. To-day it is one of the great grain crops of the world, and in the United States it is the largest, more than one-tenth of all the farm land being devoted to its culture. There are several varieties of sweet corn, which is eaten from the cob or canned. Another and smaller variety is popcorn. The kernels of popcorn have much moisture. When this corn is heated the moisture turns into steam and expands, bursting the shell. Then the white starchy inside pops out.

Much of the corn crop is used to feed hogs and cattle. Corn is also employed to make corn oil and corn sugar. The oil serves for salads and cooking, and in making soap and drugs. Corn sugar is used for candy, ice cream and table syrups. It is valuable as a medicine, since it contains dextrose, the kind of sugar in human blood. The stalks are used in industry.

When Columbus came to America he observed the people growing and eating corn, and later explorers, reporting on this new land which they still believed to be India, called the plant Indian corn. At that time the word "corn" was used to describe any kind of grain. Several hundred years later, the great Swedish botanist, Linnæus, gave the plant its modern botanical name, maize.

The origin of this plant is still unknown, for there is no record of its ever having grown wild, but it is undoubtedly a native



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A cornfield in Iowa, heart of the "corn belt."

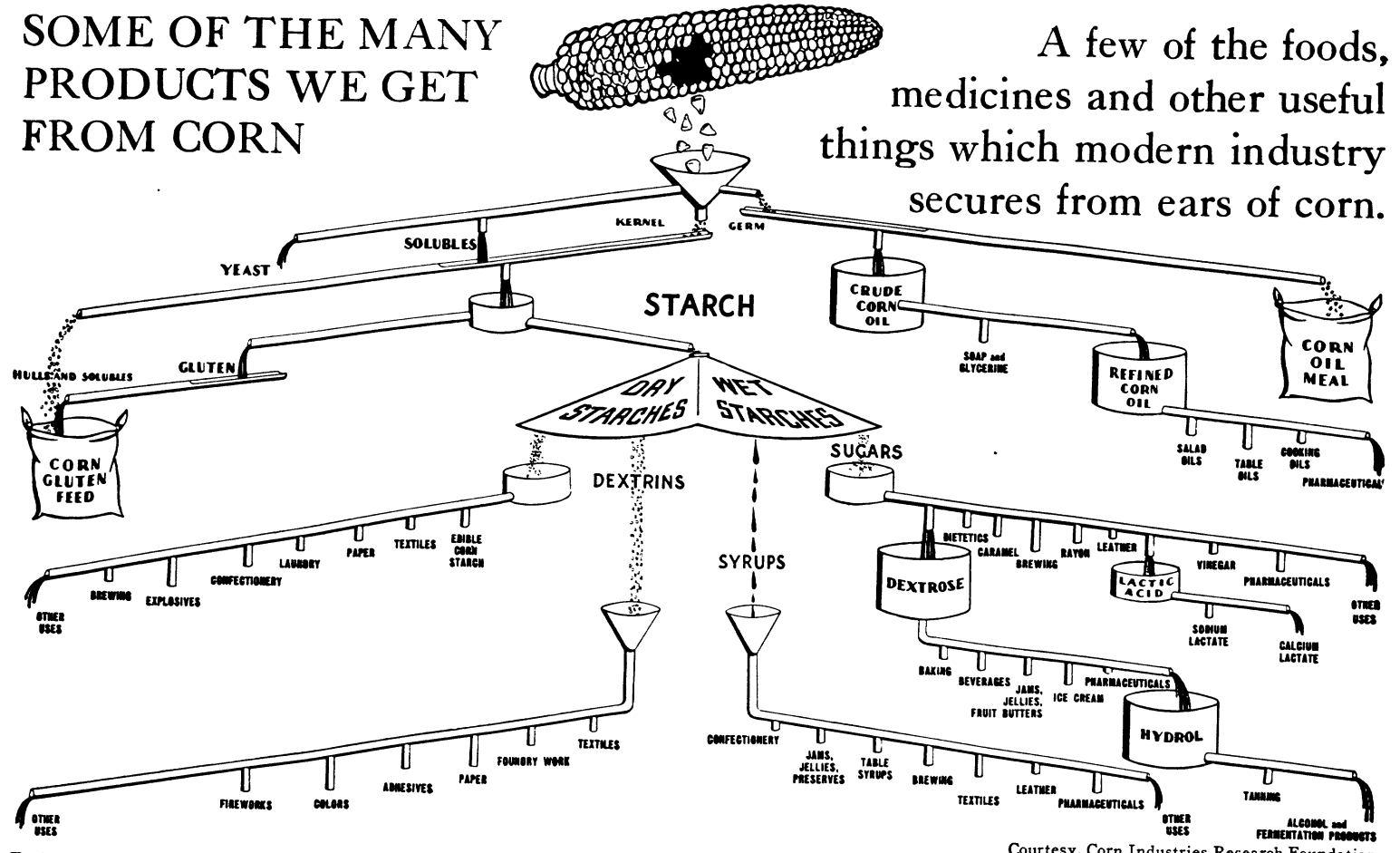
of our western continents. It is a most adaptable plant, for there are varieties which will grow and ripen in almost every type of climate. It can be grown in great fields, covering many acres, yet it will also flourish in little patches in cottage gardens.

The plant is very beautiful, and there is no lovelier sight than a field of the graceful stalks and satiny leaves when the ears are ripening. When fully grown, the stalk bears an enormous amount of leaf surface, which accounts for the large amount of starch in the grain. The leaves are the plant's starch factory. The leaf is wonderfully constructed to stand the full force of the wind. It has a spiral twist, and frills enable it to turn to left or right as freely as if it were hinged. While protecting the stalks from the wind, the leaves turn round and avoid being slit, a thing that would happen if they were less flexible.

Oats and barley are grown in large quantities. In Scotland oats have for centuries largely taken the place of wheat. They form a valuable food, but they cannot be made into flour, as wheat can, and therefore light bread cannot be made from them. That is why the Scots, and other people to whom oats are a staple food, take them in the form of porridge and cakes. Scotland has undoubtedly thrived on oats. It is told of an

SOME OF THE MANY PRODUCTS WE GET FROM CORN

A few of the foods, medicines and other useful things which modern industry secures from ears of corn.



1852

Courtesy, Corn Industries Research Foundation.

Each golden ripe kernel of corn is a plump storehouse of starch, protein, minerals, gluten and oil. Some varieties are grown for the table, where the corn is served fresh or canned. Some corn is eaten by hogs, which grow fat and sleek on this rich diet. The stalks, stored in silos, make delicious green fodder for cattle during the winter months. Poultry love the dried kernels. From sixty million to eighty million bushels of shelled corn each year in the United States go to manufacturing plants. There the starch and other ingredients are separated and refined and turned into one or more of the products you see listed on this chart. Many of these, such as cornstarch and corn meal and corn syrup and oil for salad and cooking are familiar to you in your own kitchen.



Courtesy, Canadian National Railways.

Canada raises, in most years, around 400,000,000 bushels of oats. About thirty bushels to the acre is the average yield, but here is a bumper crop on a farm near Calgary, Alberta, where 118 bushels per acre were harvested.

Englishman traveling in Scotland with a party of friends that he met a Highlander carrying a bag of oats, and said: "In England we use those for feeding horses, but in Scotland they are eaten by men." "Yes," replied the Highlander, "No doubt that is why in England you have such fine horses, and in Scotland we have such fine men."

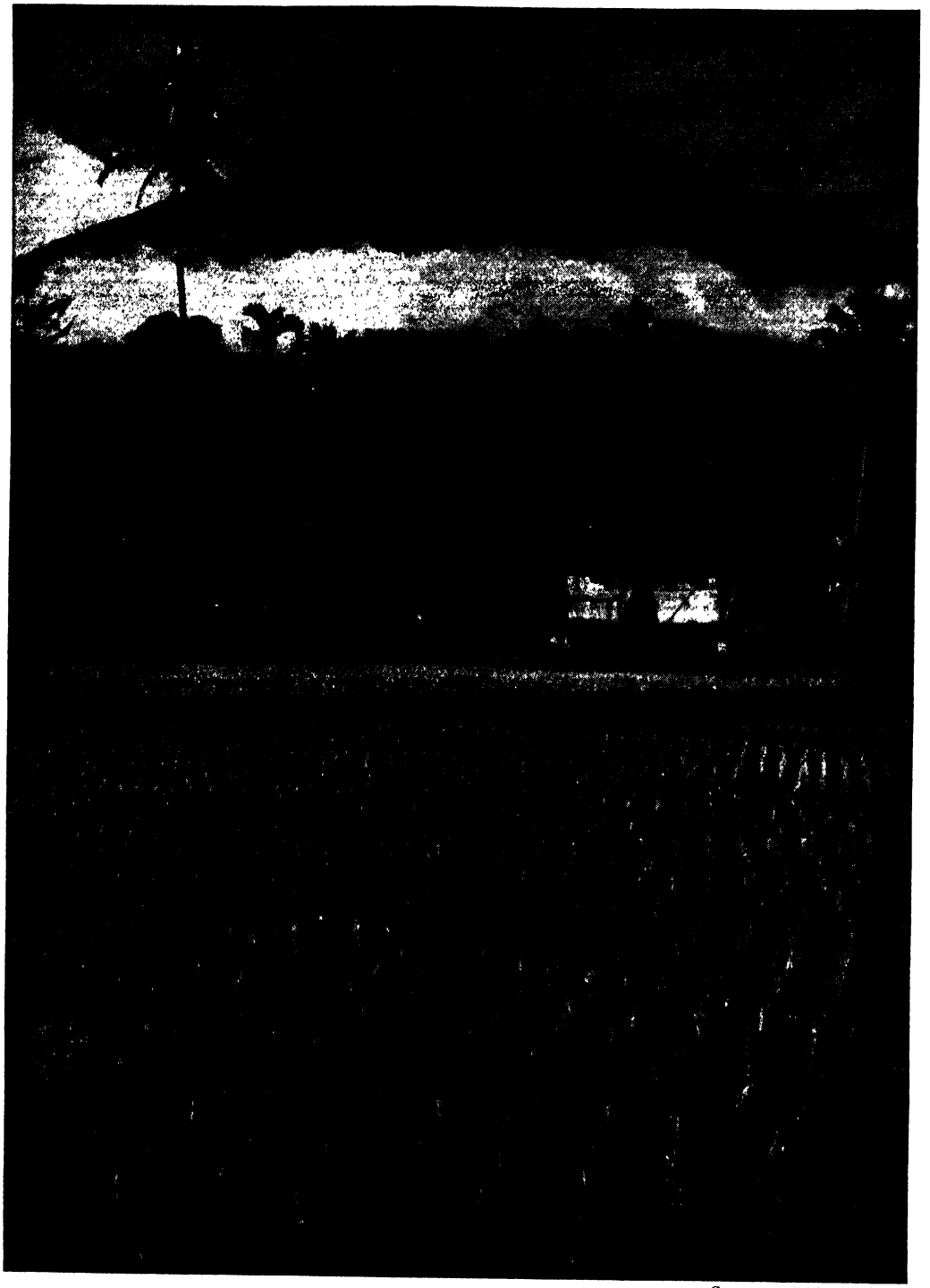
Up to the end of the first World War the world's crop of oats was bigger than the wheat crop, but since that time the oat crop has shrunk somewhat, so that in some years it is not so large as the wheat crop.

The oat is unlike most of the other cereals in that its grain is borne, not in a close spike, but in a branching head, with each ear hanging down on a thread-like attachment. Oats grow best in the colder temperate regions, and will ripen very far north. They flourish in Scotland and all over the Scandinavian peninsula, and are widely grown in the middle western part of the United States and Canada. Oats are called "the grain of hardness," and it is a very appropriate name. The grain contains more oil than any cereal but corn.

Many attempts have been made to trace the original home of the oat, but without success. Possibly our cultivated varieties, of which there are very many, were all derived from the common wild oat, and it is believed that the plant was first cultivated in the temperate and colder parts of Eastern Europe and Western Asia. It does not seem to have been known to the Egyptians or to the ancient Hebrews. The oat plant puts out long roots that branch in many directions, and careful study by botanists has proved that if all the parts of the root of a single oat plant were joined into one long strand this would reach over one hundred and fifty feet.

Like wheat, oats suffer from a number of enemies, the worst of which is a fungus disease known to farmers as smut. It makes its presence manifest by changing the healthy heads into masses of black powder, which are the spores of the fungus, and these are scattered broadcast by the wind, so that the disease spreads to other oatfields very rapidly. The spores stick to the seed when it is sown, and germinate along with it, producing other spores which inoculate the young oat plant. In recent years this disease has been controlled by sprinkling the seed grain with a solution of formaldehyde, but before this remedy was discovered the United States alone used to lose nearly

RICE PLANTS AFTER TRANSPLANTING



Courtesy, the Dutch Line.

Sumatra, in the Netherlands East Indies, is a rice-growing country. Here, against a background of cloud-wreathed mountains, we see the young plants growing in the flat, flooded fields. The water gives nourishment to the plants and support to their slender stems.

twenty million dollars a year through the ravages of smut.

Another important cereal is barley, one of the most ancient of cultivated plants. Three varieties have been found among the prehistoric lake-dwellings of the Stone Age men in Switzerland, and among the relics of the Bronze Age men in Italy.

Some students think that the ancestor of all the modern kinds of barley was a wild plant which is still found growing in Western Asia. Others believe that this particular plant came from cultivated barley which has escaped and become wild. Many think that our modern varieties have come from more than one ancestor. The plant grows better in the north than any other grain. It will flourish where no other cereal will.

Barley has a shorter period for root development than wheat, and as a consequence, it is what the farmer calls a surface feeder —that is, it has to rely upon the surface soil for nutriment, especially for mineral supplies. A field of barley, therefore, needs more mineral fertilizer than does a field of wheat. The grain is lacking in gluten, and cannot be made into light, airy bread in the way that wheat can. Barley bread is dark in color and rather heavy. The grain, with the hulls removed, is used for soups and gruels and is nourishing, but the "pearl" barley which is also used for these purposes has lost much of its nutritive value by the process which ground the kernel into a smooth, polished ball.

The greater part of the barley crop of the world is grown, not for human food, but for feed for livestock and for alcoholic beverages. It is chosen by brewers for this purpose because it sprouts more quickly than other grains. In the sprouting process the starch of the kernels is changed into a kind of sugar called maltose which is used for making beer, spirits and malted foods. Barley is also used as cattle fodder. The average yearly production of barley in the United States is around three hundred million bushels. Canada raises about eighty million bushels a year.

After wheat, rye contains more gluten than any other cereal, and that is why it was formerly grown so much in Europe for the making of bread in areas where the soil and climate are unsuitable for wheat. In



Courtesy, the Dutch Line.

Here we see a native of the island of Bali, in the Netherlands East Indies, plowing a ricefield with the help of his patient team of water buffalo. These small but strong draft animals are a familiar sight in the Far East.

the sandy districts south of the Baltic and the Gulf of Finland it has always provided an abundance of food for the poorer people.

Rye is one of the cereals that has probably not been long in cultivation. It has no name in older languages, and no trace of it has been found in the Egyptian monuments or in the Swiss lake-dwellings. Nor does it seem to have been known in ancient Chinese agriculture. Botanists think its parent form grew on the dry mountainous regions running from Southern Europe eastward to Central Asia.

It will thrive on soil too poor and dry for other grains, and has been called "the grain of poverty." The famous black bread eaten in Germany and Russia is really bread made from rye. The green rye is often cut to feed cattle, but the matured straw is not very good for them. Much of it is used to make paper and cardboard, for straw hats, and as bedding for animals. Rye has a smaller grain than the other cereals, as may be seen by the average number of grains to the bushel, thus: rye, 1,161,600; oats, 731,000; wheat, 700,000; barley, 547,200.

Rye suffers very severely from a fungus disease known as ergot, which not only destroys a large part of the crop, but infects the hay and grass on which cattle feed, giving them a disease which is a form of gangrene and has much the same symptoms as hoof-and-mouth disease. This disease can be communicated to human beings. Curiously enough, a medicine is made from ergot.

The cereals that have been described—wheat, oats, barley and rye—all flourish in Europe, and were carried from there to North and South America and Australia. Among them wheat stands first in importance, but when the whole world is taken into consideration, the next most important cereal is undoubtedly rice. Nearly half the human race is dependent upon this grain for its existence, and the rice crop of the world is enormous. It is difficult to calculate the actual size of the world crop, however, for much of the rice is eaten by the people who grow it, and therefore does not come into the open market.

Rice is a grass with long, narrow leaves, and the wiry stems grow from two to five



© J. W. McManigal.

Sorghum is not really a cereal. Several varieties are grown for their seeds, for stock and poultry feed.

feet high. It is believed to have originated in India, but thousands of years ago men began to cultivate it, and the plant spread eastward through China, Japan and Siam (Thailand) to the islands of the Eastern Archipelago. In more recent times it has been carried to the Western Hemisphere and to Australasia.

HOW RICE CAME TO BE GROWN IN NORTH AMERICA

It is said that the introduction of rice into North America was the result of an accident. About 1685 a sailing ship bound to England from Madagascar was blown out of her course and put in at Charleston, South Carolina, for repairs. The captain of the ship found that one of the leading residents of the colony was an old friend of his, and before the ship was repaired and the captain sailed away, he gave a small bag of rice to his friend, who had it sown on a swampy piece of land that he owned. The crop was so successful that other planters began to cultivate rice. A dozen years later seventeen shiploads of rice left the port of Charleston for England, and that was the beginning of the American export trade in cereal grains which has since grown so large.

To-day, rice is no longer among the staple crops of South Carolina and Georgia. The Civil War ruined the industry in these states, for it was kept up by means of slave labor. Later on it was found that rice could be grown with great success in the prairie regions of Louisiana and Texas, where the soil was firm enough to permit the use of modern farm machinery between the irrigation periods. So the great rice-growing states are now Louisiana, Texas, and to a certain extent, Arkansas and California.

RICE IS A THIRSTY PLANT AND NEEDS MUCH WATER

Over two thousand different kinds of rice have been developed, suited to a variety of soils and modes of culture. Most of them are grown on level fields that can be flooded, but there are also upland and hill varieties of rice. The grain is planted and drilled in, and when it has sprouted, the water is let in and is kept rising as the stems grow taller. When the plants have reached the proper height, from twelve to fifteen inches, the water is drained off and the rows are cultivated. Then the water is let in again and is kept rising until flowering time. The grain turns yellow when it is ripe, but before this the water is run off, and after the rice is cut, it is stacked for threshing.

In China, and other lands where more primitive methods still prevail, the rice is simply broadcast on a seed-bed, and when the shoots are three inches high the bed is flooded. Then the water is turned off, and as soon as the plants have reached a height of six inches they are transplanted to the swampy fields and are kept in water until they are fifteen inches high. Then they are drained, weeded and hoed, and the water is let in again until the harvest.

RICE SHOULD BE EATEN WITH FAT AND PROTEIN FOODS

Rice is deficient in oil and the food elements called proteins, and it should be eaten with other foods that contain these substances, such as meat and gravy, eggs and milk, or the like. The Chinese often eat it with beans, which are rich in proteins. It has been found that the outer skin of the grain is rich in certain important vitamins, but these are removed from the polished rice which most people are accustomed to buy. It is better to buy the brown, or unpolished, rice, in order to get the greatest possible food value.

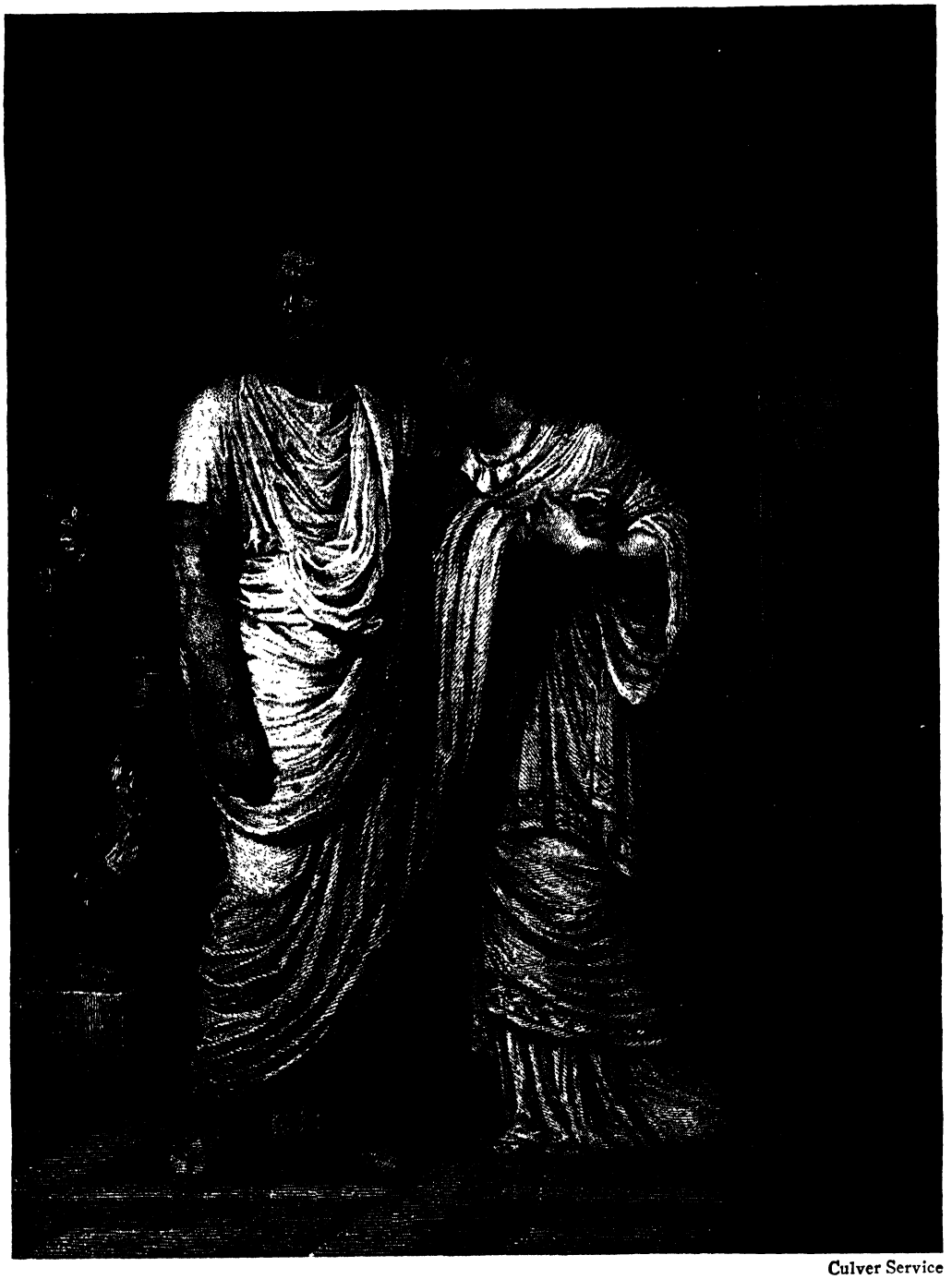
The American wild rice, which grows in marshy places and is loved by the wild fowl, is an entirely different plant from true rice, but it is delicious to eat, especially when served with wild duck, or even with ordinary duck or chicken.

THE SORGHUMS AND OTHER GRAIN CROPS

There are several grain crops of lesser importance. In India, millet takes the place of rice in the drier regions, and some people think this was the first grain that man ever took from the wild, and cultivated for his own use. Durra, often called African millet, but really one of the varieties of sorghum, is another grain grown largely in Africa and now introduced into America. Sorghum is not, strictly speaking, a cereal, yet it is often included among the cereals. Some of the sweet varieties of sorghum give us a pleasant syrup, which is used in the same way as maple or corn syrup, or molasses. This is not manufactured on a commercial scale, however, and is usually made and largely consumed by the farmers in the southern and midwestern United States. Buckwheat, much used in America, is not really a cereal at all, although very much like one. It is the seed of a plant of the smart-weed family, a relative of the dock and sorrel.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 2057.

ON THE IDES OF MARCH



Culver Service

It is the morning of the Ides of March—March 15—44 B.C. The first citizen of Rome is about to leave his beautiful and spacious house for a meeting at the Senate. But his wife, Calpurnia, begs him to stay at home this day, for she has had strange dreams, threatening harm. Cæsar laughs at her fancies, and goes out to his death. In the Senate chamber, at the foot of Pompey's statue, he is stabbed by a group of Romans, some of whom fear his power, others of whom are jealous of his high place. The moment pictured above is a scene of deep suspense in Shakespeare's play Julius Cæsar. The audience knows of the plot against Cæsar's life; Calpurnia senses the danger but Cæsar will not listen to her. The swift and tragic course of the play closely follows history.

FAMOUS MEN OF ANCIENT ROME—II

IN the article beginning on page 1360 we told you about some of the generals and statesmen who won immortal renown in the days of ancient Rome. In this chapter we shall tell you about some other famous Romans who flourished in those days.



The Bettmann Archive

Julius Cæsar and his troops, crossing the Rubicon.

CÆSAR (see'-zer)

GAIUS Julius Cæsar (100–44 B.C.) was the greatest man of ancient Rome. Though he was descended from an old aristocratic family, he was a member of the popular party from his earliest youth. Marius, the leader of this party, had married Cæsar's aunt; and he took a great interest in the promising youth.

When he was eighteen, Cæsar faced mortal danger. Marius was now dead; Sulla, who had been his bitterest enemy, was in power. He demanded that Cæsar should divorce his wife Cornelia, the daughter of one of Marius' friends. Cæsar refused; and he escaped the wrath of Sulla only because the Vestal Virgins (see page 3226) pleaded for the lad. "That boy," grumbled Sulla, as he granted Cæsar's pardon, "will some day be the ruin of the aristocracy, for there is in him many a Marius."

In 76 B.C. Cæsar sailed for the island of Rhodes, in the Mediterranean Sea, in order to study oratory—the art of making speeches. He was captured by pirates off Miletus, in Asia Minor, and kept a prisoner upon the island of Pharmacusa till he was ransomed by his friends. While in captivity Cæsar laughingly told the pirates that some day he would have them all crucified. His captors thought it a great joke. But, sure enough, after he was released, young Cæsar came back with a powerful expedition, captured many of the pirates and succeeded in carrying out his threat.

When he returned to Rome, he did all in his power to win the favor of the people by means of gifts and entertainments of all kinds. After he had used up his own fortune in this way, he borrowed large sums from the moneylenders of Rome. His efforts bore fruit. He became a great favorite with the people, who elected him to public office again and again.

Cæsar had won success as a public leader, but his debts threatened to overwhelm him. So he got the help of his friend Crassus, the wealthiest man of Rome, in arranging for payments to the anxious moneylenders. Cæsar was now put in charge of a military campaign in Spain, and for the first time he showed his military genius.

In 60 B.C. Cæsar formed a political partnership with Crassus and Pompey, who at that time was considered the foremost Roman citizen. These three men were now all-powerful in Rome; and Cæsar had no difficulty in winning election as consul. After serving a year as consul, he was made governor of several provinces, including Gaul (the land we know as France).

In the course of the next ten years he conducted a series of magnificent campaigns in Gaul; he subdued the barbarians who had defied Rome in many parts of that region. While governor of Gaul, Cæsar crossed the Rhine River twice and carried the war to the German tribes that dwelt on the other side of that river. He also made two expeditions to England, where no Roman had ever landed before. Cæsar has told us the



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This picture by J. L. Gérôme shows the Roman Senate chamber a moment after the assassination of Cæsar.

story of his campaigns in his Commentaries of the Gallic Wars, a work familiar to all young people who study Latin.

Cæsar's victories caused Pompey to turn against him, and by 49 B.C. open fighting broke out between the two men. Cæsar defeated his rival in the battle of Pharsalia in 48 B.C. and pursued him to Egypt, where Pompey met his death. Cæsar remained in Egypt for a time, for he had fallen victim to the charms of Cleopatra, a beautiful Egyptian princess. He even fought a war so that Cleopatra might rule over Egypt together with her young brother.

He then departed for Asia Minor, where King Pharnaces of Pontus was threatening the Asiatic possessions of Rome. Cæsar routed the army of Pharnaces in the battle of Zela (47 B.C.). Then he sent the senate a message that consisted of just three words: *Veni, vidi, vici.*—"I came, I saw, I conquered."

Cæsar turned his attention next to the remaining supporters of Pompey. The victories of Thapsus (46), in Africa, and Munda (45), in Spain, made him the master of the Roman world. Many people at Rome were now filled with fear and trembling, for hitherto the victors in civil warfare at Rome had generally brought about a reign of terror. But on his return to Rome, Cæsar pardoned those who had fought against him. Now he ruled alone. His word was law.

We tell you about the achievements of Cæsar as dictator in our article on the Roman Republic. There is no doubt that he did much for the Roman state. There also seems to be little doubt that he wanted to become king. He had his friend, Mark Antony, offer him a golden diadem, or crown, and he only refused because the people greeted the offer with howls of disapproval. At any rate, Cæsar determined to keep the supreme power in his own family; he named his grandnephew and adopted son, Octavius, as his successor.

His enemy, Gaius Cassius, formed a conspiracy against him and won the help of Marcus Brutus. Brutus had fought at Pharsalia against Cæsar, who had pardoned him and showered favors upon him. Brutus joined the conspiracy against the man who had befriended him because he thought that he would thus help to bring back the good old days of the Roman Republic.

Cæsar was attacked by the conspirators in the senate house on the Ides of March (March 15), 44 B.C. He tried to defend himself at first. But when he saw Brutus among those who sought to slay him, he said sadly: *Et tu, Brute?*—"Thou, too, Brutus?"—covered his face with his robe and accepted his fate. He died, pierced by more than twenty wounds, at the foot of Pompey's statue.

This astonishing man excelled in many ways. He was one of the world's greatest

soldiers, worthy to be compared with Alexander the Great, Hannibal and Napoleon. He was a statesman and lawgiver of the first order. He was greatly esteemed for his eloquence by the Romans. Unfortunately only his Commentaries on the Gallic Wars have come down to us, but he wrote many other works, of which ancient authors speak highly.

ANTONY (an'-toh-nee)

MARK Antony (83?-30 B.C.), whose name in Latin was Marcus Antonius, was an ambitious man, who for a time was master of half the Roman world. He neglected his studies as a youth and wasted his time with gay companions. No one thought that he would ever amount to much. But when he entered the armies of Rome, he found his real calling. He fought in Syria, Palestine and Egypt and won the reputation of being a brave and energetic officer. He then served under Julius Cæsar in Gaul and became his right-hand man.



Culver Service

Mark Antony (Marcus Antonius).

In 50 B.C. Antony went to Rome to serve Cæsar's interests. He was elected as tribune of the people, an important office that carried with it the right of veto over the acts of the senate. As was expected, Antony used his powers to help Cæsar's cause and aroused the anger of the aristocratic party at Rome. He had to flee for his life and took refuge with Cæsar in Gaul. He was with that general when he invaded Italy and drove Pompey and his supporters into exile in 49 B.C.

While Cæsar was dictator of Rome, he honored Mark Antony greatly. In the year 44 B.C. the dictator was assassinated by a band of conspirators led by Cassius and Brutus. Antony thought it wise to adopt a cautious policy. He soon came to terms with the senate, which backed the conspirators. But when he delivered a funeral oration over Cæsar's body, his eloquence so inflamed the excitable people of Rome that Cassius and Brutus and the rest did not dare remain in the city.

For a time Antony was the most influential man in Rome. But he soon found a rival in Octavian, Cæsar's adopted son and heir, and presently the two men were engaged in open warfare. Then they joined forces. Together with Marcus Lepidus, they formed a triumvirate, or government by three men, in 43. In the following year Antony and Octavian routed the armies of Brutus and Cassius in the battle of Philippi. It was Antony who won the day by his generalship.

Not long afterward Antony became the ruler of all the provinces east of the Adriatic Sea, while Octavian and Lepidus took over the rest of the Roman world. Antony now met the woman who was to become his evil genius. This was the beautiful Egyptian queen, Cleopatra, who in years gone by had won the heart of Cæsar. Antony fell madly in love with Cleopatra. He had married Octavia, the sister of Octavian; he now sent her back to Italy while he remained in Egypt in the company of Cleopatra.

From now on he was Cleopatra's slave. From time to time he would bestir himself and would become again for a while the great general that he used to be. Most of his time, however, was spent in the luxurious court of Cleopatra in Alexandria. Antony forgot that he was a Roman; he assumed the airs and the ceremonies of an Eastern despot. This conduct disgusted some of his Roman friends. They left him to enter the service of Octavian, who now ruled alone over western Rome.

By 32 B.C. Octavian and Antony had broken off relations and they began to prepare for a fight to the finish. At last, one day in September, 31 B.C., the fleet of Octavian faced the combined fleets of Antony and Cleopatra off Actium, in Greece. In the mighty sea battle that followed, Antony and Cleopatra were routed and they had to flee to Alexandria.

In the following year Octavian appeared off Alexandria with a powerful fleet and army. Antony's fleet and his cavalry went over to Octavian; his infantry was cut to pieces in battle. He now heard a rumor, which later proved to be false, that Cleopatra had taken her own life. In despair Antony slew himself by falling on his sword. He was

spared at least the suffering of learning that Cleopatra had tried to betray him and to make peace with Octavian.

CICERO (siss'-e-roh)

MARCUS Tullius Cicero (106-43 B.C.) was the foremost orator of ancient Rome. In his youth he studied the law, literature and philosophy with equal zeal. He also tried his hand at soldiering, but he did not distinguish himself. So he gave up all hope of a military career and determined to win fame as a lawyer. He soon became one of the most successful lawyers of Rome. So renowned was his eloquence that the courts were always crowded when it became known that Cicero was going to speak.

The Romans, who always greatly esteemed orators, elected Cicero to a number of public offices, including the highest office of all, the consulship. While he was consul, in 63 B.C., Rome was threatened by a great conspiracy, led by Catiline, a worthless member of the aristocracy. The conspiracy was revealed to Cicero, who denounced Catiline in the senate house in one of the most famous orations of all time.

Catiline managed to make his way out of the city, but some of the conspirators were caught. Cicero had been given great power in order to crush the conspiracy, and he now had five of the conspirators put to death without a trial. Catiline was later defeated in battle and slain.

Cicero was hailed as the Father of his Country by the grateful people of Rome. But after he had become a private citizen again, the fickle Romans forgot the great services that he had rendered to the state. He was accused by his enemies of having had Roman citizens put to death without a trial and he was forced into exile. For several years he remained in exile in Greece. When he returned to Rome, he bowed to the might of the three men who ruled Rome at that time—Cæsar, Pompey and Crassus.

In 51 B.C. he had to leave Rome, much against his will, to become governor of the province of Cilicia, in Asia Minor. Unlike most Roman governors of foreign provinces, Cicero proved to be both honest and humane and he won the gratitude of the Cilicians. He was impatient to return to Rome, and as soon as his year of office was over, he left for the scene of his former triumphs.

Soon after Cicero's return to Rome, civil war broke out between Cæsar and Pompey (49 B.C.). Cicero did not know which side to support at first. At last he decided to follow Pompey into exile in Greece. After Pompey's defeat in the battle of Pharsalia, Cicero went back to Italy and threw himself on the mercy of Cæsar, who generously pardoned him. Cicero now retired from public life for a while. He remained in his villa at Tusculum and spent his time writing works on philosophy.

After the assassination of Cæsar, Cicero attached himself to Octavian, Cæsar's heir, who had made an alliance with the Roman senate. Octavian was soon openly at war with Mark Antony, who had been Cæsar's friend and supporter. Cicero thought it was perfectly safe for him to turn the full force of his eloquence against Antony, and he attacked him in twelve bitter philippics. (A philippic is an oration full of personal attacks; the name comes from the orations against King Philip of Macedonia by Demosthenes, a famous Athenian orator.)

When Octavian joined hands with Antony in 43 B.C., Cicero was doomed; for Octavian consented to Antony's demand that the great orator should be put to death. Warned of his danger, Cicero was in despair. He fled from Italy in a boat and then returned to his Tusculan villa because the winds were unfavorable. Then he was persuaded to flee again, but this time he was caught by the soldiers sent in pursuit of him. Cicero's devoted slaves prepared to defend their master to the death, but he forbade them to do so. Wearily he told his pursuers to strike. He was cut down in the sixty-third year of his life.

Cicero was one of the greatest figures in Roman literature. His orations, most of which have come down to us, are the finest example of Roman eloquence. He wrote many works on philosophy, discussing the great problems of life and death in wonderful prose. His letters gave a remarkable picture of one of the most interesting periods in the history of mankind.

AUGUSTUS (aw-gus'-tus)

AUGUSTUS (63 B.C.-14 A.D.), the founder and first ruler of the Roman Empire, was called Gaius Octavius as a boy. He was the grandnephew and the particular favorite of Julius Cæsar. Since Cæsar had no sons of his own, he made up his mind that some day his grandnephew would succeed him as ruler of Rome.

Young Octavius went to Spain in 45 B.C. in order to join Cæsar, who was campaigning against certain followers of his rival, Pompey. It was at this time that Octavius was

formally adopted by Cæsar. The lad took the name of his granduncle with the added name of Octavianus. So he was now Gaius Julius Cæsar Octavianus, or Octavian, as he is generally called by historians who write in English.

After Cæsar's assassination in March, 44, Octavian came to Rome. In spite of his youth he soon became one of the most powerful men of the Roman state. In our two articles on the Story of Ancient Rome we have told you about Octavian's career as a Roman leader—how he strove with Cassius and Brutus and, later, with Mark Antony, for the mastery of Rome; how he set up an empire which was to endure for centuries; what he accomplished as the emperor Augustus. (This name, meaning highly honored, was bestowed upon him by the Roman senate.)



Culver Service

Cicero was the greatest orator of ancient Rome. He is shown here in the Senate, accusing one of the senators, Catiline, of conspiracy against the state. Catiline, well knowing his own guilt, sits downcast and alone. The other senators have moved away from him. This picture is taken from a mural (wall painting) in the Senate house of modern Rome, by Cesare Maccari.

It has been said that the life of the first Roman emperor was really the life of two men—Octavian and Augustus. In the years when, as Octavian, he was fighting for the rule of the Roman world, he did many mean and treacherous things to bring about his ends. He thought nothing of sacrificing his friends in order to win over powerful enemies. We have told you, in our life of Cicero, how he gave up that famous orator to the vengeance of Mark Antony. In this period of his life he also won a reputation for great cruelty.

But after Octavian became the emperor Augustus, a ruler with no serious rivals, there was a great change for the better. In general he showed a kindness and a generosity that had been almost entirely lacking in former years. He was sometimes merciful even to those who, like the conspirator Cornelius Cinna, had sought his death.

Though Augustus was the supreme ruler of the Roman state, he was too prudent to take the title of king—a title hated by the Romans. Nor did he assume the outer appearance of a king. He never wore a crown, nor did he ever have a kingly court. To the end of his life he lived like an ordinary Roman citizen. His friends never considered him as a master, but as an equal.

Augustus was not a good general, but he had the happy gift of choosing his officers well. In some of the battles in which he took part it was only the skill of others that won the day after his own bungling had almost lost it. After he became emperor, he left the fighting almost entirely to his generals, who were worthy of his trust.

There was only one serious defeat in his reign—the battle of the Teutoburger Forest,



From the painting by George Hiltensperger

This is a symbolical picture of the time of Augustus, the Golden Age of Rome, when all the arts flourished.

in which three Roman legions, led by Varus, were cut to pieces by the Germans. Augustus could not be consoled when he heard of this disaster. He let his hair and beard grow and often cried out in his grief: "Varus, Varus, give me back my legions!"

It is true that by setting up a government in which one man was all-powerful, Augustus paved the way for such wicked emperors as Caligula, Nero and Domitian. But his own reign was a prosperous and happy one, and he was proud of his achievements as emperor. On his deathbed, he turned to those who were standing about him and said: "If I have acted well my part in life's drama, greet my departure with your applause!"

MÆCENAS (meh-see'-nas)

WHEN we speak of a patron of art—a man who helps artists and men of letters and musicians—we often say: "He is a Mæcenas." This Mæcenas was a real person, who flourished at Rome in the last days of the Republic and the early days of the Empire.

Gaius Cilnius Mæcenas (70?-8 B.C.) was a member of a respectable old Roman family, which claimed descent from the old kings of Etruria, in central Italy. He was a wealthy man and a cultured one, with a deep knowledge of Latin and Greek literature. While still a young man he became an intimate friend of Octavian, the grandnephew and adopted son of Julius Cæsar. After the assassination of Cæsar in 44 B.C. Octavian became one of the most important men of Rome. Mæcenas was his most trusted adviser.

It is said that Mæcenas had a good deal to do with the establishment of the Roman Empire. After Octavian had crushed Mark Antony and had become the sole ruler over Rome, he did not know whether or not to restore the republican form of government. He summoned two of his oldest friends, Mæcenas and Agrippa, and asked them what they advised.

Agrippa was all in favor of the republic. But Mæcenas reminded Octavian of the evils that the republican form of government had brought to Rome. He claimed that Octavian could bring about peace by setting up a monarchy—a permanent form of government

that would not be changed at the whim of the fickle Roman public. Octavian took the advice of Mæcenas. He became the first emperor of Rome under the name of Augustus.

For a few years Mæcenas continued to enjoy the favor of the Emperor, but then, for some unknown reason, the relations between the two men cooled. After 21 B.C. Mæcenas took no further part in public life. He spent most of his time in his magnificent villa on the Esquiline Hill, in the city of Rome. This villa was a favorite meeting-place for all sorts of people—statesmen, men of letters, artists, musicians, actors and clowns.

Some of these guests were vulgar people, whose only merit was that they made their host laugh. But Mæcenas did not permit them to become intimate with him. He reserved his friendship for men of talent. His particular favorites were Virgil and Horace, the greatest poets of that day. (See our article on the Literature of Rome.)

Mæcenas used his influence to help Virgil recover his farm, which had been taken from him by the government. He showered even greater favors upon Horace. He got a pardon for him for having fought against Octavian at Philippi in 42 B.C. Later Mæcenas gave Horace a farm in the Sabine district near Rome—a farm that was made immortal in Horace's odes. Nor did Mæcenas ever make any demands on the poet. The relationship between them was always that of two intimate friends of equal rank, though Mæcenas was a man of distinguished family and Horace was the son of a freedman—a man who had once been a slave.

Mæcenas wrote a good deal himself—both prose and poetry—but very little of what he wrote has come down to us. This is no great loss, to judge by the fragments which still exist. Like many other people, Mæcenas was an excellent critic of other men's writings, but could not write well himself.

MARCUS AURELIUS (oh-ree'-li-us)

THE great Greek thinker Plato once wrote that men would enjoy a perfect form of government only when a philosopher became a king or when a king became a philosopher. For a philosopher is a man who is interested in the eternal problems of life and death;

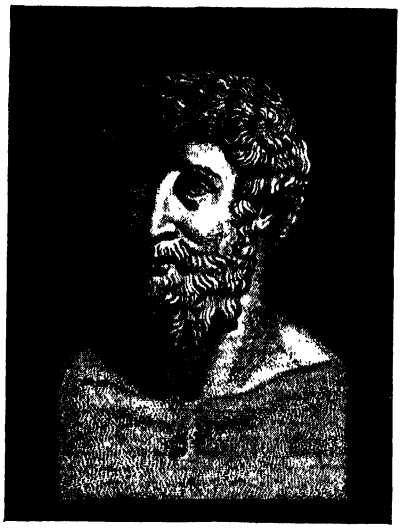


The Bettmann Archive

The poets Virgil, Horace and Varius at the home of Mæcenas, seated. The painting is by C. Jalabert.

such a man would not care for personal glory and gain, but would seek only the happiness of his subjects. In the year 161 A.D. what Plato longed for actually came to pass; for a philosopher became the emperor of Rome. He was Marcus Aurelius Antoninus (121-80), or Marcus Aurelius, as he is generally known.

His name as a boy was Marcus Annus Verus. From his early childhood he studied the works of Latin and Greek literature and philosophy with great enthusiasm. He was particularly inspired by the writings of the Greek Stoic (stoh'-ik) philosophers. The Stoic sect had been founded by the Greek Zeno in the third century B.C. The name Stoic came from a famous *stoa,* or porch, where the Stoics of Athens used to teach. A hundred years before Marcus Aurelius, Seneca, the wise old philosopher and writer who was tutor to Nero, was a famous Roman Stoic.



Culver Service
Marcus Aurelius Antoninus.

The Stoics held that a wise man should not allow himself to be influenced by either joy or grief; he should willingly accept all that was in store for him. Furthermore, he should lead a frugal life, shunning all luxury in food and clothing. The Stoics had a very stern idea of duty, too. They thought that a man should do his assigned task without any thought of reward either in this world or in the world to come.

The Stoics, as you see, had a rather forbidding faith, which certainly would not attract most children. Yet as a mere boy of twelve Marcus became a Stoic and from that time he faithfully obeyed all the Stoic teachings. He continued his study of philosophy and attracted much attention at Rome as a lad of great promise.

The emperor Antoninus Pius adopted Marcus as his son, and he became known thereafter as Marcus Aurelius Antoninus. He was the Emperor's trusted companion and adviser; and when Antoninus died, in 161, Marcus Aurelius followed him upon the throne.

In our article on the Roman Empire we tell you about his achievements as a ruler. He continued to be a Stoic to the end of his days. Even when he was the master of a great part of the civilized world, with all the luxuries of the Orient his for the asking, he lived simply and dressed in plain garments. And he gave himself up with all his heart and soul to what he realized was his duty—watching over the interests of his millions of subjects.

In his spare time the Emperor wrote down in a diary the serious thoughts that came to him concerning the meaning of life and the way it should be lived. He so loved the Greek philosophers who had converted him to the Stoic belief that he wrote this diary in the Greek language. After a while it came to contain a fairly complete summing up of the Emperor's Stoic faith.

The Emperor gave the name "To Himself" to this diary of his. There is no reason to believe that he ever meant it to be read by anybody but himself. But, under the name Meditations of Marcus Aurelius, it became one of the most widely read works of Greek literature, second only to the New Testament in popularity. It is perhaps the noblest monument of pagan thought.

It is sad to record that this great man was an enemy of the Christians. Some people think that he was influenced by the Stoic philosophers who were his constant companions and who were jealous of a faith that was robbing them of many followers. However that may be, Marcus Aurelius believed, as did many people in his day, that the Christians were secretly planning to overthrow the Empire. He thought, therefore, that his duty as emperor made it necessary for him to treat them with great severity.

The Romans mourned deeply at the death of Marcus Aurelius. Yet they could not think of him as a mortal man who had passed away. They thought rather that he had been sent down from heaven for a time in order to bless mankind and that he had now returned to Heaven. He was worshiped as a god after his death. For many years to come the image of the Emperor was to be found among the household gods of almost every Roman family that still remained faithful to the ancient pagan beliefs.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 1891.



Brown Brothers

Johnson comes to the aid of Goldsmith, whose landlady would not let him go out until he paid his rent.

SAMUEL JOHNSON AND OLIVER GOLDSMITH

THE years between 1750 and 1785 are so full of the personality of one man when we think of English literature, that we feel compelled to group all other names around his. That central figure is Doctor Samuel Johnson (1709-1784), the most extraordinary character in the English world of books.

He certainly was not the best writer of his day. Though he wrote verse and prose which have the ring of worth, the chief reason why his work is still read is the influence he had upon other writers.

Judged by its style, some of Doctor Johnson's writing was bad rather than good. It was weighty to the borders of pomposity. It tended to establish a bad fashion and, indeed, ruined the literary work of admiring imitators. In the chapter beginning on page 1726, for instance, we told how Fanny Burney's later novels were inferior to her first success (EVELINA) because she tried to imitate Doctor Johnson's way of writing.

Why then, should we speak of the Age of Johnson? He wrote fair verse, but nothing to compare with the charm of Goldsmith's easy, natural flow. He saw the revival of nature poetry in James Thomson, and the exquisite pictures in words of Thomas Gray and William Collins, and did not even appreciate them. He wrote formal essays in his periodical called THE RAMBLER, but they are not to be compared with the essays written in earlier years by Addison and Steele, or later by Oliver Goldsmith.

Johnson's chief writings were in dignified, balanced prose. But this never attained the stately march of his contemporary, Edward Gibbon, nor still less the strength and beauty of the language of his friend, Edmund Burke. He made one attempt, in RASSELAS, at romantic fiction; but he was only an amateur compared with the new school of novelists, such as his early patron, Samuel Richardson, Henry Fielding, Tobias Smollett, Oliver Goldsmith and his little friend, Fanny Burney. He made a little much-needed money by his one tragedy, IRENE, produced by the friend of his youth, David Garrick; but as a dramatist he was completely outclassed by Goldsmith and Sheridan.

The best work he ever did was his LIVES OF THE POETS, much of it sound criticism; but it was mixed with an unusual share of violent prejudice. He compiled a DICTIONARY OF THE ENGLISH LANGUAGE, but his work on it was drudgery and valuable chiefly because it called other men to labor more successfully in the same literary field.

Yes, the fact is that Samuel Johnson never deserved by his actual writings the place given him by his own generation and confirmed by after-ages.



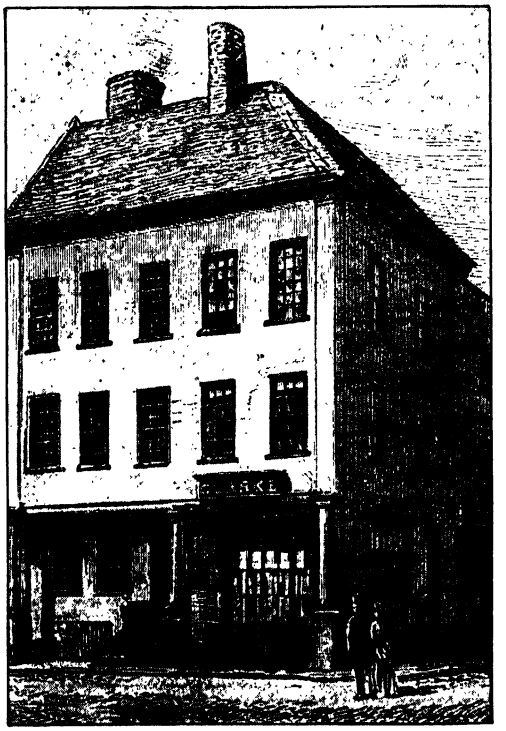
Culver Service
The great Dr. Samuel Johnson.

Yet he most emphatically did deserve the position he held for thirty years or more as the central figure of his period. It is as a man, as a character, rather than by anything that came from his pen, that he lives, justly and triumphantly, the most commanding figure of an age rich in notable men.

A biography of him was written by his Scottish admirer and friend, James Boswell. Undoubtedly Boswell's LIFE of his hero is the most complete biography in the English tongue. It pictures with minute and enthusiastic faithfulness a man who is continually interesting and stimulating. We are glad to know Johnson exactly as he was in the midst of his friends, many of them famous men. We hear his talk, forgive his weaknesses, love his manly character and feel toward him as the people of his circle felt when they gathered around him. In no sense did Boswell "make" Johnson. He simply mirrored the master, and Johnson was really a master man, powerful in mind, great in soul and worthy to be borne in everlasting remembrance.

Born in Lichfield, the son of a bookseller, Samuel Johnson was a devourer of books from his boyhood. He grew up big, strong and fearless, but was handicapped all his life by dim sight, and tormented by a blood disease, causing a tendency to depression. At Lichfield Grammar School he was the best scholar, and left there for Oxford, but his father could not support him through a full university course. Johnson's appreciation of his father and his own unshrinking bravery in doing what he thought right are shown by an act of penance which he imposed on himself when he had become famous. He recollected that once, when he was a boy, he had objected to accompanying his father to Uttoxeter market, where his father kept a bookstall on market-day. Thinking back, he realized that it was pride that had made him disobedient, and so, as an old man, he tried suitably to punish himself. His own account is: "I desired to atone for this fault, so I went to Uttoxeter in very bad weather, and stood for a considerable time bareheaded in the rain on the spot where my father's stall used to stand. In contrition I stood, and I hope my penance was expiatory." None of the stories of Johnson shows better than this the simple sincerity of his character.

After disappointing experiences as a schoolmaster, he went to London at twenty-eight to make his way as a writer. In a terrible line he has described the frequent



The T. F. Healy Collection
The house at Lichfield where Dr. Johnson was born.



Culver Service

Dr. Johnson, then poor and unknown, waiting with other petitioners in the outer rooms of Lord Chesterfield.

fate of the men who wooed fortune with their pens in those days:

> Toil, envy, want, the patron, and the gaol.

Johnson spent years in a stern struggle with poverty, from which he emerged slowly, till, at forty-six, on the eve of the publication of his DICTIONARY, he could proudly rebuff Lord Chesterfield, who wished to patronize him by having the work dedicated to himself. Here is a part of the famous letter he wrote to Chesterfield.

> Seven years, my lord, have now passed since I waited in your outward rooms, or was repulsed from your door; during which time I have been pushing on my work through difficulties of which it is useless to complain, and have brought it at last to the verge of publication without one act of assistance, one word of encouragement, or one smile of favour.
>
> Is not a patron, my lord, one who looks with unconcern on a man struggling for life in the water, and, when he has reached the ground, encumbers him with help?
>
> The notice which you have been pleased to take of my labours, had it been early, had been kind; but it has been delayed till I am indifferent and cannot enjoy it; till I am solitary and cannot impart it; till I am known and do not want it.

Seven years after writing this letter, Doctor Johnson was given a pension of $1,500 a year by the King, and during the remainder of his life—twenty-two years—he lived in comfort, till his death at the age of seventy-five. It was during the last twenty-one years that he was known by his almost idolatrous admirer and biographer, Boswell.

A literary club had been privately formed, and to it came Reynolds, Burke, Goldsmith, Gibbon, Garrick, Adam Smith, Bishop Percy, Sheridan and others, and Boswell was present as often as possible. He noted down, night by night, the conversations he heard, always with a view to showing how his hero shone above all the rest.

One of the first engagements as a writer that Johnson obtained after he arrived in London had been the reporting of the speeches in Parliament in THE GENTLEMAN'S MAGAZINE. Reporting was not then allowed, but Johnson went to the House and brought away the speeches in his big memory. He reproduced them as an account of the DEBATES IN THE SENATE OF LILLIPUT, from which his readers could understand in outline what had been said and who had said it. He was, it is true, very one-sided, and he afterward admitted that he had been careful in his reports to make his own side have the best of the argument—a very bad thing, of course, for a reporter to do. Boswell imitated him in this. Johnson's was the Tory side throughout. In all things he stood firm for the old ways. In politics and religion and social usages he had no belief in change.



From an old print

Goldsmith spent a year wandering through Europe on foot, paying for food and shelter with the music of his flute.

Often he was wrong; but everyone realized that he was completely honest. He fought newfangled notions fiercely and continuously. The king, the constitution as it then existed, and the Church of England were good enough politics for him, and he had little patience and a good deal of suspicion for all who were less content than himself with these three things. He could never forgive Milton, for example, or judge him fairly, because Milton was a Nonconformist. But Johnson softened somewhat with the years, and his last book, THE LIVES OF THE POETS, though still one-sided, was by far his best book in fairness and in style.

Toward the close of his life, as friends, including admiring women like Mrs. Thrale and Fanny Burney, gathered round him, he became less rough and overbearing, and everybody knew that Goldsmith was right when he said that he had nothing of the bear but his skin. Indeed, he was one of the kindest and most merciful of men, and he spent his money in helping all kinds of poor and unfortunate people. His rudeness never lessened the love of his friends. Rough, untidy, awkward and odd though he was, he had a heart of gold, and his sturdy common sense won for him universal respect. He had a deep though fearful piety. Everyone felt that underneath an almost repulsive exterior here was a great and good man. He remains the one Englishman who talked his way into everlasting fame.

It is not easy to see why Doctor Johnson remained so blind to the merits of Thomas Gray, the poet, who lived at almost the same time. On hearing that Gray's works were to be published complete, he exclaimed, "I think we have had enough of Gray. One bad ode may be suffered, but a number of them together makes one sick."

The irregularity of the ode in form may have had some effect in producing this strange criticism. But against the form of Gray's ELEGY WRITTEN IN A COUNTRY CHURCHYARD no such charge could be laid; yet Johnson held that only two of the stanzas were poetry, and he called their author "a dull fellow, dull in a new way."

Yet after more than a century and a half of criticism, Thomas Gray remains

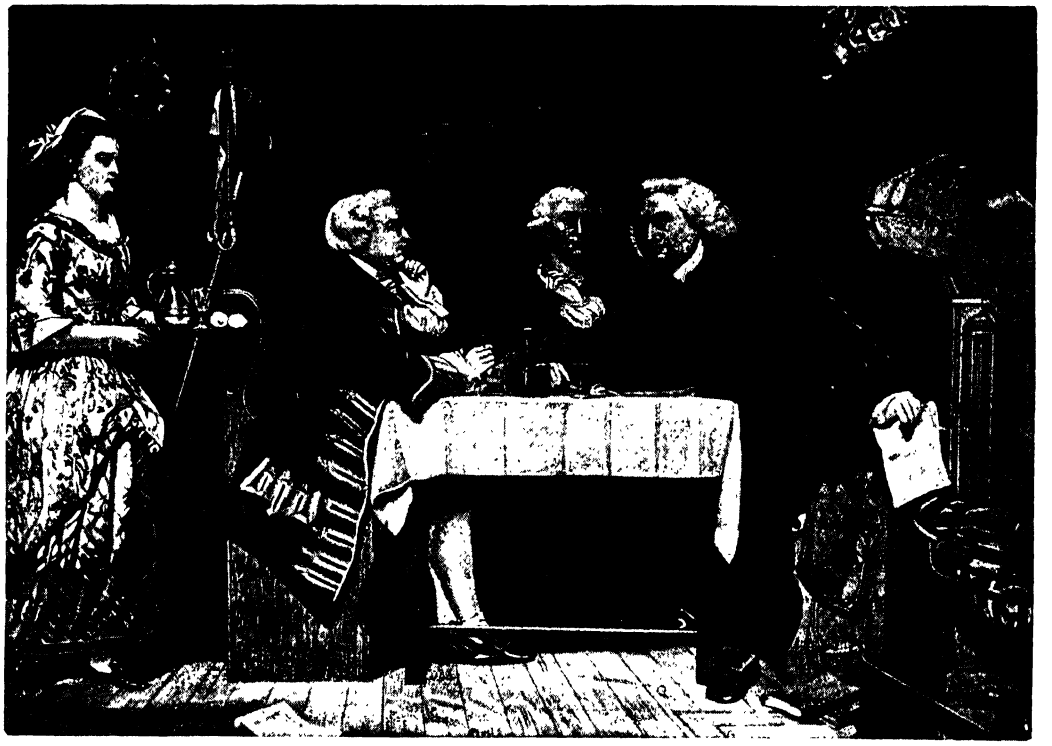
today one of the most choice of English poets. None of his writings is disregarded, while Samuel Johnson's verse is almost forgotten.

The great rival of Johnson, in the eyes of Boswell, was Oliver Goldsmith, and well he might be if writing were the test applied. Johnson himself, however, was too truly Goldsmith's friend to trouble about rivalry.

The best illustration is his account of how he sold Goldsmith's VICAR OF WAKEFIELD, and delivered the unbusiness-like poet from the bottle, and desired him to be calm, and began to talk to him of the means by which he might be extricated.

"He then told me he had a novel ready for the Press, which he produced to me. I looked into it and saw its merit. I told the landlady I should soon return, and having gone to a bookseller, I sold it for £60. I brought Goldsmith the money, and he discharged his rent, not without rating his landlady in a high tone for having used him so ill."

But Johnson believed in Goldsmith as



Brown Brothers

Goldsmith and Boswell spent many hours with Dr. Johnson at his favorite inns, enjoying his wise and kindly talk.

his difficulties of the moment. Here is his own account as recorded by Boswell.

"I received one morning a message from poor Goldsmith that he was in great distress, and as it was not in his power to come to me, he begged that I would go to him as soon as possible.

"I sent him a guinea, and promised to come to him directly. I found his landlady had arrested him for his rent, at which he was in a violent passion.

"I perceived that he had already changed my guinea, and had got a bottle of Madeira and a glass before him. I put the cork in

a poet even more than as a prose writer. With his usual air of authority he pronounced him "the greatest poet since Pope."

Oliver Goldsmith (1728-1774) was an Irishman, almost twenty years younger than Johnson. His father, a curate at Pallas, a village in Longford, had barely enough income to support the family. Later a better post was given to the parson, and young Oliver was sent to school. He entered Trinity College, Dublin, with the aid of a scholarship, but did little to profit by his opportunities. He had low marks in his studies, and in conduct he was happy-go-lucky,

frequently breaking rules for the fun of it.

After securing his university degree he tried one profession after another, with no success. At last he felt sure he wanted to study medicine. He stayed eighteen months at the University of Edinburgh, Scotland, and then went to Leyden, Holland, for further study, but left before winning a degree in medicine. In his twenty-seventh year he was still without a profession.

It was then the custom for boys of wealth, upon leaving school, to spend a year or so traveling on the Continent—the Grand Tour, the English called it; *Wanderjahr* (wander year) the Germans called it.

Goldsmith had his *Wanderjahr,* too—on foot mostly, paying his way along from town to town by playing tunes on his flute. This was perhaps the best chapter of his life. Some of the experiences of this year he later wove into a fine poem, THE TRAVELLER. He returned to England without a shilling. He tried acting. He served as chemist's assistant and errand boy. He took a menial job in a school. He was a beggar.

Then, at last, he turned to writing. He did hack work at first, reviews for newspapers and magazines, amusing essays, some children's books and even a history of England. His skill grew, and his reputation with it. He had the Irishman's touch—a joyous manner with sadness shining through here and there. And so at last he was introduced to Doctor Johnson, and the doctor's friendship opened all doors to him.

In 1765 THE VICAR OF WAKEFIELD was printed; this remains one of the finest novels in the English language. In 1770 THE DESERTED VILLAGE appeared, a poem that many of you will read in high-school English. Phrases, and even whole lines, from THE DESERTED VILLAGE have become part of our common speech. He wrote other poems and plays and histories and essays of varying worth. He could, and did, rewrite difficult tomes into simple language that anyone could understand, and he had a way of making facts interesting. However, his respect for facts was not very deep, and there are amusing errors in some of his informational works. Among his plays SHE STOOPS TO CONQUER ranks first.

For all his ready skill with the pen, Goldsmith seems to have been a shy and blundering fellow. "He writes like an angel and talks like poor poll" (a parrot), said one friend.

In the last ten years of his life Goldsmith had a good, even a very good, income; but he was as happy-go-lucky in wealth as in poverty. He died penniless.

With watchful eyes and tender heart Oliver Goldsmith passed through the world, gently making fun of the weaknesses in his own character, which he could not conquer, and turning all he saw and felt into literature. No doubt he was weak of will, vain in small ways, wildly extravagant whenever his sympathies were excited, never wise on his own account. But no man who ever wielded a pen was better loved by friends, whom he teased by his unpracticalness, and nobody has more successfully transformed his own life into imperishable literature. THE TRAVELLER was himself; THE VICAR OF WAKEFIELD was his father; THE DESERTED VILLAGE was (in parts) the hamlet in Ireland where he spent his childhood.

THE NEXT STORY OF LITERATURE IS ON PAGE 2027.



Culver Service

Left to right: Boswell, Johnson, Reynolds, Garrick, Burke, Paoli the Corsican hero, Burney, Warton and Goldsmith.



Three heads painted by Jean Baptiste Greuze.

THE RISE OF FRENCH ART

THE real art of the French people, which is one of the glories of Europe, was centuries in growing and developing its own form.

France lay on the high road between Flanders and Italy, and we know that these two widely separated countries were for a long time the strongholds and the outposts of European painting.

Not content with their own work, Italian artists put packs on their backs and set off across the continent to see how those marvelous Flemings created their pictures. And artists from the Low Countries went to Italy on a kind of pilgrimage of their own, fired by a purpose as earnest and devout as that which led pilgrims to Rome. We can trace the highway whereon men walked, dreaming of beauty, by the beautiful things they have left behind —at Paris, Lyons, and in Provence, where they broke their travels for a time and worked and studied.

The French thus received the impress of the art of both countries; and it seems strange that they should not have shaped it to their own individuality. But for several generations the kings of France, who were the chief patrons of the arts, were on the field of battle and had other things to think of besides painting and sculpture. And when the country at length had rest from war and rumors of war and could turn to the occupations of peace, French art could scarcely be said to exist. We have seen how a beginning had been made by Froment and Fouquet and the Clouets in the fifteenth and sixteenth centuries; but after their time came a period clouded by imitating and by following Italian influence of a wrong sort.

In 1589, when Henry IV came to the throne, he hastened to take up the intermittent work of earlier kings. As soon as he had finished fighting, this Henri Quatre set about making Paris beautiful.

The memory of this beloved monarch still lives on the Pont Neuf, which he had built across the Seine four hundred years ago and ornamented with an equestrian statue of himself cast in bronze.

The revival of Catholicism in the early seventeenth century led to the building of churches in various parts of the country, and this was of immense importance to painters, as altar-pieces and panels were presently needed.

The king encouraged wealthy citizens to build beautiful houses and adorn them with statuary and pic-

tures. Marie de' Medici, the queen who survived him, erected just outside Paris the Palace of the Luxembourg. She looked about in France, and finding no one worthy, sent for Rubens to decorate her long gallery.

Other Flemish artists, like Philip de Champaigne, followed him, and French painters became their pupils. A great many less important artists of Flanders and Holland had already settled in France. Nearly all French artists imitated either the Flemish or the Italians. If they could not go to Italy to see the work of these men, they took inspiration from engravings.

We can easily see the reason why these two great forces, Flemish and Italian art, controlled French art for a long time. Art in the Netherlands, like art in Italy, had lived through a long apprenticeship and knew all there was to be known. Art in France had had no such student years, and French painters were like pupils who had skipped many lessons and wanted to copy what other scholars had done, instead of going back to the A B C. The result of this was several generations of poor, imitative work.

An artist called Jean Cousin, who was born in 1500, was said to be the founder of the National School. But it is clear, on looking back, that for some time after Cousin's day the National School did not yet exist. Cousin's famous picture, which made men talk a great deal, is called The Last Judgment, and is now in the Louvre; but we can see that it might quite easily have been painted by an Italian.

THREE BROTHERS AND THE FINE SIMPLICITY OF THEIR ART

Henry IV and his son Louis XIII had encouraged art; but Louis XIV dictated it. There was no public opinion except that of the king. Mazarin and Colbert, the ministers of the youthful Louis, had created in 1648 an Academy of Sculpture and Painting and Architecture which officially directed the art of the country. This institution lasted till the Revolution; yet, in spite of it, French art as we know it, grave, sonorous, dainty, grew to power and triumphed.

In the meantime the poorest generation had yielded one or two notable men. There were the brothers Le Nain, all three gifted artists of the seventeenth century. The Italian realist Caravaggio seems to have inspired much in their pictures, for they tried to get his effects of dark, sombre color lighted up in a striking way. The result was that their painting was often dark and heavy. The brothers painted some very fine portraits and studies of peasants, such as The Blacksmith, in the Louvre, and the Portrait Group in the National Gallery, London.

The Le Nain pictures can never be overlooked in a study of French art, if only because they seem so out of place in an artificial age. Like the artists of their day, the brothers borrowed freely of the learning of Italy and the Netherlands, but their fine simplicity and ruggedness and their lack of affectation are their very own. The two outstanding French painters in the seventeenth century were Nicholas Poussin and Claude Lorrain, who both lived almost all their lives in Italy.

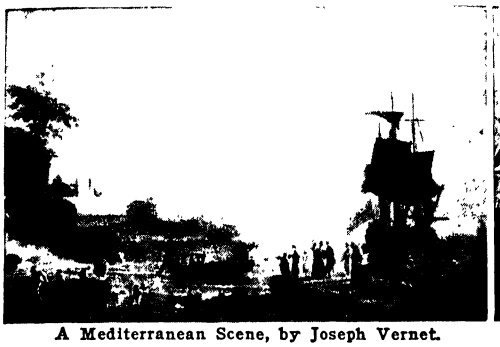
NICHOLAS POUSSIN, AND HIS PASSION FOR CLASSICAL ART

Poussin, who lived from 1594 to 1665, is one of the memorable figures in the story of French art. He was the first great classical painter, and had a strong influence on the men who followed him. All his life he had had an intense love for ancient history and classical art and legend. He painted a large number of pictures of old story and mythology; and these canvases seem to have been worked on partly by a historian who had a passion for being right in details, and partly by an artist who had a passion for magnificent landscapes and scenes of bygone times.

The beauty of the Italian landscape, which always seems in itself a picture, he used in a new way. It was not simply a setting for his figures, nor were the figures simply an adornment for the landscape. The two elements were used side by side to make a picture of charm and beauty.

The figures themselves are like sculptured figures in a carved relief. For Poussin had studied form by modeling and by drawing from sculptured low reliefs. The figures and their relative positions are distinguished by contrasts in light and shade, rather than by an effect of atmosphere. Like Raphael, Poussin was born with a gift for making beautiful compositions in his space, and his study of Raphael's paintings added knowledge to his gift. If you look at the picture Shepherds of Arcadia, on page 1875,

PICTURES OF OLD FRANCE



A Mediterranean Scene, by Joseph Vernet.



The Landing of Cleopatra, by Claude Lorrain.



A Pastoral Idyl, by François Boucher.



Grace before Meat, by Chardin.



A Piper among the Hills, by one of the Le Nain brothers.



Shepherds of Arcadia, landscape by Poussin, in the Louvre.

you see that it clearly illustrates all the qualities we have noted in Poussin's art.

Besides the well-known classical scenes, he painted some remarkable pictures on Bible subjects, such as The Deluge, in the Louvre. They are nearly as fine as Raphael's Bible.

CLAUDE LORRAIN, PAINTER OF A SUN-LIGHTED WORLD

Claude Lorrain, who lived from 1600 to 1682, was an artist of another kind. He, too, loved classical landscapes and subjects, but less as a historian and more as a dreamer. He had an intense love for the tranquil sunny landscape of Italy and the Mediterranean coast. By his imagination he devised ideal views, so that we think "if there is no spot on earth like this, there ought to be one." His love of natural beauty showed itself in the light and space which flooded and made charming his most artificial scenes. Claude Lorrain, the Frenchman, and Turner, the Englishman, who lived two hundred years later, each dreamed the same dream of a sun-washed world.

Living in Italy, Poussin and Lorrain escaped the thraldom of the Academy. Most of their fellow-painters were absorbed into this association, which was presided over by an artist called Charles Le Brun. Some of them were famous in their day and are still remembered, such as Le Sueur, Mignard, Hyacinthe Rigaud. Le Sueur painted a great many subject pictures, among them twenty-two paintings dealing with the life of St. Bruno. Mignard produced some fine compositions and some portraits, which are a little too charming to be strong. Rigaud also painted portraits; in fact, every painter painted portraits in the reign of Louis XIV. The magnificent portraiture of France had its beginnings then.

THE ARTIFICIALITY WITH WHICH GREAT ART COULD NOT LIVE

The king was never tired of seeing his own likeness in color or stone, and the aristocracy and wealthier citizens were not slow in following his lead. Nearly all the portraits painted reflect the pompous artificiality of the age. Hyacinthe Rigaud's pictures of Louis and of Bossuet are good examples of that particular branch of art in the seventeenth century.

But it is in Charles Le Brun that we can best see reflected the spirit of the "Century of Louis XIV." Le Brun was painter to the king, director of the Academy, head of the Gobelins tapestry school founded by Louis, and, with Colbert, director of the decorations at Versailles, the huge palace which the "sun-king" built outside Paris. Colbert, the mighty statesman, worked very hard indeed in the interests of art in France, and spared no expense to help painters and sculptors toward the fulfillment of a high ideal.

But the whole age was soaked through with false splendor, and in such an atmosphere great art could not thrive. We can see it all in Le Brun's work. He could draw very well, it is true; he was a good decorator of spaces, and could adapt a subject to its setting. But his painting was uninspired; and this might be said of most of the men who held the Academy honors in his day. Moreover, all his life he was trying to please the king.

We are here face to face, in this reign of Louis XIV, with one of the astonishing events of Europe. It has rarely happened that so much wealth, so much success, so much false greatness has been crowded into the lifetime of one king.

AN ASTOUNDING THING THAT HAPPENED TO THE ART OF A NATION

The face of Paris had changed, and the capital had become a centre of art activities and scholarships; a great country became aroused, almost as if it were one man, to an interest in books, painting, sculpture and architecture. If it had not been that Louis said: All these pictures, these statues, these bindings, must glorify *me;* instead of painting the heroes of the old world, paint *me;* leave France a monument of *me*—the story of French art might have been very different. A whole colony of artists were pressed into service at Versailles; beautiful scenes of Greek mythology were painted, with the king in place of the hero.

As the long reign drew to a close, true art began in a quiet, hidden way to thrive. Paris had become a school not only of artists but of collectors and lovers of pictures and statues. Already men's eyes were turned away from Versailles, where courtiers still did homage to a worn-out old man, and were watching eagerly for the dawn of freedom's day. To do justice to Louis and his ministers we must remember that if they did not produce great art, they gave men practice in art. The French style and the mastery of technique

A FEW PICTURES BY FRENCH ARTISTS



THE BROKEN PITCHER, A FAMOUS GREUZE PORTRAIT, IN THE LOUVRE



THE YOUNG ROGUE, BY GREUZE, IN THE WALLACE COLLECTION



PORTRAIT OF THE COMTE D'ESPAGNAC AS A BOY, BY VIGEE LE BRUN



PEASANTS AT SUPPER BY THE BROTHERS LE NAIN IN THE LOUVRE



FIDELITY, BY GREUZE, IN THE WALLACE COLLECTION, LONDON



PORTRAIT OF A BOY AS A PIERROT, BY FRAGONARD



A SCENE OF FAMILY LIFE IN OLD FRANCE, BY GREUZE



PICTURE OF A GIRL DANCING, BY WATTEAU, IN THE ROYAL COLLECTION OF BERLIN



MADAME LE BRUN AND HER DAUGHTER, IN THE LOUVRE



INNOCENCE, BY GREUZE, IN THE WALLACE COLLECTION

were unconsciously acquired during those decades of second-rate work. When the eighteenth century dawned, French painters could hold their own with Italians.

One artist, indeed, had flowered—and here that word is the fitting one to use—in Louis's old age. This was the incomparable Antoine Watteau. There is something very beautiful and fragrant in Watteau's work; it would seem as if the pictures ought to smell of lavender. All the grace, the solemn, proud, fantastic soul of France hides in those dainty figures that go pacing by under heavy trees and arching skies. These men and women who knew no hurry, who lived in a world where horses and coaches and sailing boats were quite swift enough means of travel, were caught and imprisoned in a remote, smiling perfection on the canvases of Watteau.

THE ELFIN TOUCH OF WATTEAU THAT WAS THE DESPAIR OF HIS RIVALS

This young artist, who was only thirty-seven when he died, in 1721, is the acknowledged head of the painters of "gallant" pictures of the early eighteenth century. These men turned France into a merry playground, in their mood of reaction after the stifling dominance of Louis XIV.

They painted endless pictures of picnics and countryside revelries, where ladies and gentlemen in shining silks and velvets made merry in the sunshine with dancing and singing and artless play. In Watteau's pictures there is always a slight aloofness and a dignity, which the men of his day vainly strove to imitate and failed, because the aloofness and the dignity were in the soul of Watteau, and the spirits of the others were made of commoner stuff.

Watteau was not only an exquisite painter: he was a marvelous draftsman. Pencil studies of faces in his sketch-books show how accurate was his knowledge, how much delicate and strong construction underlay his soft textures and flesh tints. For "Watteau has this note of a great artist, that as a foundation for his poetry, his dream, his idealism, he lays a constant and minute study of nature." His color is now silvery and shining, now warm like roses, now sombre gray. Across color and features, trees and costumes alike, falls that faint flicker of remoteness, as if an elfin brush had caught the picture in a spell.

Several of Watteau's paintings are in the Royal Collection in Berlin; among them The Dance, The Concert, the Fête Champêtre, Gersaint's Signboard. In the Louvre is his famous Embarkation for Cythera, and there also we can see pages of his sketch-book.

THE MERRY PICTURES OF THE GALLANT AGE IN FRANCE

The "gallant age" carried art very far from the style of the seventeenth century. The classical stream was still flowing; but the stream that bubbled with new life and gaiety and freedom was the one to which men were drawn at this time.

A great many artists painted pictures of gaily dressed people making merry—artists like Lancret and Pater, who frankly imitated Watteau. Boucher, whose output was enormous, painted many subjects, nearly all spoiled by a touch of vulgarity.

Some years later, in Fragonard, who lived from 1732 to 1806, the gallant age seems to have been caught in the form of one man. He was a happy, vivid kind of painter with a strength and purpose of his own. His graceful, jaunty, carefree figures in their charming settings may be seen at their best in the Wallace collection, London, in the Louvre, and in the Morgan collection, New York.

Before Fragonard's death taste in France had swung back to classical forms and subjects, and the artist of the gay and merry age was left poor and neglected.

THE MAN WHO PAINTED PEOPLE AS IF THEY WERE THINKING ALOUD

The eighteenth century carried on the work of portraiture so freely exercised in the reign of Louis XIV. Some very fine pictures were produced. The man whose paintings are the most memorable is Quentin de la Tour, who lived from 1704 to 1788. Shortly before his day a Venetian painter had introduced to the world of art the use of pastel—painting in crayon. This medium attracted La Tour's fancy, and he adopted it for most of his work. He has left a whole gallery of the men and women of his day—brilliant portraits, most of them, wherein a keen and fearlessly truthful picture of a person's character was recorded with light, vibrating strokes.

Like all portrait-painters, La Tour was interested in costume and setting, but when we look at his work we can see how intensely important to him were the fea-

tures of his sitters. He showed men and women thinking aloud, their lips hardly closed after a characteristic speech: "faces," says one writer, "touched in with colors like the dust on wings of butterflies." The principal collection of his works is in the museum of St. Quentin, his native town.

THE WAY CHARDIN LOVED TO PAINT THE HUMBLE PEOPLE OF FRANCE

In the meantime there was another and separate kind of painting developing in France, in the pictures of Siméon Chardin, who was born in 1699 and died in 1779. This artist was much influenced by the little Dutch masters, whose work was greatly admired in Paris. His pictures have the simplicity and honesty that belong to the Dutch genre paintings, with an added sweetness and refinement. In Chardin's work there is a seriousness that was new to the times. He painted pictures of home-loving people busy about their daily work, and these figures are refreshing to the eye and mind after the multitude of gay aristocrats who throng most of the canvases of that sumptuous age.

Chardin's "early love" in painting had been still-life subjects—fruit, dishes, game. Fine examples of this work of his are the pictures called The Silver Goblet, in the Louvre, and the Study of Still Life, in the National Gallery, London. Presently he began to paint interiors—a kitchen, a pantry or a sitting-room; and in them he placed people in the quiet, reposeful mood that was his secret. We feel we should like to have known the people and the homes that Chardin painted.

THE SERIOUSNESS IN FRENCH ART THAT CAME BEFORE THE REVOLUTION

The lovable picture Grace before Meat, shown on page 1875, The Housewife, The Industrious Mother, all in the Louvre, and La Fontaine, in the National Gallery, London, are excellent examples of the work of this man who knew nothing of classic lore or mythology and had no acquaintance with people of high estate. Not greatly appreciated in his own time, Chardin has grown into high favor now. In his handling of color he has probably not been surpassed by any other French painter.

Chardin's work has some kinship with that of the brothers Le Nain and of Fouquet, the artist of an earlier century—all men who, like the little Dutch masters, loved simple, honest things, forswearing the glitter of riches.

Another kind of seriousness developed in the sentimental generation that preceded the Revolution. About 1760 men found that they were weary of the frivolities of the gallant age, and they began to want pictures that should teach lessons of modesty and sober living. They also wanted landscapes because such subjects lead to meditation. A large number of painters reflected this public taste—among them Greuze, Madame Vigée le Brun, Joseph Vernet and Hubert Robert.

Jean Baptiste Greuze (1725–1805) introduced a new kind of genre, in story-telling pictures which gave a moral lesson. Such are The Father's Curse and The Wicked Son Punished. But he is better known as the painter of graceful young girls of a sweet innocence and amiable prettiness, often a little melancholy or wistful. If they were less sugary in their sweetness, less sentimental in expression and pose, they would make a more lasting appeal. Among the best are The Milkmaid and The Broken Pitcher, in the Louvre, and The Girl with Doves, in the Wallace collection, London.

THE LAST PHASE OF THE ART OF A REMARKABLE CENTURY

Madame Vigée le Brun, in the course of her long life—1755 to 1842—painted a great many portraits, among them several of Queen Marie Antoinette. The painter, who was a favorite of the French nobility, had to live in other countries while France was suffering under the Revolution; everywhere she was welcomed and honored. But her last years, like her early ones, were spent in France.

In her portraits Madame le Brun gives the sitters a sort of emotional charm and grace; they are all beautiful and affectionate. Her painting technique was excellent, her drawing careful, and her color warm and pleasing. Some of her best portraits can be seen in Paris and London. One, in the Louvre, is known and loved by all the world—the one portraying herself with her daughter (page 1880).

Joseph Vernet (whose son and grandson were also painters) and Hubert Robert were landscape-painters that delighted the public—Vernet with his storms and shipwrecks and evening skies, and Robert with his ruins of temples and gardens.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 1999.

THE GLORY OF SUNLIGHT AND MIST



Photo, courtesy Metropolitan Museum of Art.
David at the Cave of Adullam, by Claude Lorrain, is an example of the French classic style, in which landscape and figures were idealized to heroic beauty or grandeur. In Claude's paintings the figures are of much less importance than the landscape itself. Though he studied nature and gave his light the appearance of real sunlight, his "nature" is too studied to be natural.



The Embarkation for Cythera, by Antoine Watteau, in the Louvre, is one of this artist's most characteristic pictures. The graceful figures move lightly through a lovely fanciful scene like the figures in a dream. While the life he pictured was artificial and the scenes were imaginary, the style in which he painted is in no way artificial and his landscape is built upon sound knowledge of natural forms.



POEMS OF COURAGE

Illustrated by Harry Sternberg

Columbus

By JOAQUIN MILLER (1839-1913)

BEHIND him lay the gray Azores,
Behind the Gates of Hercules;
Before him not the ghost of shores,
Before him only shoreless seas.
The good mate said: "Now must we pray,
For lo! the very stars are gone.
Brave Admiral, speak, what shall I say?"
"Why, say 'Sail on! sail on! and on!'"

"My men grow mutinous day by day;
My men grow ghastly wan and weak."
The stout mate thought of home; a spray
Of salt wave washed his swarthy cheek.
"What shall I say, brave Admiral, say,
If we sight naught but seas at dawn?"
"Why, you shall say at break of day,
'Sail on! sail on! sail on! and on!'"

They sailed and sailed, as winds might blow,
Until at last the blanched mate said:
"Why, now not even God would know
Should I and all my men fall dead.
These very winds forget their way,
For God from these dread seas is gone.
Now speak, brave Admiral, speak and say"—
He said: "Sail on! sail on! and on!"

They sailed. They sailed. Then spake the mate:
"This mad sea shows his teeth to-night.
He curls his lip, he lies in wait,
With lifted teeth, as if to bite!
Brave Admiral, say but one good word:
What shall we do when hope is gone?"
The words leapt like a leaping sword:
"Sail on! sail on! sail on! and on!"

Then, pale and worn, he kept his deck,
And peered through darkness. Ah, that night
Of all dark nights! And then a speck—
A light! a light! a light! a light!
It grew, a starlit flag unfurled!
It grew to be Time's burst of dawn.
He gained a world; he gave that world
Its grandest lesson: "On! sail on!"

Incident of the French Camp

By ROBERT BROWNING (1812-1889)

YOU know, we French stormed Ratisbon:
A mile or so away,
On a little mound, Napoleon
Stood on our storming-day;
With neck out-thrust, you fancy how,
Legs wide, arms locked behind,
As if to balance the prone brow
Oppressive with its mind.

Just as perhaps he mused, "My plans
That soar, to earth may fall,
Let once my army-leader Lannes
Waver at yonder wall,"—
Out 'twixt the battery-smokes there flew
A rider, bound on bound
Full-galloping; nor bridle drew
Until he reached the mound.

Then off there flung in smiling joy,
And held himself erect
By just his horse's mane, a boy:
You hardly could suspect—
(So tight he kept his lips compressed,
Scarce any blood came through),
You looked twice ere you saw his breast
Was all but shot in two.

"Well," cried he, "Emperor, by God's grace
We've got you Ratisbon!
The Marshal's in the market-place,
And you'll be there anon
To see your flag-bird flap his vans
Where I, to heart's desire,
Perched him!" The chief's eye flashed; his plans
Soared up again like fire.

The chief's eye flashed; but presently
Softened itself, as sheathes
A film the mother-eagle's eye
When her bruised eaglet breathes;
"You're wounded!" "Nay," the soldier's pride
Touched to the quick, he said:
"I'm killed, Sire!" And his chief beside,
Smiling the boy fell dead.

The Charge of the Light Brigade at Balaclava

By ALFRED, LORD TENNYSON (1809-1892)

HALF a league, half a league,
Half a league onward,
All in the valley of Death
Rode the six hundred.
"Forward, the Light Brigade!
Charge for the guns!" he said:
Into the valley of Death
Rode the six hundred.

"Forward, the Light Brigade!"
Was there a man dismayed?
Not though the soldier knew
Some one had blundered:
Theirs not to make reply,
Theirs not to reason why,
Theirs but to do and die:
Into the valley of Death
Rode the six hundred.

Cannon to right of them,
Cannon to left of them,
Cannon in front of them
Volleyed and thundered;
Stormed at with shot and shell,
Boldly they rode and well,
Into the jaws of Death,
Into the mouth of Hell
Rode the six hundred.

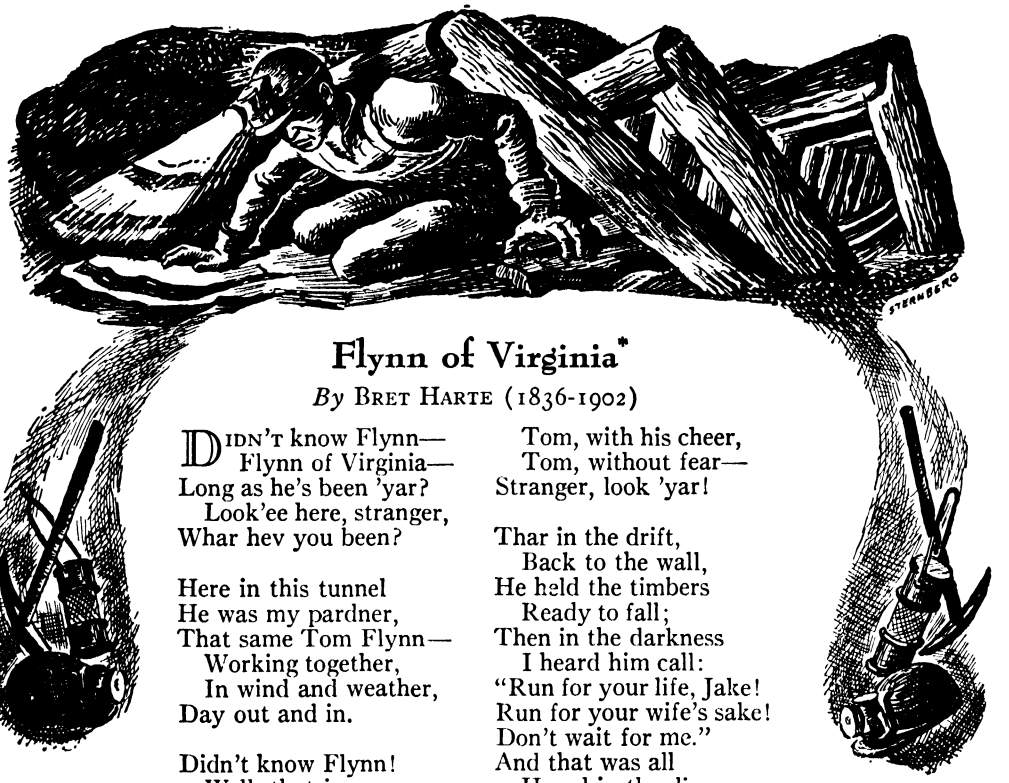
Flashed all their sabres bare,
Flashed as they turned in air
Sabring the gunners there,
Charging an army, while
All the world wondered:
Plunged in the battery-smoke
Right through the line they broke;
Cossack and Russian
Reeled from the sabre-stroke,
Shattered and sundered.
Then they rode back, but not,
Not the six hundred.

Cannon to right of them,
Cannon to left of them,
Cannon behind them
Volleyed and thundered;
Stormed at with shot and shell,
While horse and hero fell,
They that had fought so well
Came through the jaws of Death,
Back from the mouth of Hell,
All that was left of them,
Left of six hundred.

When can their glory fade?
O the wild charge they made!
All the world wondered.
Honor the charge they made!
Honor the Light Brigade,
Noble six hundred!



1885



Flynn of Virginia*

By BRET HARTE (1836-1902)

DIDN'T know Flynn—
Flynn of Virginia—
Long as he's been 'yar?
Look'ee here, stranger,
Whar hev you been?

Here in this tunnel
He was my pardner,
That same Tom Flynn—
Working together,
In wind and weather,
Day out and in.

Didn't know Flynn!
Well, that is queer.
Why, it's a sin
To think of Tom Flynn—
Tom, with his cheer,
Tom, without fear—
Stranger, look 'yar!

Thar in the drift,
Back to the wall,
He held the timbers
Ready to fall;
Then in the darkness
I heard him call:
"Run for your life, Jake!
Run for your wife's sake!
Don't wait for me."
And that was all
Heard in the din,
Heard of Tom Flynn—
Flynn of Virginia.

Little Giffen

By FRANCIS ORRAY TICKNOR (1822-1874)

OUT of the focal and foremost fire,
Out of the hospital walls as dire,
Smitten of grape-shot and gangrene
(Eighteenth battle and *he* sixteen!)
Spectre such as you seldom see,
Little Giffen of Tennessee.

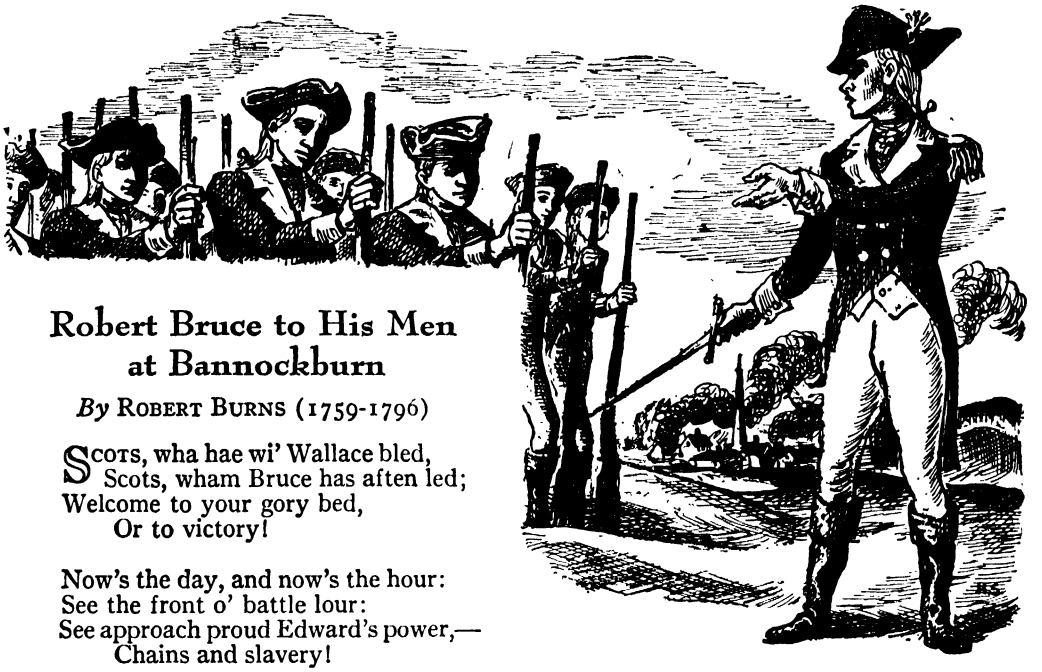
"Take him and welcome!" the surgeon said;
"Little the doctor can help the dead!"
So we took him and brought him where
The balm was sweet on the summer air;
And we laid him down on a wholesome bed—
Utter Lazarus, heel to head!

And we watched the war with bated breath—
Skeleton Boy against skeleton Death.
Months of torture, how many such!
Weary weeks of the stick and crutch;
And still a glint in the steel-blue eye
Told of a spirit that would not die,—
And didn't. Nay, more! in death's despite
The crippled skeleton learned to write.
"Dear Mother," at first, of course; and then,
"Dear Captain," inquiring about "the men."
Captain's answer: "Of eighty-and-five,
Giffen and I are left alive."

Word of gloom from the war, one day:
"Johnston's pressed at the front, they say!"
Little Giffen was up and away;
A tear—his first—as he bade good-by,
Dimmed the glint of his steel-blue eye.
"I'll write, if spared." There was news of the fight;
But none of Giffen.—He did not write.

I sometimes fancy that, were I king
Of the princely Knights of the Golden Ring,
With the song of the minstrel in mine ear,
And the tender legend that trembles here,
I'd give the best on his bended knee,
The whitest soul of my chivalry,
For Little Giffen of Tennessee.

*By permission of the Houghton Mifflin Company.



Robert Bruce to His Men at Bannockburn

By ROBERT BURNS (1759-1796)

Scots, wha hae wi' Wallace bled,
Scots, wham Bruce has aften led;
Welcome to your gory bed,
Or to victory!

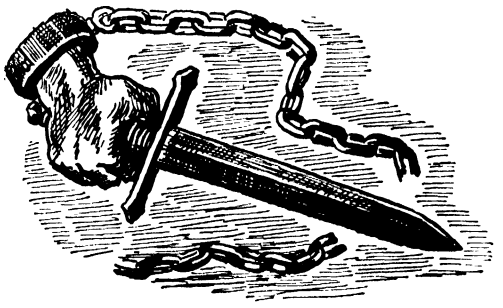
Now's the day, and now's the hour:
See the front o' battle lour:
See approach proud Edward's power,—
Chains and slavery!

Wha will be a traitor knave?
Wha can fill a coward's grave?
Wha sae base as be a slave?
Let him turn and flee!

Wha for Scotland's king and law
Freedom's sword will strongly draw,
Freeman stand, or freeman fa',
Let him follow me!

By oppression's woes and pains!
By your sons in servile chains,
We will drain our dearest veins,
But they shall be free!

Lay the proud usurpers low!
Tyrants fall in every foe!
Liberty's in every blow!—
Let us do or die!



Warren's Address to the Soldiers at Bunker Hill

(June 16-17, 1775)

By JOHN PIERPONT (1785-1866)

Stand! the ground's your own, my braves!
Will ye give it up to slaves?
Will ye look for greener graves?
Hope ye mercy still?
What's the mercy despots feel?
Hear it in that battle-peal!
Read it on yon bristling steel!
Ask it,—ye who will.

Fear ye foes who kill for hire?
Will ye to your homes retire?
Look behind you!—they're afire!
And, before you, see
Who have done it! From the vale
On they come—and will ye quail?
Leaden rain and iron hail
Let their welcome be!

In the God of battles trust!
Die we may,—and die we must:
But, O, where can dust to dust
Be consigned so well,
As where heaven its dews shall shed
On the martyred patriot's bed,
And the rocks shall raise their head,
Of his deeds to tell?

Barbara Frietchie

By JOHN GREENLEAF WHITTIER
(1807-1892)

UP from the meadows rich with corn,
Clear in the cool September morn,

The clustered spires of Frederick stand
Green-walled by the hills of Maryland.

Round about them orchards sweep,
Apple and peach tree fruited deep,

Fair as the garden of the Lord
To the eyes of the famished rebel horde,

On that pleasant morn of the early fall
When Lee marched over the mountain-wall;

Over the mountains winding down,
Horse and foot, into Frederick town.

Forty flags with their silver stars,
Forty flags with their crimson bars,

Flapped in the morning wind: the sun
Of noon looked down, and saw not one.

Up rose old Barbara Frietchie then,
Bowed with her fourscore years and ten:

Bravest of all in Frederick town,
She took up the flag the men hauled down;

In her attic window the staff she set,
To show that one heart was loyal yet.

Up the street came the rebel tread,
Stonewall Jackson riding ahead.

Under his slouched hat left and right
He glanced; the old flag met his sight.

"Halt!"—the dust-brown ranks stood fast.
"Fire!"—out blazed the rifle-blast.

It shivered the window, pane and sash;
It rent the banner with seam and gash.

Quick as it fell, from the broken staff
Dame Barbara snatched the silken scarf.

She leaned far out on the window-sill,
And shook it forth with a royal will.

"Shoot, if you must, this old gray head,
But spare your country's flag," she said.

A shade of sadness, a blush of shame.
Over the face of the leader came;

The nobler nature within him stirred
To life at that woman's deed and word;

"Who touches a hair of yon gray head
Dies like a dog! March on!" he said.

All day long that free flag tossed
Sounded the tread of marching feet:

All day long that free flag tossed
Over the heads of the rebel host.

Ever its torn folds rose and fell
On the loyal winds that loved it well;

And through the hill-gaps sunset light
Shone over it with a warm good-night.

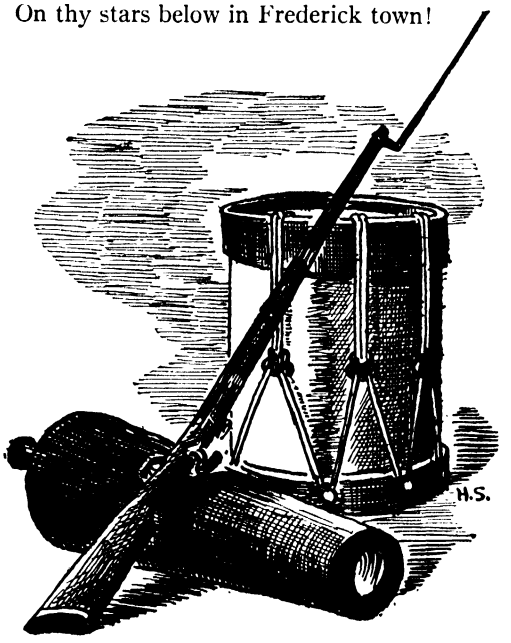
Barbara Frietchie's work is o'er,
And the Rebel rides on his raids no more.

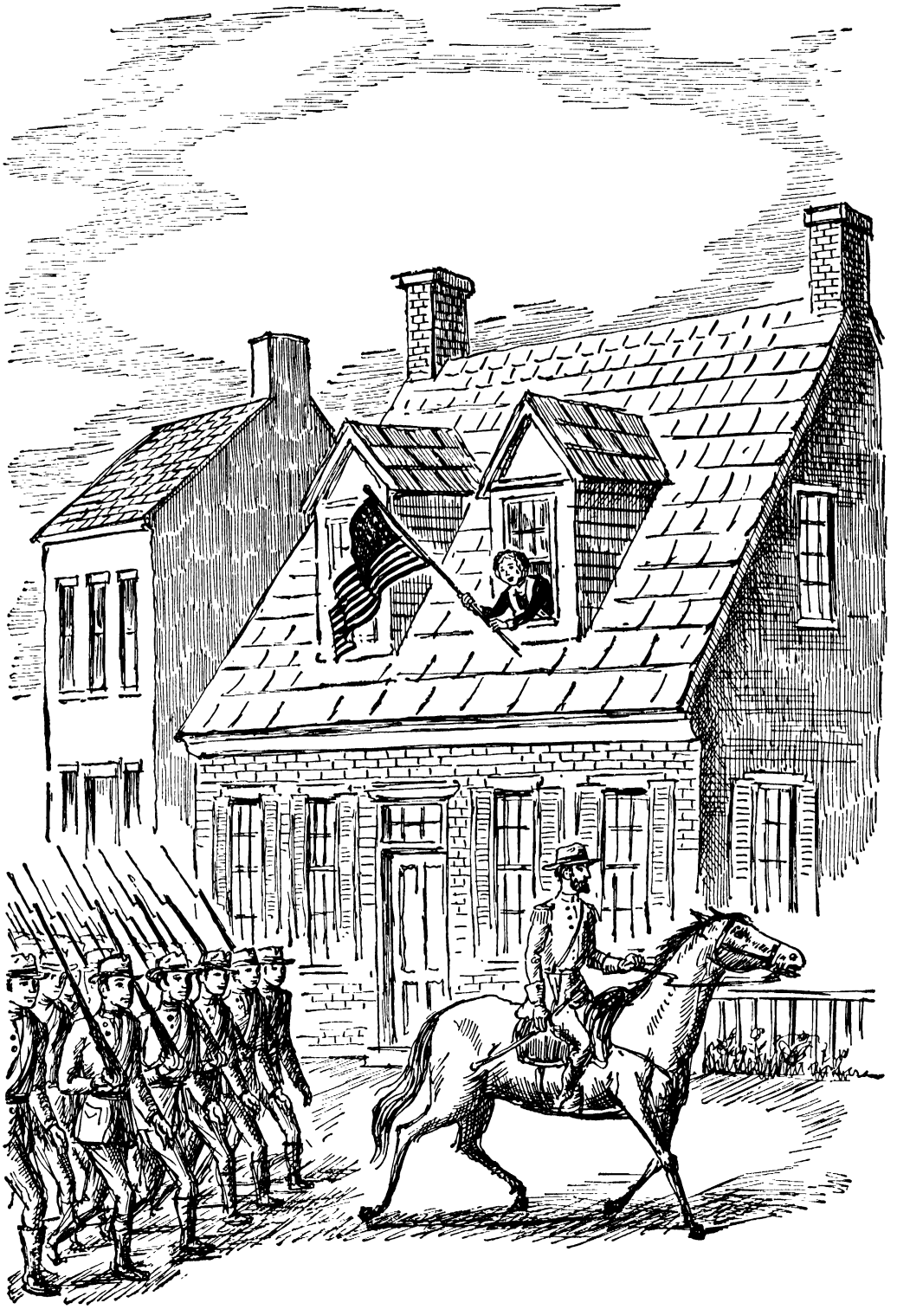
Honor to her! and let a tear
Fall, for her sake, on Stonewall's bier.

Over Barbara Frietchie's grave,
Flag of Freedom and Union, wave!

Peace and order and beauty draw
Round thy symbol of light and law;

And ever the stars above look down
On thy stars below in Frederick town!





Invictus

By WILLIAM ERNEST HENLEY (1849-1903)

OUT of the night that covers me,
Black as the pit from pole to pole,
I thank whatever gods there be
For my unconquerable soul.

In the fell clutch of circumstance
I have not winced nor cried aloud.
Under the bludgeonings of chance
My head is bloody, but unbowed.

Beyond this place of wrath and tears
Looms but the Horror of the shade,
And yet the menace of the years
Finds and shall find me unafraid.

It matters not how strait the gate,
How charged with punishments the scroll,
I am the master of my fate:
I am the captain of my soul.

Vitae Lampada*

(The Torch of Life)

By SIR HENRY NEWBOLT (1862-1938)

THERE's a breathless hush in the close to-night—
Ten to make and a match to win—
A bumping pitch, and a blinding light,
An hour to play, and the last man in.
And it's not for the sake of a ribboned coat,
Or the selfish hope of a season's fame,
But his captain's hand on his shoulder smote:
Play up! Play up! and play the game!

The sand of the desert is sodden red—
Red with the wreck of a square that broke—
The Gatling's jammed, and the Colonel dead,
And the regiment blind with dust and smoke.
The river of death has brimmed his banks,
And England's far, and honor a name,
But the voice of a school-boy rallies the ranks:
Play up! Play up! and play the game!

This the word that year by year,
While in her place the school is set,
Every one of her sons must hear,
And none that hears it dare forget.
This they all with a joyful mind
Bear through life like a torch of flame,
And falling, fling to the host behind—
Play up! Play up! and play the game!

*By permission of the author.

I Have a Rendezvous with Death**

By ALAN SEEGER (1888-1916)

I HAVE a rendezvous with Death
At some disputed barricade,
When Spring comes back with rustling shade
And apple-blossoms fill the air—
I have a rendezvous with Death
When Spring brings back blue days and fair.

It may be he shall take my hand
And lead me into his dark land
And close my eyes and quench my breath—
It may be I shall pass him still.
I have a rendezvous with Death
On some scarred slope of battered hill,
When Spring comes round again this year
And the first meadow-flowers appear.

God knows 'twere better to be deep
Pillowed in silk and scented down,
Where Love throbs out in blissful sleep,
Pulse nigh to pulse, and breath to breath,
Where hushed awakenings are dear . . .
But I've a rendezvous with Death
At midnight in some flaming town,
When Spring trips north again this year,
And I to my pledged word am true,
I shall not fail that rendezvous.

Pandora's Song***

From THE FIRE-BRINGER

By WILLIAM VAUGHN MOODY (1869-1910)

OF wounds and sore defeat
I made my battle stay;
Winged sandals for my feet
I wove of my delay;
Of weariness and fear
I made my shouting spear;
Of loss, and doubt, and dread,
And swift oncoming doom
I made a helmet for my head
And a floating plume.
From the shutting mist of death,
From the failure of the breath,
I made a battle-horn to blow
Across the vales of overthrow.
O hearken, love, the battle-horn!
The triumph clear, the silver scorn!
O hearken where the echoes bring,
Down the gray disastrous morn,
Laughter and rallying!

**From Poems by Alan Seeger, copyright 1916 Charles Scribner's Sons; 1944 Elsie Adams Seeger. Charles Scribner's Sons, publisher.

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THE NEXT POEMS ARE ON PAGE 2148.

THE WIZARD OF MENLO PARK

THOMAS ALVA EDISON, INVENTOR

SUPPOSE you are a boy or girl living on a farm remote from town. Only fifty years ago you would have been dependent upon the feeble and uncertain light of candles or kerosene lamps at the coming of nightfall. But now the wonderful electric light is at your beck and call. You have only to reach out your hand and turn a switch, and the room in which you are will be flooded with light. You will be able to read or write and play games by artificial light that rivals even the light of the lordly sun.

Perhaps you may wish to hear a great orchestra or violinist or singer. Your radio may not provide you with what you want, but it does not matter. You have but to select the proper phonograph record, place it on your phonograph or combination phonograph and radio, and soon you will be listening to the magnificent chords of the orchestra or the singing tones of the violin or the superb voice of a great soprano. You may even study a foreign language through phonograph records.

Perhaps it is Friday evening. Home lessons are laid aside, for you are going to a movie in the nearest town. For two hours or more you will be taken to places of interest in your own country or in one far distant; you laugh heartily over a comedy, or your heart aches over some sad, pathetic story. A great parade is held in a distant city, and within a few days the men and women will march down toward you on the picture screen. You see the launching of a proud ship, the forging of a giant anchor, a carnival held in New Orleans or in Rome, or perhaps a native wedding procession in far-off Bombay, or a football game at Yale.



From Ewing Galloway

Thomas Edison in 1877, experimenting with carbonized paper for his system of electric light.

Here we are going to read something about the man to whom we owe the fact that our lives are so much richer than the lives of our grandfathers and grandmothers, or even our fathers and mothers when they were young.

Thomas Alva Edison worked out his inventions by known laws of science. He had studied these laws, so that he was able to apply them to make real the visions of his imagination. Yet he had few advantages and little help, and his story is one of those that inspire us to great effort to cultivate the talents that have been given to each one of us.

He was born in February, 1847, in the little village of Milan, in Ohio. His parents were poor because his father did not keep to a settled occupation. Mr. Edison senior had the same kind of mind as his wonder-working son—the kind of mind that is called versatile, that can turn easily from one thing to another. He had not learned, however, that it is wise for a man with a versatile mind to find out how to do one thing thoroughly before he turns to another, and so he was not successful.

Thomas Alva Edison was a quiet, thoughtful little boy, but very inquisitive and always wanting to know how things were done. He was not very strong, however, and was not sent to school until he was quite a big child. When he did go, his teacher, who does not seem to have been very wise, thought him stupid because he asked so many questions. So his mother, who had herself been a teacher, took him away from school at the end of two months and taught him at home. With so kind and loving a teacher

he made rapid progress; and above all, he learned to think. His mother had some good books, which he learned to enjoy; and when he was ten years old he read Gibbon's Decline and Fall of the Roman Empire and Hume's History of England. About that time he began to study an encyclopedia. It was probably from the encyclopedia that he first learned to take an interest in chemistry and to make experiments.

EDISON'S FIRST SIMPLE LABORATORY

By this time his parents, who had moved with him to Port Huron, Michigan, were able to indulge him in his love for making experiments. He bought some books, made a little laboratory in the cellar of his home, and there, by himself, with no teacher, laid the foundation of his knowledge of chemistry.

When he was twelve years old he decided to start out in life for himself, and he became a newsboy on the train which ran from Port Huron to Detroit. Such a newsboy had never been seen before. He was given a corner in the baggage car in which to keep his stocks of newspapers, magazines and candy. To this corner he moved his little laboratory and library of chemical books, and when he was not engaged in his business, went on with his experiments. Still time hung heavy on his hands, and to fill it up he bought a printing-press and type and published on the train a weekly newspaper filled with local news, stories of things that happened on the railway and notes of the markets. The trainmen and passengers were glad to buy the paper from this enterprising young publisher.

AN ACCIDENT WITH SAD CONSEQUENCES

All went well for two or three years. But when he was in his sixteenth year, one day a phosphorus bottle was jarred off one of his shelves and broke on the floor. It set fire to the baggage car, and in his anger at the danger to his train the conductor not only put the boy off the train, but soundly boxed his ears. That was the most unfortunate part of the accident, for as a result of the boxing Edison gradually lost his hearing and became almost totally deaf. His stock was lost, but an act of great bravery and presence of mind on his part brought to his aid a new resource and opened up a new field for him to work in.

He was standing one day on the platform of the depot at Mt. Clemens, Michigan, watching a train come in, when he saw the station agent's little boy on the track right in front of the oncoming engine. Another moment and the child would have been crushed, but Edison sprang to the track, seized the little one in his arms, and rolled with him to one side, just in time to escape the wheels. To show his gratitude the baby's father offered to teach Edison telegraphy. The offer was gratefully accepted, and now that his career as a train newsboy was closed, he turned to his new accomplishment as a means of making a living.

FIRST JOBS IN TELEGRAPHY

He worked at telegraphy for some years, first in Port Huron, Michigan, then at Stratford, Canada, and a little later in the western states, and finally in Boston. At the same time he spent all his spare moments studying chemistry and electricity and experimenting on improved telegraph apparatus. It was during these years that he first turned his attention to duplex telegraphy, but through no fault of his own he was unable to sell his invention, and the matter dropped for a time.

In 1869, when he was in his twenty-second year, he went to New York. He arrived penniless in the city; but he was a good telegraph-operator, and was fearless of the future. And now a strange thing happened. He applied to the Gold and Stock Telegraph Company for work, and while he was waiting for a reply part of the apparatus broke down. No one knew what was the matter, and everything was in confusion until Edison said he could set the machine at work again. Permission was given him to try, and at the end of two hours, work in the office was going on as if nothing had happened. Edison was asked if he would accept a position at a salary of three hundred dollars a month and, needless to say, he accepted.

EDISON SELLS HIS TELEGRAPH INVENTIONS

In a little over a year Edison sold his telegraph inventions for a large sum of money; this enabled him to set up in business for himself. First he built a factory at Newark, New Jersey, for the manufacture of telegraph apparatus. He gave up this factory in 1876, and set up a laboratory at Menlo Park, New Jersey. Later this laboratory was moved to West Orange, New Jersey. His chief business now was making inventions. He gave employment to hun-

EDISON IN THE MUSEUM NAMED FOR HIM



Courtesy, Edison Institute

Edison made some of his most important inventions, including the incandescent light, in an unpretentious workroom in Menlo Park, New Jersey. Years later Henry Ford moved the laboratory to Michigan to form part of an Edison memorial. Here we see Edison helping to set up the laboratory just as it had been in Menlo Park.

dreds of workmen and his inventions made him famous the world over.

His first great invention was the quadruplex system of telegraphy, about which you may read in the story of the telegraph, which begins on page 6049.

THE FIRST PHONOGRAPH IS INVENTED

It was about the same time that he invented the phonograph. The idea of an instrument which would "write sound" and reproduce it had been thought of before by scientists, though it is doubtful if Edison knew of their efforts to make such an instrument. At any rate, he was the first to make an instrument which would work, and even he did not know that it would work until he heard it repeat the words that he shouted into it.

Edison patented his invention, which from the first excited the wonder of the world. Of course, like all first things, it was crude, and the sounds that it gave back were harsh. For the time he had to lay it aside, for he was busied with many other important projects. But others took it up, and from his parent idea the phonograph and other instruments were invented. Later on, when he had more leisure, Edison himself worked out a phonograph that gave back each beautiful vibration from voice or instrument.

WONDERFUL IMPROVEMENTS IN ELECTRIC LIGHTS

When electricity was first used for illumination only large arc-lights were used. The lamps sputtered and scattered sparks, and the light was so harsh that it could be used only for street-lighting and large buildings, such as factories, drill halls and the like. Such a thing as incandescent lights, which make possible the use of softly shaded lamps or indirect lighting in our homes, or brilliant illumination of concert halls and theatres, was not even thought of. For this work Edison put aside the work of his phonograph. He believed that a number of lights could be supplied from one distributing wire, and he believed that the light could be improved so that its use would be a common thing, so he invented the incandescent lamp, from which our modern lighting has grown. He spent a couple of years over this work, and to perfect his system improved dynamo machines, and invented a whole scheme of distributing electricity so that it might be used on a large scale for supplying light, heat and power.

Now we come to the moving pictures, where again Edison took up an idea which others had had before him. While it can not be said that Edison invented the moving pictures, he did work out the underlying principle on which they are based, insofar as motion is shown on a screen. The development of "sound" pictures came later and was worked out by others.

SOME OTHER INDUSTRIAL INVENTIONS

Other inventions of his were hardly less wonderful. He invented the apparatus called the Giant Rolls, by means of which huge rocks could be reduced to fragments in a few seconds. He perfected a new type of storage battery, which did away with the lead and sulphuric acid of the old type. He increased the speed of cement manufacture with his "Long Kiln," used in burning the mixture of cement material. His new method of cement pouring made it possible to pour the cement for a complete house in a few hours.

When World War I broke out, he found himself in danger of being cut off from his source of supply of carbolic acid for his factories at West Orange. He therefore devised a means of making it for himself. He also erected a number of plants for manufacturing products which formerly had been obtained from Europe.

ARTIFICIAL RUBBER FROM GOLDENROD

During the last years of his life he was busied with the problem of producing synthetic, or artificial rubber. Finally, in 1930, he patented a process for extracting rubber from goldenrod. He died October 18, 1931, at the age of eighty-four.

We have mentioned here but a few of the numberless inventions of this wonderful man. An attempt was made, indeed, to estimate the value of these inventions. When the United States Congress awarded Edison its Gold Medal, it set the value of his contributions to mankind at $15,599,000,000. Any estimate of this sort is futile. It is enough to say that few men have done so much to make life more complete for countless millions.

Shortly before the death of this great man another important inventor, Henry Ford, established near Dearborn, Michigan, a museum known as Edison Institute. Among the memorials to Edison that it contains is his original laboratory, moved from Menlo Park. See page 1893.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 2083.

EVANGELINE

THE STORY OF A FAITHFUL HEART

Illustrated by George Avison

IN the reigns of George II of England and Louis XV of France there was much fighting between the two countries. Some of the fighting took place on North-American soil, and there occurred one of the saddest events that history has to record.

In a pleasant little valley near the sea, in Acadie (the land we now call Nova Scotia), there dwelt perhaps 10,000 French farming folk, loyal to their king in Paris, simple, devout, home-loving souls. When Acadie came into English hands, through the fortunes of war, these simple folk were unable to understand how such a thing could be.

Many times they were ordered to take an oath of allegiance to their new king, the English king; and always they refused. English patience wore thin, and it was even suspected that some of the Acadians were secretly working to bring back French rule to the land. They were God-fearing people, and the English believed that if they could be induced to take the oath of allegiance they would keep it faithfully. When finally it appeared that they could never be induced to swear obedience, the English governor determined to rid himself of these stubborn souls and to stock the land with loyal settlers of British blood.

On a clear day in October, 1755, the leading men of this pleasant valley were summoned to meet at the little village church of Grand Pré. They came from their smiling fields, and from the town—farmer and blacksmith, priest and notary, miller and fiddler, and all. And the word of doom was read to them, the terrible message from the governor that their lands were forfeit, and their homes, and their flocks and herds. They and their families must embark upon the vessels that lay riding in harbor, and be taken away to exile forever.

By the aid of armed troops this word of doom was carried out. In the confusion, families and friends were torn apart, mothers lost sight of their children, husbands and wives were driven aboard separate ships. Many families were not re-united for years, and some never came together again.

Years after the Acadians had been driven forth from their homes, the American writer Nathaniel Hawthorne heard a story about them, which he thought would make a sadly beautiful poem. He urged his friend Longfellow to write it, and the poet did so. He changed minor facts here and there, perhaps, as poets do. But, in the main, the story of Evangeline is truly set down in Longfellow's verses. This is the tale.

Evangeline Bellefontaine, in that Indian summer of 1755, was just seventeen years old, a black-eyed, brown-haired girl, the loveliest maid in the parish. Her mother was dead, and Evangeline kept house for her father, Benedict Bellefontaine, a wealthy farmer. But her thoughts were on a home of her own, for she was betrothed to Gabriel Lajeunnesse, son of Basil, the village blacksmith. Gabriel and Evangeline were the happiest boy and girl in Acadie, till that day came when they were driven from home.

Under the guard of the English troops the men of the village were hurried from the meeting in the church to the shore. The terrible word spread through the hamlet; weeping women and children left their homes to join the men. Evangeline waited upon the shore until she saw Gabriel. Running to meet him she whispered, "Gabriel! Be of good cheer! For if we love one another nothing can harm us."

Suddenly she paused. Her aged father was approaching. He had changed overnight. The glow was gone from his cheeks. His eyes were lifeless and his footstep, weary. The mournful procession continued to the beach. There disorder prevailed. No effort was made to keep families together. No one was told his destination. Heartbroken and terrified, Evangeline stood beside her father and watched their friends depart one after another.

One ship took Gabriel and Basil. As Evangeline waited at the shore, her father Benedict dropped dead from shock, and his neighbors buried him there beside the sea. Evangeline was then forced to go, alone,



The tragic leave-taking of Evangeline and Gabriel is one of the most touching scenes in our literature.

upon the next ship that was to be filled.

She was young and beautiful and in love. Gradually her sorrow for her father was healed; and there grew in her heart the single desire, the dream of finding Gabriel Lajeunnesse. But it was a dream that beckoned always, and faded as she approached, and beckoned again, and faded.

The little sailing ships that carried off the Acadians landed at different ports; and after landing, the exiles scattered further. A few tried to make their way home again on foot. Some of the younger men became *voyageurs* and *coureurs de bois*, that is, woodsmen and fur traders in the untamed forests. Some found homes in the French settlements of Louisiana.

From settlement to settlement Evangeline wandered, seeking for news of her lover. "Gabriel Lajeunnesse?" men would say. "Yes, we have heard of him. He has gone with the *voyageurs*." Or, "He has gone with the *coureurs de bois*." Or, "He is in Louisiana."

Wherever Evangeline wandered, Gabriel had gone before; but always, when she reached a town, he had moved on. Sometimes she was only a few days behind him, once only a day behind. But he, urged on by his restless longing for his lost sweetheart, kept moving on, searching for forgetfulness, yet ever remembering his last happy evening at Grand Pré, when he and Evangeline sat by the window and

> Silently, one by one, in the infinite meadows of heaven,
> Blossomed the lovely stars, the forget-me-nots of the angels.

So the long years of wandering passed. Evangeline's beauty faded. She grew into a heartbroken old woman. In the city of Philadelphia she became a Sister of Mercy, a nursing sister, devoting herself to the service of the poor and ill.

The dread plague visited the city; and Evangeline went each day to the almshouse, to nurse the plague-stricken paupers. One Sunday morning, as she made her way through the ward, she saw before her on one of the cots an old man, thin and gray and dying, burning with fever; yet she knew him, her Gabriel. The long weary years of a whole lifetime's search were over at last.

> On the pallet before her was stretched the form of an old man . . .
> But, as he lay in the morning light, his face for a moment
> Seemed to assume once more the forms of its earlier manhood;
> So are wont to be changed the faces of those who are dying.
> Hot and red on his lips still burned the flush of the fever,
> As if life, like the Hebrew, with blood had besprinkled its portals,
> That the Angel of Death might see the sign, and pass over.
> Motionless, senseless, dying, he lay, and his spirit exhausted
> Seemed to be sinking down through infinite depths in the darkness,
> Darkness of slumber and death, forever sinking and sinking.
> Then through those realms of shade, in multiplied reverberations,
> Heard he that cry of pain, and through the hush that succeeded
> Whispered a gentle voice, in accents tender and saint like,

"Gabriel! O my beloved!" and died away into silence.
Then he beheld, in a dream, once more the home of his childhood;
Green Acadian meadows, with sylvan rivers among them,
Village, and mountain, and woodlands; and, walking under their shadow,
As in the days of her youth, Evangeline rose in his vision.
Tears came into his eyes; and as slowly he lifted his eyelids,
Vanished the vision away, but Evangeline knelt by his bedside.
Vainly he strove to whisper her name, for the accents unuttered
Died on his lips, and their motion revealed what his tongue would have spoken.
Vainly he strove to rise; and Evangeline, kneeling beside him,
Kissed his dying lips, and laid his head on her bosom.
Sweet was the light of his eyes; but it suddenly sank into darkness,
As when a lamp is blown out by a gust of wind at a casement.

So the lovers were united once more. Death stood aside to grant them a last joyful moment; then he came forward and claimed his own.

All was ended now, the hope and the fear and the sorrow,
All the aching of heart, the restless, unsatisfied longing,
All the dull, deep pain, and constant anguish of patience!
And as she pressed once more the lifeless head to her bosom,
Meekly she bowed her own, and murmured, "Father, I thank thee!"

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 2006.



From the shore, Evangeline and her father watch in silence as their friends and neighbors are herded into ships.

ONE OF THE IMMORTALS



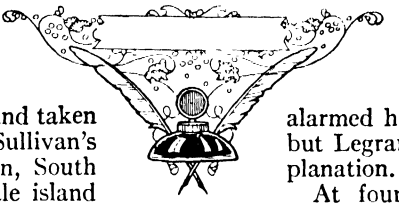
Photo, courtesy of the Metropolitan Museum of Art

"The lofty pine is oftenest shaken by the wind; high towers fall with a heavier crash; and the thunderbolt strikes the highest mountains." Such is the translation of the Latin lines taken from Horace, which are part of the inscription of the memorial to Edgar Allan Poe. The two lines in English just above the Latin quotation say "He was great in his genius; unhappy in his life; wretched in his death. But in his fame he is immortal." This memorial is in one of the buildings of the College of the City of New York.

THE STORIES OF EDGAR ALLAN POE

EDGAR ALLAN POE was born in Boston in 1809 and died in Baltimore in 1849. His life was one of tragedy, and misfortune followed him all his days. Yet with that shadow over his life he produced some poems that will always live. And he became a master of mystery-story writing in a short form. Some of his tales are gruesome and full of horror, but they are perfectly told. As time goes on, people honor Poe's memory more and more, for no one in America has surpassed him in the art of story-telling. The Gold-Bug is a delightful treasure mystery story, in which the secret is revealed by a cipher, or code.

THE GOLD-BUG



WILLIAM LEGRAND, formerly wealthy but reduced to want, had left New Orleans and taken up his residence at Sullivan's Island, near Charleston, South Carolina. On this little island he had built a hut. An old negro called Jupiter attended to all his wants. Legrand's amusements were gunning, fishing and collecting shells and insects.

One chilly evening in October a friend called upon him and found him greatly excited. He had found a bug the color of gold and very strange and rare. Jupiter insisted that the insect was made of real gold. As he had lent the bug to another friend, Legrand pulled a piece of paper from his pocket and drew a picture of the little creature. The friend, who was holding the paper near the fire, declared he saw only a picture of a skull. Legrand was angry, but took back the paper, looked at it carefully, then put it quickly in his writing desk.

Some days later Jupiter told this friend that he was worried about his master, who all day long made figures on a slate. In answer to a note from Legrand the friend hurried over. He found Legrand waiting at the little wharf. In a boat close by were a scythe and three spades. The owner of the hut was acting strangely. Jupiter declared that his master's actions were caused by the gold-bug. Legrand said that was true. His statement alarmed his friend exceedingly, but Legrand would give no explanation.

At four o'clock that afternoon Legrand led the friend and Jupiter to a remote part of the island. He was carrying the gold-bug attached to a string, while the other two carried the tools. Beneath a large tulip tree a halt was called. Legrand gave the gold-bug to the old negro and told him to climb this very tall tree. Jupiter did not want to take the insect, of which he was afraid, but his master shamed him into obeying.

When the old man had climbed to the seventh branch Legrand told him to crawl out along the limb. There Jupiter found a skull, nailed down. Legrand became very much excited and instructed him to pass the bug through the left eye of the skull. From the spot where the bug touched the ground when let down by the string his master began to take measurements. At a certain point he told Jupiter to clear away the brambles with the scythe. Giving spades to his two companions, Legrand began digging. The three men worked hard until they had reached a depth of five feet. But they found nothing.

Legrand was bitterly disappointed

and was about to start for home when a thought struck him. Turning to Jupiter, he asked which was his left eye. The old negro immediately put his hand over his right eye.

"I thought so!—I knew it! Hurrah!" shouted Legrand. He went back to the tulip tree and altered the mark where the bug had touched the ground. From the new mark he measured once more. Again he gave the order to dig.

In a few seconds the spades had turned up a mass of human bones and a few coins. Excitement became intense. Ten minutes' work revealed an oblong chest of wood bound with iron. The men drew back the bolts. The rays of the lantern were reflected back by a heap of jewels!

All that night and next day the three men worked to carry the treasure to the hut. Everything in the chest was of gold. There was four hundred and fifty thousand dollars in gold coins, all very old. There were quantities of diamonds, rubies, emeralds and sapphires. There was a vast quantity of gold ornaments, including one hundred and ninety-three watches richly jeweled. All told, the value of the find was over a million and a half dollars.

The friend, who had been almost overcome with astonishment, demanded that Legrand tell how he had discovered the secret of the treasure. This the successful treasure-hunter was glad to do. He was proud of what he had accomplished.

The gold-bug was at the bottom of it all. Upon finding the bug Legrand had told Jupiter to pick it up. The negro had wrapped it in a scrap of paper he had found near by. It was on this paper that Legrand had sketched the insect. When his friend had seen a skull instead of a bug, Legrand's pride had been hurt, for he considered himself an artist. To his amazement he had discovered late that night that on the back of the paper was a drawing of a skull. Sure that this had not been on the paper, or rather parchment, when he had drawn the bug, he held the scrap close to the fire. The figure of an animal appeared. Legrand realized that someone had written on the parchment in invisible ink. The animal turned out to be a kid. At once Legrand thought of Captain Kidd and his buried treasure.

The rest of the explanation is given in Legrand's words taken directly from Poe's story.

THE SOLUTION OF THE CIPHER

"I HELD the vellum again to the fire, after increasing the heat, but nothing appeared. I now thought it possible that the coating of dirt might have something to do with failure: so I carefully rinsed the parchment by pouring warm water over it, and, having done this, I placed it in a tin pan, with the skull downward, and put the pan upon a furnace of lighted charcoal. In a few minutes, the pan having become thoroughly heated, I removed the slip, and, to my inexpressible joy, found it spotted, in several places, with what appeared to be figures arranged in lines. Again I placed it in the pan, and suffered it to remain another minute. Upon taking it off, the whole was just as you see it now."

Here Legrand, having re-heated the parchment, submitted it to my inspection. The following characters were rudely traced, in a red tint, between the death's-head and the goat:

"53‡‡†305))6*;4826)4‡);806*;48†8¶60))85;1‡(;:‡*8†83(88)5*†;46(;88*96*?;8)*‡(;485);5*†2:*‡(;4956*2(5*—4)8¶8*;4069285);)6†8)4‡‡;1(‡9;48081;8:8‡1;48†85;4)485†528806*81(‡9;48;(88;4(‡?34;48)4‡;161;:188;‡?;"

"But," said I, returning him the slip, "I am as much in the dark as ever. Were all the jewels of Golconda awaiting me upon my solution of this enigma, I am quite sure that I should be unable to earn them."

"And yet," said Legrand, "the solution is by no means so difficult as you might be led to imagine from the first hasty inspection of the characters. These characters, as any one might readily guess, form a cipher—that is to say, they convey a meaning; but then from what is known of Kidd, I could not suppose him capable of constructing any of the more abstruse cryptographs. I made up my mind, at once, that this was of a simple species—such, however, as would appear, to the crude intellect of the sailor, absolutely insoluble without the key."

"And you really solved it?"

"Readily; I have solved others of an abstruseness ten thousand times greater. Circumstances, and a certain bias of mind, have led me to take interest in such riddles, and it may well be doubted whether human ingenuity can construct an enigma of the kind which human ingenuity may not, by proper application, resolve. In fact, having once established connected and legible characters, I scarcely gave a thought to the mere difficulty of developing their import.

"In the present case—indeed in all cases of secret writing—the first question regards the *language* of the cipher; for the principles of solution, so far, especially, as the more simple ciphers are concerned, depend upon, and are varied by, the genius of the particular idiom. In general, there is no alternative but experiment (directed by probabilities) of every tongue known to him who attempts the solution, until the true one be attained. But, with the cipher now before us all difficulty was removed by the signature. The pun upon the word 'Kidd' is appreciable in no other language than the English. But for this consideration I should have begun my attempts with the Spanish and French, as the tongues in which a secret of this kind would most naturally have been written by a pirate of the Spanish Main. As it was, I assumed the cryptograph to be English.

"You observe there are no divisions between the words. Had there been divisions the task would have been comparatively easy. In such cases I should have commenced with a collation and analysis of the shorter words, and, had a word of a single letter occurred, as is most likely, (*a* or *I*, for example,) I should have considered the solution as assured. But, there being no division, my first step was to ascertain the predominant letters, as well as the least frequent. Counting all, I constructed a table thus:

Of the character	8	there are	33.
"	;	"	26.
"	4	"	19.
"	‡)	"	16.
"	*	"	13.
"	6	"	11.
"	†1	"	8.
"	0	"	6.
"	92	"	5.
"	:3	"	4.
Of the character	?	there are	3.
"	¶	"	2.
"	—	"	1.

"Now, in English, the letter which most frequently occurs is *e*. Afterward, the succession runs thus: *a o i d h n r s t u y c f g l m w b k p q x z*. *E* predominates so remarkably that an individual sentence of any length is rarely seen in which it is not the prevailing character.

"Here, then, we have, in the very beginning, the groundwork for something more than a mere guess. The general use which may be made of the table is obvious—but, in this particular cipher, we shall only very partially require its aid. As our predominant character is 8, we will commence by assuming it as the *e* of the natural alphabet. To verify the supposition, let us observe if the 8 be seen often in couples—for *e* is doubled with great frequency in English—in such words, for example, as 'meet,' 'fleet,' 'speed,' 'seen,' 'been,' 'agree,' etc. In the present instance we see it doubled no less than five times, although the cryptograph is brief.

"Let us assume 8, then, as *e*. Now, of all *words* in the language, 'the' is most usual; let us see, therefore, whether there are not repetitions of any three characters, in the same order of collocation, the last of them being 8. If we discover repetitions of such letters, so arranged, they will most probably represent the word 'the.' Upon inspection, we find no less than seven such arrangements, the characters being ;48. We may, therefore, assume that ; represents *t*, 4 represents *h*, and 8 represents *e*—the last being now well confirmed. Thus a great step has been taken.

"But, having established a single word, we are enabled to establish a vastly important point; that is to say, several commencements and terminations of other words. Let us refer, for example, to the last instance but one, in which the combination ;48 occurs—not far from the end of the cipher. We know that the ; immediately ensuing is the commencement of a word, and, of the six characters succeeding this 'the,' we are cognizant of no less than five. Let us set these characters down, thus, by the letters we know them to represent, leaving a space for the unknown—

t eeth.

"Here we are enabled, at once, to discard the *'th,'* as forming no portion of the word commencing with the first *t ;* since, by experiment of the entire alphabet for a letter adapted to the vacancy, we perceive that no word can be formed of which this *th* can be a part. We are thus narrowed into

t ee,

and, going through the alphabet, if necessary, as before, we arrive at the word 'tree,' as the sole possible reading. We thus gain another letter, *r,* represented by (, with the words 'the tree' in juxtaposition.

"Looking beyond these words, for a short distance, we again see the combination ;48, and employ it by way of *termination* to what immediately precedes. We have thus this arrangement:

the tree ;4(‡?34 the,

or, substituting the natural letters, where known, it reads thus:

the tree thr‡?3h the.

"Now, if, in place of the unknown characters, we leave blank spaces, or substitute dots, we read thus:

the tree thr...h the,

when the word *'through'* makes itself evident at once. But this discovery gives us three new letters, *o, u,* and *g,* represented by ‡, ?, and 3.

"Looking now, narrowly, through the cipher for combinations of known characters, we find, not very far from the beginning, this arrangement,

83(88, or egree,

which, plainly, is the conclusion of the word 'degree,' and gives us another letter, *d,* represented by †.

"Four letters beyond the word 'degree,' we perceive the combination

;46(;88.

"Translating the known characters, and representing the unknown by dots, as before, we read thus:

th.rtee,

an arrangement immediately suggestive of the word 'thirteen,' and again furnishing us with two new characters, *i* and *n,* represented by 6 and *.

"Referring, now, to the beginning of the cryptograph, we find the combination,

53‡‡†.

"Translating as before, we obtain

.good,

which assures us that the first letter is *A,* and that the first two words are 'A good.'

"It is now time that we arrange our key, as far as discovered, in a tabular form, to avoid confusion. It will stand thus:

5	represents	a
†	"	d
8	"	e
3	"	g
4	"	h
6	"	i
*	"	n
‡	"	o
(	"	r
;	"	t
?	"	n

"We have, therefore, no less than eleven of the most important letters represented, and it will be unnecessary to proceed with the details of the solution. I have said enough to convince you that ciphers of this nature are readily soluble, and to give you some insight into the *rationale* of their development. But be assured that the specimen before us appertains to the very simplest species of cryptograph. It now only remains to give you the full translation of the characters upon the parchment. Here it is:

"*'A good glass in the bishop's hostel in the devil's seat forty-one degrees and thirteen minutes northeast and by north main branch seventh limb east side shoot from the left eye of the death's-head a bee-line from the tree through the shot fifty feet out.'*"

"But," said I, "the enigma seems still in as bad a condition as ever. How is it possible to extort a meaning from all this jargon about 'devil's seats,' death's-heads, and 'bishop's hotels?'"

"I confess," replied Legrand, "that the matter still wears a serious aspect, when regarded with a casual glance. My first endeavor was to divide the sentence into the natural division intended by the cryptographist."

"You mean, to punctuate it?"

"Something of that kind."

"But how was it possible to effect this?"

"I reflected that it had been a *point* with the writer to run his words together without division, so as to increase the difficulty of solution. Now, a not overacute man, in pursuing such an object, would be nearly certain to overdo the matter. When, in the course of his composition, he arrived at a break in his subject which would naturally require a pause, or a point, he would be exceedingly apt to run his characters, at this place, more than usually close together. If you will observe the MS., in the present instance, you will easily detect five such cases of unusual crowding. Acting upon this hint, I made the division thus:

"'*A good glass in the bishop's hostel in the devil's seat—forty-one degrees and thirteen minutes—northeast and by north—main branch seventh limb seat side—shoot from the left eye of the death's-head—a bee-line from the tree through the shot fifty feet out.*'"

"Even this division," said I, "leaves me still in the dark."

"It left me also in the dark," replied Legrand, "for a few days; during which I made diligent inquiry, in the neighborhood of Sullivan's Island, for any building which went by the name of the 'Bishop's Hotel'; for, of course, I dropped the obsolete word 'hostel.' Gaining no information on the subject, I was on the point of extending my sphere of search, and proceeding in a more systematic manner, when, one morning, it entered into my head, quite suddenly, that this 'Bishop's Hostel' might have some reference to an old family, of the name of Bessop, which, time out of mind, had held possession of an ancient manor-house, about four miles to the northward of the island. I accordingly went over to the plantation, and re-instituted my inquiries among the older negroes of the place. At length one of the most aged of the women said that she had heard of such a place as *Bessop's Castle,* and thought that she could guide me to it, but that it was not a castle, nor a tavern, but a high rock.

"I offered to pay her well for her trouble, and, after some demur, she consented to accompany me to the spot. We found it without much difficulty, when, dismissing her, I proceeded to examine the place. The 'castle' consisted of an irregular assemblage of cliffs and rocks—one of the latter being quite remarkable for its height as well as for its insulated and artificial appearance. I clambered to its apex, and felt much at a loss as to what should be next done.

"While I was busied in reflection, my eyes fell upon a narrow ledge in the eastern face of the rock, perhaps a yard below the summit upon which I stood. This ledge projected about eighteen inches, and was not more than a foot wide, while a niche in the cliff just above it gave it a rude resemblance to one of the hollow-backed chairs used by our ancestors. I made no doubt that here was the 'devil's-seat' alluded to in the MS., and now I seemed to grasp the full secret of the riddle.

"The 'good glass,' I knew, could have reference to nothing but a telescope; for the word 'glass' is rarely employed in any other sense by seamen. Now here, I at once saw, was a telescope to be used, and a definite point of view, *admitting no variation,* from which to use it. Nor did I hesitate to believe that the phrases, 'forty-one degrees and thirteen minutes,' and 'northeast and by north,' were intended as directions for the levelling of the glass. Greatly excited by these discoveries, I hurried home, procured a telescope, and returned to the rock.

"I let myself down to the ledge, and found that it was impossible to retain a seat upon it except in one particular position. This fact confirmed my preconceived idea. I proceeded to use the glass. Of course, the 'forty-one degrees and thirteen minutes' could allude to nothing but elevation above the visible horizon, since the horizontal direction was clearly indicated by the words, 'northeast by north.' This latter direction I at once established by means of a pocket-compass; then, pointing the glass as nearly at an angle of forty-one degrees of elevation as I could do it by guess, I moved it cautiously up or down, until my attention was arrested by a circular rift or opening in the foliage of a large tree that overtopped its fellows in the distance. In the centre of this rift I perceived a white spot, but could not, at first, distinguish what it was. Adjusting the focus of the telescope, I again looked, and now made it out to be a human skull.

"Upon this discovery I was so sanguine as to consider the enigma solved; for the phrase 'main branch, seventh limb,

east side,' could refer only to the position of the skull upon the tree, while 'shoot from the left eye of the death's-head' admitted, also, of but one interpretation, in regard to a search for buried treasure. I perceived that the design was to drop a bullet from the left eye of the skull, and that a bee-line, or, in other words, a straight line, drawn from the nearest point of the trunk through 'the shot' (or the spot where the bullet fell), and thence extended to a distance of fifty feet, would indicate a definite point—and beneath this point I thought it at least *possible* that a deposit of value lay concealed."

"All this," I said, "is exceedingly clear, and, although ingenious, still simple and explicit. When you left the Bishop's Hotel, what then?"

"Why, having carefully taken the bearings of the tree, I turned homeward. The instant that I left 'the devil's-seat,' however, the circular rift vanished; nor could I get a glimpse of it afterward, turn as I would. What seems to me the chief ingenuity in this whole business, is the fact (for repeated experiment has convinced me it *is* a fact) that the circular opening in question is visible from no other attainable point of view than that afforded by the narrow ledge upon the face of the rock.

"In this expedition to the 'Bishop's Hotel' I had been attended by Jupiter, who had, no doubt, observed, for some weeks past, the abstraction of my demeanor, and took especial care not to leave me alone. But, on the next day, getting up very early, I contrived to give him the slip, and went into the hills in search of the tree. After much toil I found it. When I came home at night my valet proposed to give me a flogging. With the rest of the adventure I believe you are as well acquainted as myself."

"I suppose," said I, "you missed the spot, in the first attempt at digging, through Jupiter's stupidity in letting the bug fall through the right instead of through the left eye of the skull."

"Precisely. This mistake made a difference of about two inches and a half in the 'shot'—that is to say, in the position of the peg nearest the tree; and had the treasure been *beneath* the 'shot,' the error would have been of little moment; but 'the shot,' together with the nearest point of the tree, were merely two points for the establishment of a line of direction; of course the error, however trivial in the beginning, increased as we proceeded with the line, and by the time we had gone fifty feet threw us quite off the scent. But for my deep-seated impressions that treasure was here somewhere actually buried, we might have had all our labor in vain."

"But your grandiloquence, and your conduct in swinging the beetle—how excessively odd! I was sure you were mad. And why did you insist upon letting fall the bug, instead of a bullet, from the skull?"

"Why, to be frank, I felt somewhat annoyed by your evident suspicions touching my sanity, and so resolved to punish you quietly, in my own way, by a little bit of sober mystification. For this reason I swung the beetle, and for this reason I let it fall from the tree. An observation of yours about its great weight suggested the latter idea."

"Yes, I perceive; and now there is only one point which puzzles me. What are we to make of the skeleton found in the hole?"

"That is a question I am no more able to answer than yourself. There seems, however, only one plausible way of accounting for them—and yet it is dreadful to believe in such atrocity as my suggestion would imply. It is clear that Kidd—if Kidd indeed secreted this treasure, which I doubt not—it is clear that he must have had assistance in the labor. But this labor concluded, he may have thought it expedient to remove all participants in his secret. Perhaps a couple of blows with a mattock were sufficient, while his coadjutors were busy in the pit; perhaps it required a dozen—who shall tell?"

. . . . . .

So ends the curious tale as Edgar Allan Poe tells it. But the end is so sharp and sudden that it leaves us gasping and eager to know more. What of the gold-bug itself? From the moment Jupiter dropped it through the eye of the skull we hear no more of it. Did Legrand abandon the strange insect that restored him to fortune? Or did the scarabæus unfold its golden wings and vanish into the waiting night? Evidently Poe thought it well to leave the end of the uncanny creature to our imaginations.

THE NEXT STORY OF FAMOUS BOOKS IS ON PAGE 2401.

PRINTED IN U. S. A.

VOLUME VI

The Book of Knowledge

The Children's Encyclopedia

THAT LEADS TO LOVE OF LEARNING

Editor-in-Chief

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Educational Consultant

LEONARD POWER, Ed.D.



With an Introduction by

ALEXANDER J. STODDARD, Ed.D., L.H.D., LL.D.

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BOOK OF KNOWLEDGE

The Children's Encyclopedia

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E

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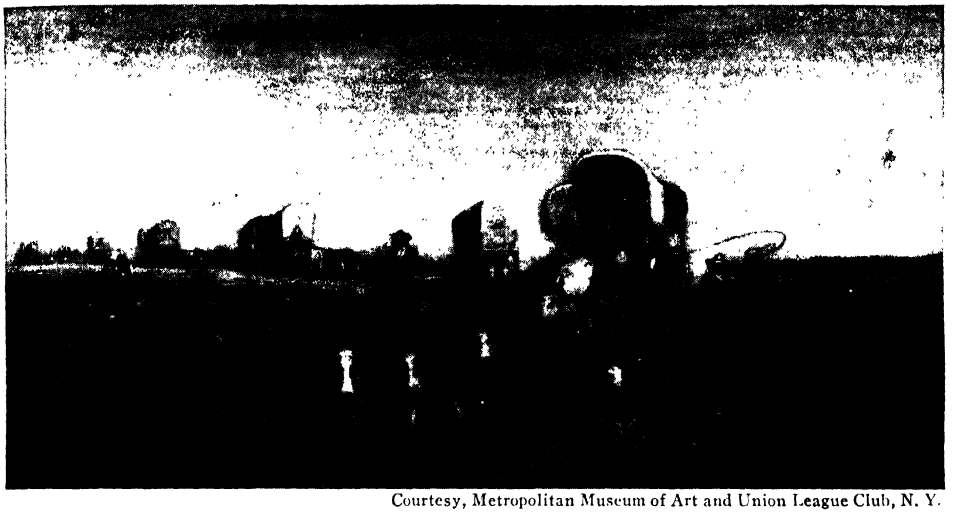
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Courtesy, Metropolitan Museum of Art and Union League Club, N. Y.

Ships of the Plain, a painting by Samuel Colman.

THE GROWING WEST

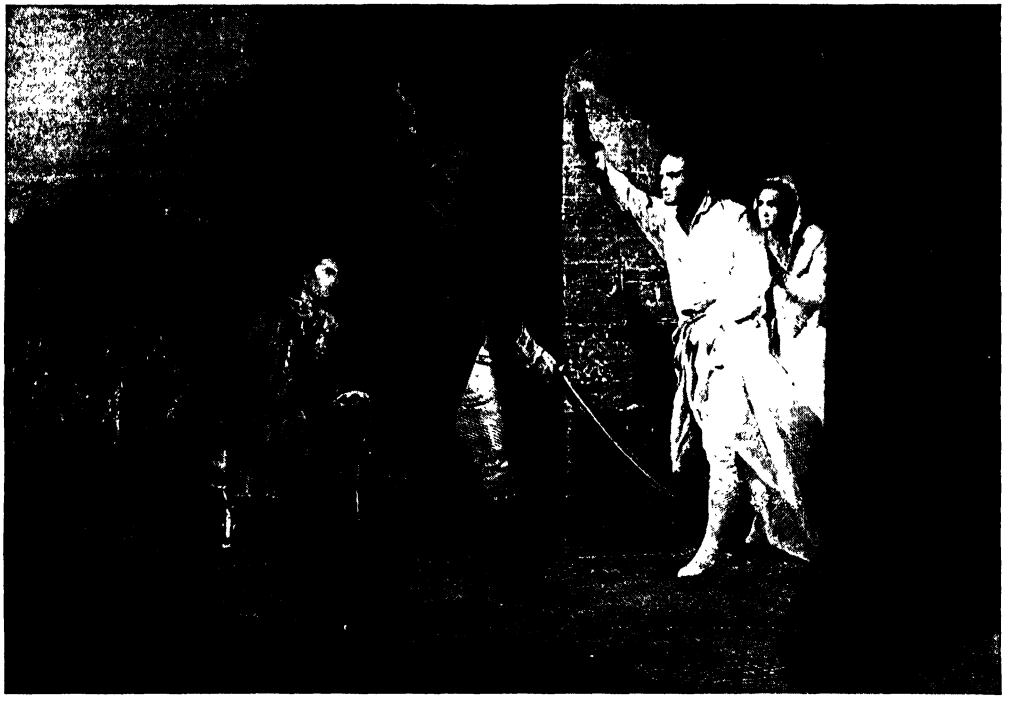
NOW we shall return to the story of our country, and trace its growth in territory, population and wealth, as our civilization spread to the shores of the great western ocean. You will find that the West has meant quite different things at different times in our country's history. To the founders of Plymouth and of Boston, the region along the Connecticut River was the West. To the dwellers in the tidewater section of Virginia, the Great Valley behind the wall of the Blue Ridge was the Far West. The Ohio River Valley, Kentucky, Tennessee, and later, the lands beyond the Mississippi, beckoned explorers and settlers toward the sunset, and they pressed on, across the prairies, the great plains, the Rocky Mountains, until they reached the shores of the Pacific Ocean, which links our Far West with the Asiatic lands that we call the Far East, though they are really west of us.

All this means that the West was the unsettled part of the country, where wild beasts and Indians were to be fought by the settlers as they moved on. To-day farms and villages are seen in every part of the country, and great cities have grown up in every section of the Union. The buffalo has disappeared, all except a few herds that are protected by law. The wolf, the bear and the mountain lion are going, and in a few years, perhaps, there will be no more great uninhabited regions, though it is to be hoped that we shall always preserve our necessary and valuable forest resources.

In the early colonial days the land near the seashore was first taken. As more people came over, they sometimes went farther into the land, and sometimes bought the farms of the earlier settlers, who themselves moved. At the time of the Revolution only a narrow strip along the Atlantic, one hundred to three hundred miles wide, had been really settled, but already a few restless men had crossed over the Allegheny Mountains into the Mississippi Valley. If you will turn back to the map on page 152, in the first volume, you can see what that meant. From the northern part of New York state down to Georgia, the mountains stood like a wall to keep back travelers.

There were rifts, or passes, in this wall, however, and the restless colonists found these passes and made their way into the fertile valleys beyond, and then moved on across the prairies. The Constitution gave Congress the power to make new states whenever the population of a district or territory was thought to be large enough, and we shall see that new states have been made, until there are now many more than the original thirteen. Let us see how and when some of these important new states were admitted into the great American Union.

The first new state was not admitted in quite the same way as those that were made a little later. When Champlain, of whom you may read elsewhere, came down from Canada to the lake which now bears his name, he looked at the beautiful mountains to the east and said, "Voilà les verts monts!" ("Behold the green mountains!") So you see that Champlain named both the lake and the state of Vermont, and the name of the state translated into English is Green Mountains. Vermont is a beautiful state.



You read in the text of the "Green Mountain Boys." Perhaps their most famous achievement was the capture of Fort Ticonderoga from the British, May 10, 1775, before the Revolution had really begun. Led by Ethan Allen, they surprised the post, arousing the commander from bed, and took it without the loss of a man. The military supplies captured were much needed, and were used in Boston.

This region was claimed both by New Hampshire and New York, and both colonies sold the land to settlers, but New Hampshire sold more. When the king of England finally decided that New York had the better claim, the settlers were not pleased, and in 1777 they declared that they would not be a part of New York, but would make an independent state, to be called either New Connecticut or Vermont. This was during the Revolution, and New York could not enforce its claim. During the Revolution Ethan Allen, Seth Warner and others were active against the British. It was Ethan Allen, at the head of a band calling themselves "Green Mountain Boys," who captured Fort Ticonderoga, May 10, 1775, and gained military supplies much needed by the colonists.

After the Revolution the Vermonters tried to get Congress to acknowledge them as independent. Congress did not wish to offend New York, and it was not until after the Constitution had been adopted that the new government listened to them. In 1790 New York agreed to give up all her claims on payment of $30,000, and on March 4, 1791, Vermont took her place as the fourteenth state of the Union.

Now let us turn to another part of the country. As we told you in Volume Two, not all the settlers in the colonies were English, though most of them came from the British Isles. Many came from the North of Ireland and were sometimes called Scotch-Irish because the ancestors of many of them had gone from Scotland to Ireland. Many Germans also came. These people generally landed in Philadelphia, and went to western Pennsylvania. So many came because of the

wise laws made by Penn that the later comers found the best lands taken. Many of them moved southward into Virginia and the Carolinas.

Daniel Boone was born in Pennsylvania, but while he was still a boy, his family moved southward to the banks of the Yadkin River, in North Carolina. Boone grew up to be a mighty hunter, married, and built a cabin on the bank of the river. Recently some patriotic people have rebuilt the cabin and furnished it as it was in Boone's time, so that the children of to-day can see how their ancestors lived. Boone, however, did not like farming. He liked much better to go on long hunting trips, sometimes lasting for days, or even weeks, during which he could kill deer, bears, panthers, squirrels and wild turkeys both for food and for skins.

Boone heard from a white man named John Finley of a wonderful region over the western mountains which was a hunter's paradise. In 1769 Boone, with five others, crossed over into this country, which was sometimes called by the Indians the "dark and bloody ground," because different tribes of Indians had fought many battles there. No Indian tribes lived there permanently, for it was kept as a hunting ground. This was the beautiful land of Kentucky. For six months the hunters wandered through the valleys and over the hills, sleeping under the stars or in caves. The other men returned to North Carolina, but Boone was joined by his brother, and the two remained all winter in a little log cabin they had built. In the spring the brother returned to the settlements to get more ammunition and supplies and to guide any other hunters who might wish to come.

For three months Boone remained alone, two hundred miles from a white man, without a horse or a dog. Other hunters came, but in 1771 all returned to their homes in the East. But the story of what had been found beyond the mountains had spread all over Virginia and North Carolina, and many men wished to try their fortunes in the new land. Many things hindered them, but in 1774 and 1775 settlements were founded which were so strong that the Indians could not break them up, and after the Revolu-



Tecumseh, or Tecumthe, as the name is sometimes spelled, was one of the most dreaded Indian chiefs. He was opposed by William Henry Harrison, then governor of Indiana Territory. In order to drive back the Americans, Tecumseh aided the British during the War of 1812, but was killed October 5, 1813, at the battle of the Thames. Some think he was the greatest Indian that ever opposed the Americans.

tion settlers came in large numbers. The territory was a part of Virginia until 1790, and on June 1, 1792, it became the state of Kentucky, the fifteenth star on the flag.

James Robertson was one of the men who went with Daniel Boone to Kentucky on one of his trips, but he liked the country on and South Carolina, they surrounded him at King's Mountain, as you may have read in the story of the Revolution, and captured his forces. Then they returned to their homes.

As Congress had no money to pay its debts at the close of the Revolution, it asked



© Ewing Galloway, N. Y.

This painting by W. G. Grauer shows pioneers with their covered wagons crossing the Allegheny Mountains on their way toward the west. The scene is near White Sulphur Springs, West Virginia. In pioneer days the road was called Buffalo Trail, later it was known as the Midland Trail. Now the route is part of the fine improved United States Highway 60 which goes from Coast to Coast across the country.

the banks of the Watauga River in what is now Tennessee better than that farther west.

He therefore led a party of North Carolina settlers there in 1770, but a few white men had already built cabins in the region. They had to meet the same kind of hardships as the Kentucky settlers mentioned above had undergone, but they too were brave men. They made a kind of agreement known as the Watauga Association, but soon they were organized as Washington District and then as Washington County, North Carolina, since that state claimed all the land as far as the Mississippi River. These settlers were brave and daring. A weak man had no place among them. When they heard that Major Ferguson was in North Carolina on the way to lay waste their territory, they hurried over the mountains to meet him. Joining other bands from Virginia and North

all of the states holding western lands to give them to the general government. North Carolina agreed in 1784, but the settlers in the west did not like being transferred without their consent, and set up a new state for themselves, which was called the state of Franklin. As money was scarce, they fixed the salaries of their officers at so many beaver and raccoon skins, and taxes could be paid in skins or produce.

When North Carolina heard of this, the act making the gift of the territory to Congress was at once repealed and the state began to try to regain control of the rebellious people. For a while the people held out, but they were not encouraged by Congress, and soon the state of Franklin was no longer in existence. Again, in 1790, North Carolina surrendered the territory to the new government under the Constitution, and on June

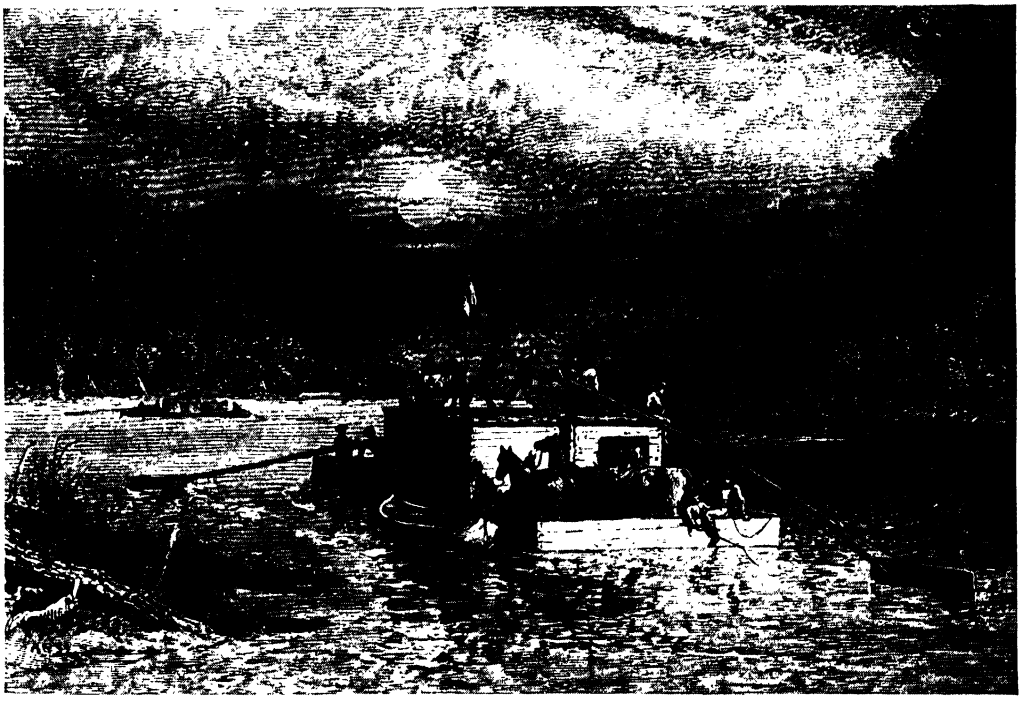
1, 1796, Tennessee was admitted to the Union as the sixteenth state.

The great body of land north of the Ohio River, and stretching to the Great Lakes, from which the states of Ohio, Indiana, Illinois, Michigan and Wisconsin have been made, was claimed by Virginia under her charter. Parts were also claimed by Massachusetts and Connecticut. All these states claimed the land under their charters, which had been given before anything was really known about America. New York also claimed some of it. All of these states finally gave to Congress their claims in this Northwest Territory, as it was called. Congress decided to sell these lands at a very low price in order to get money to pay the debts of the Confederation.

A company in which there were many Revolutionary soldiers was formed to buy lands in this territory and settle a colony. In 1787 Congress passed an act selling five million acres of land and also making laws for the government of the territory. It was provided that not less than three nor more than five states should be made as the population increased, and that when any territory had 60,000 people it should be admitted into the Union. Slavery was never to be allowed in the states made from this territory.

At once people began to move into the territory. Many of them made their way to the Ohio River, built great flatboats, like the one we show you in the picture, and floated down the river. Early in 1788 Marietta, named in honor of Queen Marie Antoinette of France, was begun. This was the first settlement in what is now the state of Ohio. A few months later, Cincinnati (first called Losantiville) was begun.

The companies advertised for settlers, saying that they had the richest and most beautiful country in the world. The land was the richest, the climate the best, and life was easiest in the Ohio country. Settlers came by the thousand, and the older states were alarmed. It seemed as if all their strongest young men were moving westward. So pamphlets were written in opposition, saying that the soil was not good, that the climate was cold, that the woods were full of Indians, panthers and terrible snakes, and that any man was a fool who would leave



When the West meant the country across the Alleghenies, a common way of going was to build or buy a flatboat, load upon it all the household goods and livestock, and then float down the Ohio River. This type of boat was called a "broadhorn" because of the two enormous steering oars which you see in the picture. This was a slow but cheap method of travel. There were no railways and no roads worth the name.

A BUFFALO HUNT IN THE WEST EIGHTY YEARS AGO



The early settlers found a few buffaloes, or bisons, as they are properly called, east of the Allegheny Mountains, but across the Mississippi River, millions were found. They roamed the plains in great herds, sometimes numbering several thousand. The Indians captured them by driving them over cliffs or into deep snow, or by attacking them on horseback, as shown in the picture, which was made from a painting. The white man with his gun was a more dangerous enemy and thousands were slaughtered for their hides or for their tongues, and left for the wolves. Now there are less than 5,000 left in the United States, and less than 20,000 in Canada, most of them protected by the two governments.

a comfortable home in the East and risk such dangers as he would meet in the West.

Part of both stories was true. Some of the land was good and some was bad. There were Indians and they troubled the settlers, and destroyed some small settlements. For a while the rush toward this part of the world was checked, but a few years later it began again, and in 1803 Ohio was admitted as a state. Other states were soon to be made from the Northwest Territory.

Now we have told of the territory in the North and in the middle of the country. What of that in the South? You remember that Great Britain kept Florida, which it had taken from Spain at the end of the French and Indian Wars. Twenty years later, in 1783, it was returned to Spain. The country then called Florida was divided into two parts. East Florida was almost the same as the present state, while West Florida stretched along the Gulf of Mexico to Louisiana, which was also owned by Spain. Georgia claimed all the territory westward to the Mississippi, but Congress said that it had been a part of West Florida and had been given up by Great Britain, and that Georgia had no rights at all. Settlers moved into the country in spite of the attempts of the Indians to prevent them, and in 1798 Congress set up the territory of Mississippi.

But after the settlers built their homes in these western forests, they found that all was not easy. It is true that game was plentiful and that corn and wheat grew rapidly, so that it was easy to get food enough. Flax grew well, and rough linen was manufactured by the women, and, since skins were plentiful, all could have clothes. They could not, however, make everything they needed, and they could get these things, which they could not produce themselves, only by trading their skins and furs or what they had grown on their farms. They could not very easily climb the mountains and haul their produce back to the old states. What could they do?

The easiest thing was to put the produce on flatboats and float down the Mississippi with it. But Spain owned the land on both sides of the lower Mississippi, and Spain was unfriendly to the United States. So every boatload that went to New Orleans was either captured or was forced to pay



Here is a band of hunters and trappers in the wilderness with their rude hut in the background. Around the campfire they told the story of what had happened during the day. Perhaps the man on the log is telling how he killed the deer. They kept their rifles near for fear of Indians or wild beasts. Many men loved the life in the woods so much that they could not live comfortably after settlers came.

high duties. The United States was not strong enough to force Spain to allow the boats to pass freely and to trade with New Orleans, and the western people grew angry. Some wished to fight and capture New Orleans. Others said that the western people ought to declare themselves independent of the United States and make a treaty with Spain. A few even wished their country to become a province of Spain.



When the Mormons were driven out of Illinois, and Joseph Smith, the founder of the sect, was killed, Brigham Young, the new leader, went in search of a new home. Far west, beyond the inhabited region he came upon the Great Salt Lake and there determined to found a new state where his people would not be disturbed. This was the beginning of what is now Utah, where there are still many Mormons.

All this trouble with Spain about the Mississippi was ended when that nation gave up Louisiana to France. You read on another page how we purchased it in 1803, and you were told how much the New England states opposed buying it. Soon a part of the territory asked to be made a state. There was great excitement in the East when this was first talked about, and much opposition. The eastern states had seen a large part of their population go to the cheap lands in the West. Some men said that unless Congress stopped making new states the whole East would be deserted and ruined.

They also said that the Constitution did not give Congress power to make new states from any land which was not a part of the country when the Constitution was adopted. This was a new question and was very important, as less than half of the present area of the United States was a part of the nation in 1789. Some New England men threatened to secede from the Union. But in spite of their threats Louisiana became the eighteenth state in 1812, just before the second war with Great Britain began. Now there were seventeen states east of the Mississippi and one west of the great river.

We have already told the story of the War of 1812, and shall not say any more about it now. After the war there was another great movement toward the West, and Indiana was admitted to the Union in 1816; Mississippi in 1817; Illinois in 1818 and Alabama in 1819. Many immigrants to the United States soon began to come, and it was not long before England was much troubled to find so many of her people coming to the United States.

The same year that Alabama came into the Union, Spain sold all her rights in Florida for $5,000,000. Another trouble was ended. Spain had not governed the country well, and bands of robbers, white, black and red, had done much damage to the people of near-by Georgia and Alabama. The United

States now was beginning to stretch across the continent. It controlled all the land east of the Mississippi and south of Canada, and nearly as much beyond the Mississippi. There were now twenty-two states, and only four more have been made from the territory east of the great river. We shall soon learn about their admission into the Union.

You remember that James Madison was president while the War of 1812 was going on, and for several years afterward. When his two terms were over, another Virginian, James Monroe, became president, in 1817, and he also served two terms. A number of important things happened during these years. The most important for us to mention in our story of the West is what was called the Missouri Compromise. In order to understand it we must go back a little.

Before the Revolution all the colonies held slaves both Negro and Indian. It was soon found that the Indians did not make good slaves, so the practice of holding Indian slaves did not get well established. It was also found that the Negro slaves were not profitable in the North. The cold climate did not agree with them, and the type of agriculture was unsuited to them. By the time of the Revolution the Northerners had begun to free their slaves or sell them to people in the south.

Some of the southern states did not find slavery profitable, and at the time the Constitution was adopted most people believed that the number of slaves would grow smaller and smaller, except in South Carolina and Georgia, where it was thought to be too hot for a white man to work in the rice fields. It was thought that perhaps a few would be kept for house servants and that the others would gradually be set free.

All this was changed by an invention that has changed the whole history of the United States and of the world. At that time the summer clothing of the poorer people was chiefly coarse linen, while the wealthier wore finer linen or silk. Cotton cloth was very expensive. A small patch of cotton was grown upon almost every southern farm, but the great difficulty was to separate the fibre from the seeds. It had to be done by hand, and it was the task of the slaves, and sometimes of the children of a family, to separate a shoeful of the cotton between supper and bedtime. A whole day's work was only about four pounds. The process was so slow that



While bands of travelers or settlers were crossing the plains in wagons, they were sometimes attacked by Indians, who attempted to drive off their cattle if they could not capture the wagons. When we think of the dangers and the hardships of pioneer days in the West, we wonder that any were brave enough to risk crossing the plains. Now you can cross the country in an airplane in a single day.

little cotton was used at home and still less could be spared for the market, even though prices were high.

After the Revolution Georgia presented General Nathanael Greene with a large tract of land on which he lived until his death in 1786. In 1792 Mrs. Greene was returning to her plantation, after a visit to relatives in New England, when she met on the boat a young man named Eli Whitney, who had just been graduated from Yale College and was on his way south to teach. When he reached Savannah, he found that the position which he had expected was no longer open, and he accepted Mrs. Greene's invitation to spend some time on her plantation while looking for another opportunity.

A LITTLE INVENTION CHANGES THE HISTORY OF THE WORLD

One day a number of gentlemen dined with Mrs. Greene and discussed the need of a better way of separating the cotton. Young Whitney had shown skill in mending clocks and such things, and Mrs. Greene told the gentlemen that she believed Mr. Whitney could make a machine. Though he knew nothing about cotton, he set to work at once, and early in 1793 produced a cotton gin which could do the work of a hundred slaves. Hundreds of others were built, and cotton soon became cheaper than linen, and the demand increased very rapidly. Another man, Hogden Holmes, also invented a machine at about the same time.

SLAVERY AT ONCE BEGINS TO GROW AGAIN

More and more land was planted in cotton, and more and more laborers were needed. Slavery had been dying out because there was not enough work that slaves could do, which paid the owners. The great increase in the cotton-fields made it profitable to own slaves wherever cotton could be grown, and many more were brought from Africa. The southern states up to this time had grown many different kinds of crops, and some of them had many small factories of different kinds. Afterward they grew more cotton than any other crop, and many of the little factories died out. In New England, where cotton could not be grown factories to make goods to sell in the South increased in number and size.

After slavery had died out in the North, many people grew to believe that it was wrong to keep slaves, and wished to prevent any new states from having them. The question came up in 1818, when Missouri asked to enter the Union as a slave state. Many people objected, and the House of Representatives in 1819 refused to agree to admit the new state, though the Senate was in favor of admission. Maine was now also asking admission as a free state. The House agreed, but the Senate refused to consent unless Missouri was admitted as a slave state. Finally it was agreed that both should be admitted, but that in the future slavery should not be allowed in any part of the Louisiana Purchase north of 36°30′, which was the southern boundary of Missouri. This is called the Missouri Compromise.

WHAT DID THE MISSOURI COMPROMISE MEAN?

A compromise is an agreement by which both parties agree to take less than they ask for, for the sake of peace. This compromise was not a good bargain for the slaveholding states. Missouri was added to the Union as a slave state, but the only part of the Louisiana Purchase south of the line, from which other slave states could be made, was what is now Arkansas and Oklahoma, while north of the line was the immense territory from which nine states have been entirely or partly made. But the compromise brought peace for a while. Maine was admitted March 15, 1820, but it was not until August 10, 1821, that Missouri became a state.

Though the dispute occurred during Monroe's administration, it did not make any enemies for him. At the end of his first term no candidate opposed him. He received the vote of every elector except one, who voted for John Quincy Adams, saying that no man except Washington should receive a unanimous election. The Federalist party was dead, and only the Republican, or the Democratic-Republican, as it was beginning to be called, was left, though all men did not have the same ideas concerning political matters.

THE MONROE DOCTRINE IS PROCLAIMED TO THE WORLD

Another important event of Monroe's administration was the announcement of what is known as the Monroe Doctrine. The Spanish colonies in South and Central America had rebelled and gained their independence, but Spain was hoping to get them back by force. In 1823, President Monroe sent a message to Congress saying that the United States would object if any European power should attempt to take any part of North or



Photo by De Cou, © Ewing Galloway, N. Y.

Preserved in the museum at Salt Lake City is this buffalo skull with a message from Brigham Young cut into it. When he and his band were crossing the plains they left advice and information along the way for other Mormons who would follow. The messages were on guide-posts that they set up, or sometimes on whitened animal bones. Wagon wheels were greased with the fat of wolves that were killed.

South America. We would not interfere with the possessions they already had, but they must not try to get any more.

During Monroe's time a public improvement which had great influence was built. This was the Erie Canal, which reached from the Hudson River at Albany to Lake Erie. It was begun in 1817 and finished in 1825. The man who had more to do with it than any other was De Witt Clinton. You may read about him elsewhere (see Index). The canal boats were pulled by horses, and traveled very slowly, we should think—hardly more than three miles an hour. But a team of horses could pull a heavy load, many times as much as they could pull up the mountains.

The effect was wonderful. Before this time it cost about $120 a ton, or six cents a pound, to carry goods from New York to Lake Erie. Soon the rate fell to less than a cent a pound by way of the canal. The canal boats carried passengers also. Before the canal was built, New York City was growing very slowly. We are told that between 1810 and 1816 the population increased only thirty-six hundred. Between 1820 and 1830 the population increased nearly sixty thousand, and continued to increase. The New York merchants grew wealthy selling goods to the West, and the people in that region were delighted to be able to get goods out of or into their country so cheaply. The rush toward the West began again, and soon Michigan Territory, from which the states of Michigan and Wisconsin were later made, gained many settlers.

The next president after Monroe was John Quincy Adams, whose father had been president before him. He had great faith in the growth of the United States, and wanted to gain more territory than we then had. He was in favor of taking Canada, buying Texas, annexing Cuba and of extending the United States to the Pacific. He believed that some day all this territory would be needed, but he was a man who made more enemies than friends and could not get Congress to act as he wished. One reason was

that the people of the new states said that they were tired of having the president chosen from Virginia and Massachusetts. At the end of Adams' term, the Constitution had been in operation forty years. During that time Virginians had been president thirty-two years and Massachusetts men eight.

Therefore, at the election in 1828 Adams was badly defeated by Andrew Jackson, the hero of New Orleans. Though Jackson was born in North Carolina, he had removed when a young man to Tennessee, then considered a part of the West, and became very popular with the people across the mountains. The common people thought of him as one of themselves. The other presidents had been men of education and the Westerners called them aristocrats. Jackson had been born poor and had little education. He had endured the hardships of life on the frontier, and had been a famous Indian-fighter, and knew what the people of the West wanted. His election meant that what Europe thought or said would have less influence than it had had before.

PRESIDENT ANDREW JACKSON PRESERVES THE UNION

So many interesting things happened during the eight years Jackson was president that we can tell only a few. The trouble about the United States Bank is very hard for young people to understand, and we can only say that Jackson had his way and destroyed it. South Carolina felt that many of the laws made by Congress to help the manufacturers of New England were unconstitutional and unjust, and declared that she would refuse to obey, or "nullify" them. But though Jackson had been born in the South, he said that the Union must be preserved, and that if necessary he would send troops to make South Carolina obey.

THE GROWING RESTLESSNESS OF THE SOUTHERN STATES

This attempt of South Carolina to nullify the laws of Congress showed that the South was getting restless, and some wise men began to fear the trouble that later brought on the Civil War. The South felt that it must have new territory, but it was not sure where it could get it. No new states had been admitted for fifteen years at the time Arkansas came in as a slave state (June 15, 1836), balanced by Michigan (January 26, 1837). What is now Oklahoma had been set aside for the Indians, who were to move there from Georgia and Florida. Except Florida there was no more territory in which slavery was permitted.

The country along the Gulf of Mexico beyond the United States possessions was called Texas by the Spanish and Mexicans. Americans began to move into this region about 1819, and very soon large numbers had arrived. Both Adams and Jackson tried to buy the territory, but Mexico, which had gained her independence from Spain, refused to sell. The Texans began to talk about independence, and in 1835 fighting began. The Texans soon showed that they were better fighters than the Mexicans, organized the Republic of Texas and asked to be admitted to the United States. Many Northerners opposed taking Texas, because they feared that it would give the southern, or slaveholding, states so much more territory. We shall hear more of Texas a little later.

RAILROADS ARE BUILT AND REAPING MACHINES INVENTED

During Jackson's term of office the first railroads were built in the United States, anthracite coal was first used in an engine, a reaping machine was invented, and many other important inventions began to come into use.

After Jackson came Martin Van Buren. His administration was unfortunate, as times were very hard, especially in the West, where nearly every man was buying or selling land. The people then believed that every little village would some day be a great city, and everybody speculated in land. Some of these villages have since grown into cities, but all could not grow at once.

Van Buren was given only one term, and was followed by William Henry Harrison, a soldier of the War of 1812 and a famous Indian-fighter. The party which elected him had grown up during Jackson's time, and its members were called Whigs. President Harrison died only a month after he became president, and the vice-president, John Tyler, of Virginia, succeeded him. Tyler spent most of the time that he was president quarreling with Congress.

EXPLORERS AND FUR TRAPPERS OPEN UP THE NORTHWEST

All this time daring explorers and settlers were going farther and farther west. The American Fur Company had opened a road to the Oregon country. Captain Bonneville in 1832 discovered the Great Salt Lake, and missionaries to the Indians settled in Oregon a little later.

CROSSING THE SIERRA NEVADA



Though the Western mountains were high and rough, occasionally a low place, called a gap or pass, was found over which a crossing could be made, though often with great difficulty. Here we see wagons crossing the Sierra Nevada Mountains, or rather going around the edge of them. Notice the straining oxen, and the men pushing with all their might to gain the top. Beyond we see one of the leading wagons in the train descending.



Painting by Barry Faulkner.

Captain Robert Gray was the first to carry the United States flag around the world. As master of the ship Columbia, he sailed around Cape Horn and up to the coast of what is now Oregon, to trade with the Indians. He discovered the Columbia River, which he named after his ship. This picture, in the Oregon Capitol, shows Indians selling furs to Captain Gray. These he carried to China, and traded them for tea and other goods.

John C. Fremont, a young army officer, made three trips to explore the Rocky Mountain country in 1842, 1843 and 1845. He had good guides and traveled over a large part of the country, but hardly deserved the name of "Pathfinder of the Rockies," which his friends gave him.

President Tyler greatly favored annexing Texas. The North opposed him strongly, but Tyler's plan succeeded, though Texas did not actually join the union until 1845, when Polk was President. Texas was given the right to be divided into five states later if its people so desired. But the Texans have been so proud of the size of their state that they have never wished it to be divided.

The next president, James K. Polk, of Tennessee, not only wished to add Texas but California besides. He was determined also to settle the Oregon question in some way. Just what Oregon was, nobody knew exactly. The name was given to the country along the Pacific coast north of California (which belonged to Mexico). The coast had been explored by Spaniards, Englishmen, Americans and Russians, but for many years there were no permanent settlements.

In 1819 Spain agreed to claim nothing north of California. In 1824 Russia agreed to claim nothing south of 54°40′. The territory between was claimed by both Britain and the United States. As it was considered worthless except for furs, it had been agreed several years before that both nations might settle or hunt in the country until an agreement should be made.

Missionaries and scattered settlers made their way into the region, and sent word that there was excellent land and that the United States ought to have the country. Soon there were several small settlements. The British had no settlements except the forts to protect the fur-traders. Great Britain was quite willing to make the Columbia River the boundary line, but this would have given her nearly all of what is now the state of Washington. The Americans demanded all of the country up to the Russian line of 54°40′, and a popular saying in 1844 was, "Fifty-four Forty or Fight," meaning that if Great Britain would not give up all the Oregon country up to that parallel of latitude we would fight for it. But this would have cut Canada off from the Pacific Ocean and Great Britain would not agree. During Polk's administration, by a compromise, the boundary line was fixed where it now stands. Great Britain took what is now British Columbia, and another large addition was made to our territory.

Mexico had never acknowledged the independence of Texas and had threatened the United States. When Polk sent a man to try to buy California, the Mexicans would not listen to him. Besides, Mexico said that some of the land claimed by Texas as a part of that country had never been so called, and that she would never give it up. So President Polk ordered General Zachary Taylor to advance into the disputed territory and close the Rio Grande (Great River). Soon a body of Mexicans (April 24, 1846) attacked a small part of his force. The President declared that Mexico had begun war against the United States, and on May 13, 1846, Congress declared war against Mexico.

Not everyone was in favor of the war with Mexico. New Englanders generally opposed the war, saying that they did not wish to help the South gain more territory for slavery. Therefore very few men in the army that was raised came from the northern states, but the South was enthusiastic and many volunteers offered themselves for the war. The two chief commanders, Scott and Taylor, were also southern men, and so it was called a southern war. New England has generally opposed adding new territory to the Union. You remember how the Louisiana Purchase caused the New England men to threaten to secede. As soon as war was declared, General Taylor was ready to advance.

Now a series of battles began in which the American arms were always successful. At Palo Alto General Taylor defeated a larger force of Mexicans on May 8, 1846; again defeated the same troops at Resaca de la Palma the next day; and then crossed the Rio Grande in pursuit of the flying Mexicans. On September 24, Monterey was captured, though defended by a larger force than the attacking party. A large part of General Taylor's army was then sent to join General Scott, the commander of the army in Mexico, who was ordered to land at Vera Cruz on the coast and capture Mexico City.

The Mexican general, Santa Anna, knew of the departure of these soldiers, and hoped to defeat Taylor's little army before marching to meet General Scott. Therefore, with 20,000 men, he attacked the little American army of 5,000 men at Buena Vista on February 23, 1847, but was badly defeated. It seemed that Taylor's army could not be beaten.

While General Taylor was marching into Mexico, General Kearny, who had been sent into New Mexico, captured Santa Fe without firing a gun, and then turned to aid in the capture of California, but found that Fremont had already aided the Americans who were living in the territory to take possession of the country.



From an old print, photo by Culver Service.

Much of the gold in California in the early days came from the beds of streams. Prospectors roamed the country examining every brook. Their method was simple, as you see. A shoveful of sand or mud is placed in a box and the box is shaken in the stream. The gold, being heavier, sinks to the bottom of the box; the mud or sand is washed away. This is called placer mining. Comparatively little placer mining is done now. At the present time most of the world's output of gold is obtained from deep mines and much heavy machinery is used to bring it to the surface.

Meanwhile General Scott landed at Vera Cruz in March, took the city and defeated Santa Anna at Cerro Gordo in April. When the march on Mexico City began in earnest, another series of brilliant victories began. Contreras was taken on August 20, Churubusco the same day, and in September, the castle of Chapultepec, which was a part of

AMERICAN LEADERS IN THE MEXICAN WAR



General Zachary Taylor and his famous horse "Whitey," at the battle of Buena Vista. Whitey was as well known to the army as his owner, and both seemed to enjoy being under fire. During the whole of the Mexican War our troops seemed always successful, even though, as at Monterey, they were heavily outnumbered.



General Winfield Scott at the head of 12,000 men landed at Vera Cruz, on the Gulf of Mexico, in March, 1847, soon captured the city, and started on the toilsome march into the interior. After several battles the capital was taken, September 14, and the army entered the City of Mexico.

the defenses of Mexico City, was taken by storm though bravely defended. On September 14 the victorious army entered the city which Cortes had taken more than three hundred years before. The American forces had been wonderfully successful.

Mexico was now helpless and was forced to make peace. All claim to Texas was given up, and in return for the sum of $15,000,000 California and what was called New Mexico were also unwillingly surrendered. From this territory have been made the states of California, Nevada and Utah, and parts of Colorado, New Mexico and Arizona. Five years later another strip of land, south of the two last-named, was purchased from Mexico for $10,000,000, and the territory of the United States proper became the same as it is at the present time.

THE NEW RELIGION PREACHED BY JOSEPH SMITH

But would this wide country ever be filled? It is not all thickly settled yet, but while the Mexican War was going on, a settlement was made in Utah which is very interesting. In 1830 Joseph Smith, a farmer living in New York state, published a book which he said was the translation of a book written in strange letters on golden plates. He declared that an angel had shown him where these plates were buried in the earth. The book said that the American Indians were descended from the lost tribes of Israel, and told of the mighty deeds of Mormon, who was a pious Christian and a great warrior.

A Mormon church was set up in Fayette, New York, but soon moved to Ohio, and then to Missouri. The Mormons were driven out of Missouri, and in 1840 founded the city of Nauvoo in Illinois, which soon had 12,000 inhabitants. Joseph Smith had entire control in all things, and soon the people of the country began to say that the Mormons were a danger to the state. It was feared that the city would be attacked by a mob, and Joseph Smith and his brother were both killed in 1844.

THE MORMONS ATTEMPT TO MOVE OUT OF THE UNITED STATES

The Mormons still held to their belief, in spite of persecution, and determined to move westward, where there were no people to trouble them. In 1847 a party reached the Great Salt Lake, which was then in Mexican territory. Here they set up a government and brought out all the other members. Many converts were made in the East and in Europe, and their settlement grew rapidly. They brought water from the hills to irrigate their fields and raised large crops, which they sold at good prices to travelers on the way to California.

Soon the leaders began to preach polygamy, that is, that it was right for a man to have more than one wife. It was believed that the Mormons were intending to build up an independent state which should not be subject to the laws of the United States but only to the officers of the church, and in 1857 a small army was sent out to keep order, but no fighting occurred. Many Mormon missionaries were sent to eastern states and to Europe, and thousands of converts moved to Utah. Many walked all the way from the Missouri River to Salt Lake City, as the few wagons were needed to carry the baggage and provisions. Much of the country through which they passed had few or no inhabitants. This was a journey of three months, and hundreds perished on the way.

In spite of the presence of the army the Mormons kept up their practices. During the Civil War they were left very much alone, and not until they wished the territory of Utah to be made a state did they declare that they would give up polygamy. Many other charges were made against the Mormons, but they were never entirely proved.

GOLD IS DISCOVERED IN CALIFORNIA

While this community was growing up, other settlements of a different sort were growing up farther west. Early in 1848, just before the treaty of peace with Mexico was signed, gold was found in California. The news spread rapidly, and the little towns in the West were deserted while the inhabitants dug for gold. When the news reached the East, thousands of farmers left their plows, mechanics dropped their tools, clerks and professional men left their desks, to seek their fortunes in the gold-fields. Some made the long journey in sailing vessels around Cape Horn, others crossed the Isthmus of Panama, and then made their way north, others took the long, dangerous trip across the plains, suffering much from hunger, thirst and the attacks of Indians.

THE WONDERFUL WORK OF THE FRANCISCAN FATHERS

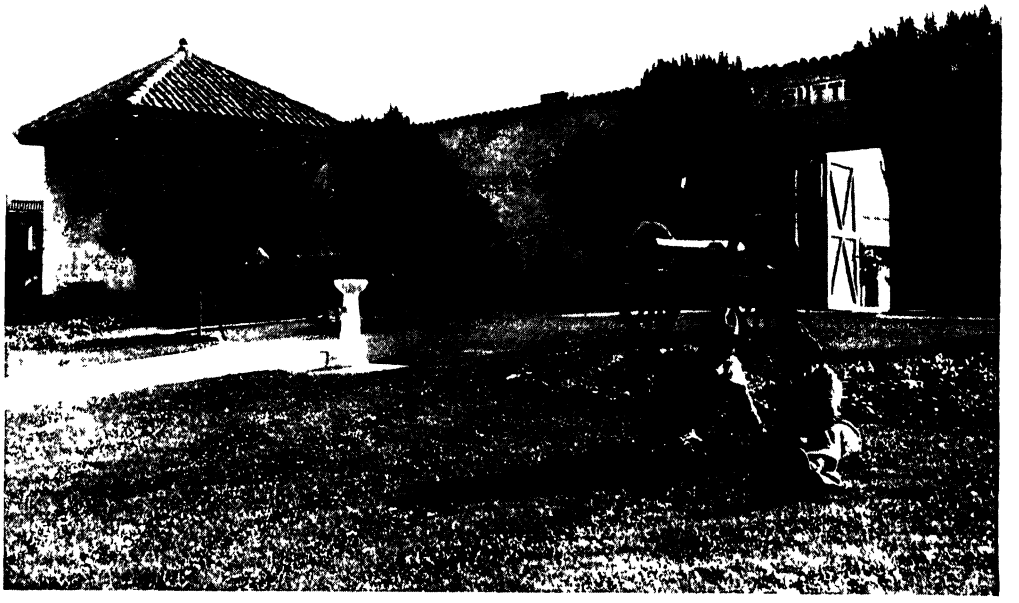
The population of California was small when it came under American rule. Though

RAILROAD BUILDING ON THE GREAT PLAINS



Photo, copyright by Culver Service.

This drawing by A. R. Waud shows a stage in the building of the Northern Pacific Railway across the great plains of the Middle West. The bustling encampment is a scene of cheerful activity. The wooden ties are being brought up in wagons, and the rails laid across them and pounded in by hand. The supply train moves forward as the line is built. Soldiers guard the camp from marauders. In the seventy years from 1830 to 1900 almost two hundred thousand miles of railway were constructed in the United States alone. More than a third of that mileage was laid in ten years, between 1880 and 1890.



This is Sutter's Fort at Sacramento, California. In 1839 a fort called New Helvetia was built by Captain John A. Sutter on a tract of land granted to him by the Mexican government. When gold was discovered in California in 1848, this was the first point chosen by miners from the East, and the village of Sacramento was started. Sutter's Fort, rebuilt, is now preserved as a memorial of those early days.

it had been visited by Sir Francis Drake, and had been explored by Spaniards from Mexico, about 1600, few settlers had gone until after the establishment of the missions to the Indians. Father Junipero Serra, with some Franciscan friars, began in 1769, and before 1823 twenty-one missions and two chapels had been established. Several important California towns and cities have grown up on the sites of the old missions. Among them are San Francisco, Santa Barbara and San Diego. Many Indians were converted and taught some of the arts of civilization. Following the friars, a few Spanish or Mexicans established great cattle ranches. The property of the missions had been confiscated by the Mexican Government after Mexico revolted from Spain, but few settlers had come.

During 1849 nearly 100,000 people poured into California, drawn by the stories that many miners were finding gold worth several thousand dollars every month. Towns sprang up in a night in districts where gold was found. Many of the new-comers were honest men, but many gamblers and ruffians also came, and robberies and murders were frequent. As the country grew so rapidly, there were not enough officers to keep order, and so the better men organized what they called Vigilance Committees, which tried men accused of crimes and punished them if found guilty. When satisfactory courts and laws were established the Vigiliance Committees no longer met.

Soon the population of California was large enough for it to become a state, but again the dispute arose as to whether the state should be slave or free. The Missouri Compromise line crossed it, and both North and South claimed it. The people of the territory, however, wished it to be admitted as a free state, and this was done by the Compromise of 1850.

When gold is discovered in a new country the sequel is always the same. Most of you have heard of the Klondike gold rush, and the gold rush to the great Rand fields in South Africa. When gold was discovered in these places, very much the same things happened as in California many years earlier. When you come to read about Alaska on

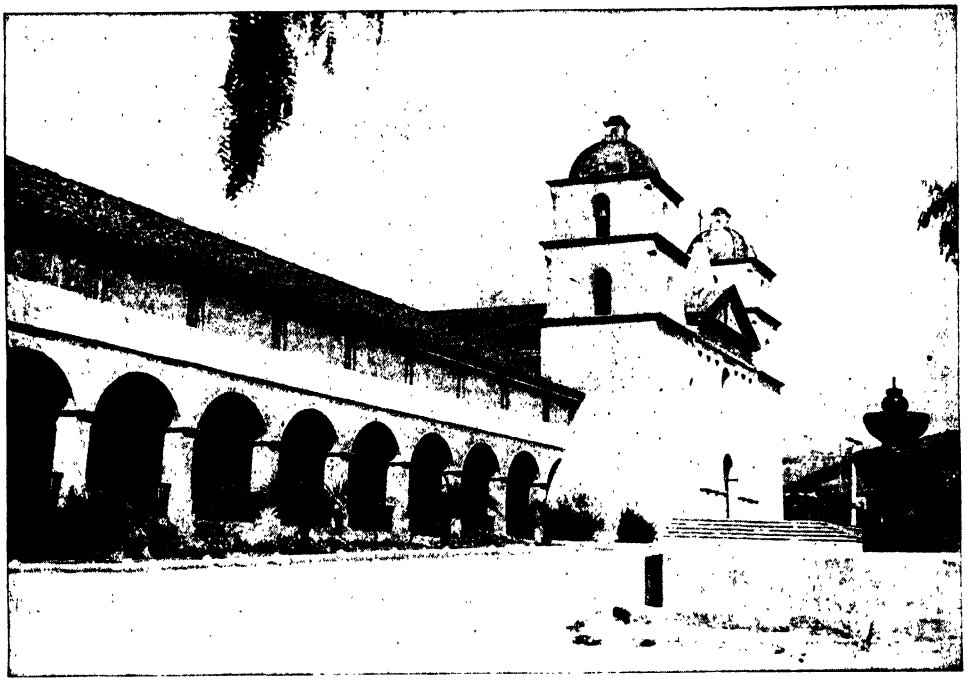
page 5789, you can understand California better. A visitor to that state now finds it very hard to believe what he has read about the days of "forty-nine," that is, the year 1849 during which the exictement was the greatest.

Now let us see what states were admitted to the Union after Texas. Iowa was the first, in December, 1846, followed by Wisconsin in May, 1848, both as free states. Then came California in September 1850, also free. There was little more slave territory out of which to make states. So in May, 1858, Minnesota, and in February, 1859, Oregon, came in as free states. The South made a strong effort to have Kansas made a slave state but failed and in January, 1861, just before the Civil War began, Kansas became a free state. We shall tell you more about the struggle for Kansas in our next story, which will also tell how the South, finding that it could not keep the number of slave states equal to the number of free states, and resolved not to become politically subservient to the North, tried to leave the Union.

Now let us look over the growth of the West. We saw that Vermont, Kentucky, Tennessee and Ohio were once western states, that the Louisiana Purchase made the land beyond the Mississippi the West. Then we gained two other great pieces of territory which carried our country to the Pacific. One of them, called Oregon, we gained by discovery, exploration and settlement; the other, the Mexican territory, by conquest and purchase.

Much of this territory seemed useless at the time we got it. Few people thought that the Oregon country was really worth having, and much of the Mexican territory has remained a desert to the present day. We have finally learned that much of the soil needs only water to make it very fertile. Therefore the Government has built, and is building, great dams in the mountains, so that the people may preserve the water of the melting snow and use it as it is needed, instead of allowing it to run away in waste.

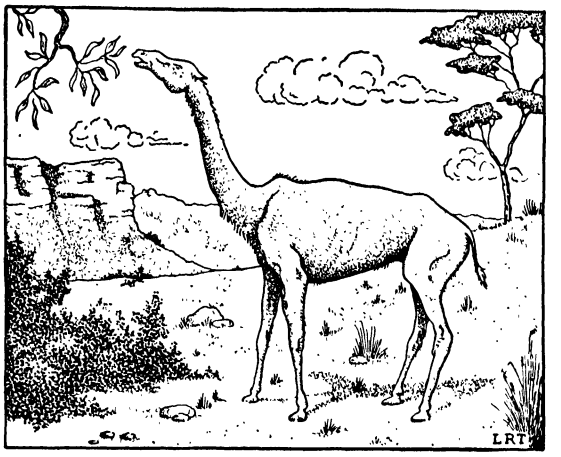
Cities and farms occupy the land where buffalo herds made the only roads there were. Of course, the railroads were perhaps the greatest factor in the rapid development of the West after the pioneers in their covered wagons, had showed the way.



Santa Barbara Mission, on the edge of the city of Santa Barbara, is one of the best examples of the old "mission style" of building. Strongly rebuilt after an earthquake in 1812 and carefully cherished, the old church has been kept in use for services. During the earthquake of 1925 the bell towers crashed down.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 2088.

THE PLIOCENE AND THE PLEISTOCENE



Alticamelus, the camel with the giraffe-like neck, roamed through the western United States in Pliocene times.

THE last division of the Tertiary system is known as the Pliocene epoch. It was during this period that the great land masses of the world took on forms much like those of the present day. Although the seas still covered many areas which are now dry land, the great bodies of water were gradually becoming less and less extensive. This is shown by the limited number of remains of Pliocene sea life which we find stored as fossils in the rocks of the period.

Vast mountain-making movements, which began in the Eocene epoch, continued during the Pliocene. In Europe, for example, the mighty Alps were still in the process of being formed. In North America the Rocky Mountain region and the eastern part of the continent were being elevated. Many of the famous volcanoes about which we have read, such as Mount Etna in Sicily, show signs of great activity during the Pliocene epoch. The geysers and bubbling hot springs of Yellowstone National Park are the result of the violent volcanic disturbances that occurred during the Pliocene.

In a great many ways the animal life of the Pliocene epoch closely resembled that of today. In fact, some of our present-day animals have come down to us from that far-off age almost completely unchanged in form and structure. Hyenas, wolves, bears and bison roamed the countryside. Fleet-footed deer, the hipparion (the three-toed horse), and long-necked camels fled before the ferocious attacks of the sabre-tooth tiger. The hippopotamus, tapir, wild boar and rhinoceros were also present during the Pliocene epoch. The mastodon, the great elephant-like beast that appeared in the Miocene epoch, lived on into the Pliocene of Europe and disappeared only late in that age. In America he continued to exist on into the Pleistocene epoch.

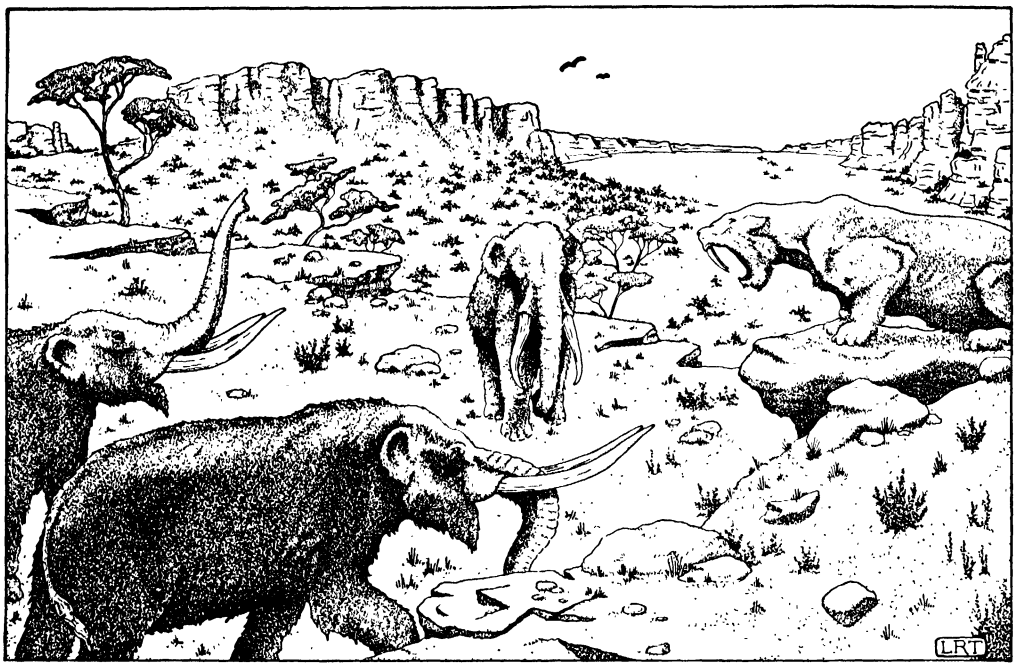
Pliocene deposits have revealed a few scant indications that man may have existed at that time. Among the best known of these remains are those of *Pithecanthropus erectus,* found in Java in 1891, and *Sinanthropus pekinensis,* or Peking man, found in China in 1929. These early men knew how to make fire; and certain stones found with their remains may have been formed into implements of various sort by hand. These stones are known as eoliths, or "dawn stones." It is not altogether certain that they were worked by hand. They may have been given their shape by purely natural action.

Toward the close of the Pliocene epoch the climate gradually turned colder and colder, a sign that the next age of the earth's history was approaching.

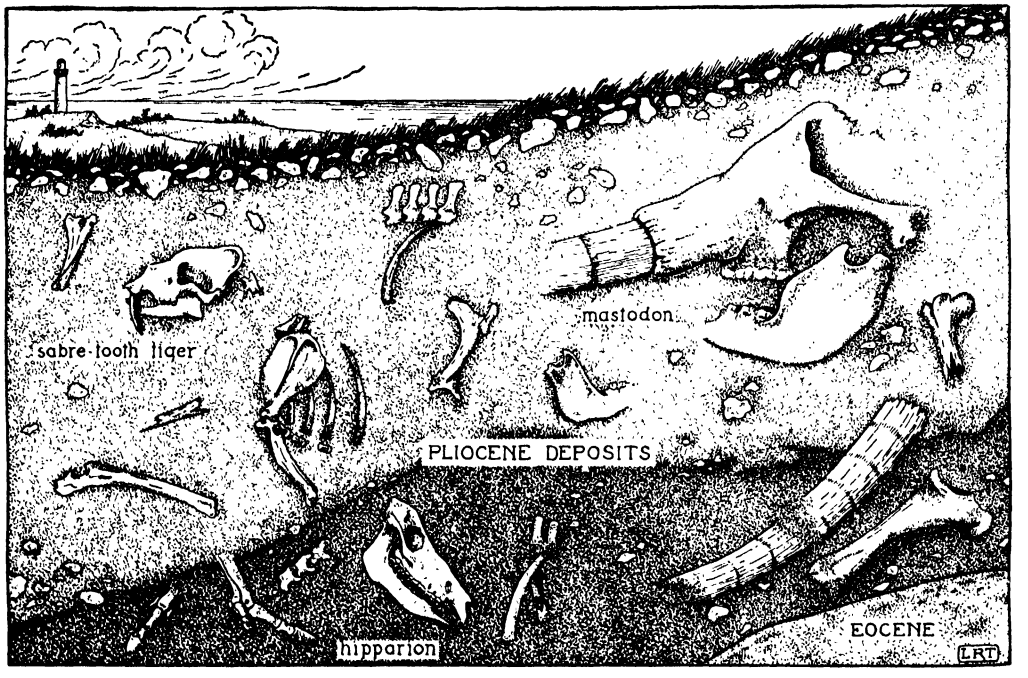
The next epoch, called the Pleistocene, was the first section of the Quaternary, in which we are now living. It is distinguished by the remarkable climatic changes which occurred, transforming whole continents into fields of ice. For this reason it is often called the Ice Age.

The climate grew colder than it ever had before. The snow fell in great quantities and became packed into vast ice-sheets a mile or more thick. From Canada, Greenland and northern Europe these ice-sheets, or glaciers, slowly spread south. A great ice-sheet covered England, filled the basins of the North Sea and the Baltic, and extended through Middle Europe as far as Silesia, Galicia and Poland. Enormous glaciers filled the Alpine valleys and descended from the Pyrenees into

LIFE AND REMAINS OF THE PLIOCENE



Here is a view of a landscape of the Pliocene epoch, showing mastodons and a sabre-tooth tiger. Scenes like this one were to be seen before the great Ice Age turned the climate to one of bitter cold, driving animals such as these to the south where the weather was milder and food more plentiful.



In this picture are seen fossil remains of some of the animals that lived during the Pliocene epoch. We see the bones of hipparion, the horse with three toes, the ferocious sabre-tooth tiger, and the elephant-like mastodon. Creatures resembling these animals are living in the world of to-day.

Spain, while glaciers penetrated even into the heart of France. Practically all of Canada was under an ice-sheet, at least two miles thick in places. In the United States the ice covered New England, New York, northern New Jersey and Pennsylvania, and most of the region between the Ohio and Missouri rivers. In the Far West there was another ice-sheet. The mountainous regions of South America and Asia were also covered.

ALL LIVING THINGS FLED BEFORE THE ADVANCING ICE

Animal and plant life was unable to stand the bitter cold brought on by the glaciers and began to move towards milder climates in the south. It is difficult to imagine plants moving, but they really can if they are given sufficient time. However, it is an extremely slow process.

These arctic conditions passed away and the climate grew warmer. The glaciers ceased to spread over the world. Plants began to move northward to those lands in which they had once flourished. They were followed by the animals who were dependent upon the plants for their food supply. This climatic change was only temporary, however, and again a period of ice and snow set in. It seems indeed likely that there were several glacial periods separated by intervals of warmer climate; certainly there are indications that the ice and snow alternately advanced and retreated more than once before they finally retired to the North. They left behind them many signs of their great force.

ICE-SHEETS, THOUSANDS OF FEET THICK, MARCHED OVER EUROPE

In Europe the great distributing centre of the ice and snow seems to have been Scandinavia. From the high table-lands there the ice advanced over Europe in all directions, but the ice-sheet covering Great Britain, though joined with the Scandinavian ice-sheet, was independent, and slid down its own mountains and valleys. In the Scottish Highlands the ice-sheet was tremendous, and filled up valleys and lakes and fiords, accumulating to a height of 4,000 or 5,000 feet. Mountains 3,000 feet high, with deep lakes at their bases, show marks of ice up to their summits.

In Canada there seem to have been three separate sheets which ran together, called the Labrador, the Keewatin, and the Cordilleran sheets. All of them came down into the United States.

As all these enormous ice-fields and glaciers moved along they brought about considerable geological changes. Huge masses of moving ice ground up the rocks over which they passed, and converted their surface layers into a mixture of clay, sand and stones known as boulder clay. As they carried the boulder clay along with them the sand and stones acted like great sheets of emery paper, and still further ground down the rocks. The glaciers even scoured over the floors of seas and lakes, and carried shells of shellfish in their further journey overland.

HOW THE GLACIERS CARVED THE FACE OF THE EARTH

There can be no doubt that the moving ice-sheets wore down the rocks to a considerable extent. We find everywhere rocks scratched, eaten away, and polished, and the great masses of boulder clay suggest that enormous destruction occurred. Not only were rocks worn down, but they were often broken off, crumpled and bent by the weight and pressure of the ice. Thousands of lakes in Canada and the United States owe their origin to the ice-sheets. On the other hand, many lakes which existed during the period have now disappeared. The Great Lakes, once larger than at present, are of glacial origin.

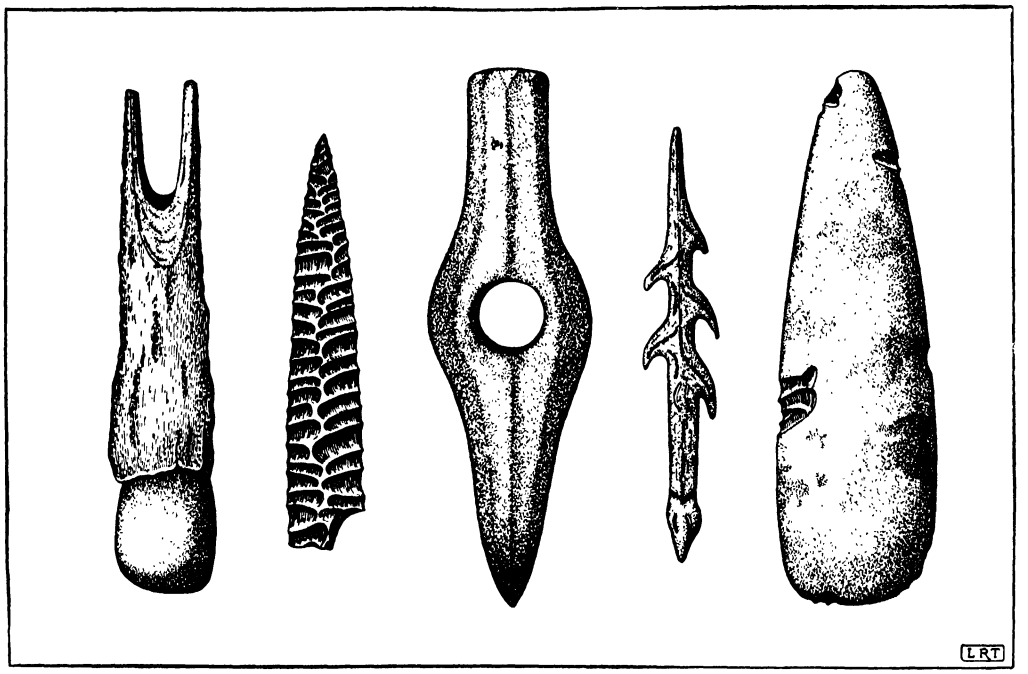
When the ice-fields and the glaciers melted they naturally gave rise to streams and torrents whose rushing water continued the work of destruction. The direction of many streams was changed. Many of the waterfalls which now furnish power go back to glacial times. How long since the ice-sheet receded we can only guess. Few scientists think it was less than twenty-five thousand years.

MAN AND HIS STRUGGLE TO EXIST IN A HOSTILE WORLD

Through all these changes man persisted. Flints, tools and skeletal remains are found in Pleistocene deposits, showing that man made great progress during that epoch. He must have had a hard fight for his life, but he managed to survive. He had to fight not only the glaciers but also the many formidable animals that then roamed the world. In this epoch the English Channel and the Irish Sea and the North Sea were all dry land and Britain was joined to the continent. The whole of northwestern Europe was overrun with elephants, mammoths, the wooly rhinoceros and the hippopotamus. Bears and hyenas were particularly plentiful in England. There were also great herds of reindeer, elk, bison, red deer and wild horses. All these man must have fought and hunted, and in the caves of the Dordogne Valley in France are found the bones of reindeer, elk,

bison and other animals killed and eaten by the cave-men of those days. Even mammoths and bears fell a victim to these early hunters, for their bones are also found in the cave larders.

As man became better acquainted with the world about him, he developed a more advanced culture. Great strides were made in the fields of religion, social organization and the arts. In some of the caves of Spain and France are found remarkably life-like drawings of the animals hunted by early man.



These are some of the tools and weapons manufactured by early man in Europe. They are, from left to right, a celt (a sort of chisel) set in a horn socket, a spear-point, axe, harpoon point and another axe.

Other drawings hint at religious ceremonies and rituals. This primitive art is an amazing record of man's cultural beginnings.

For tools, weapons and other implements to help him in his daily life, man first used naturally-formed stones found in streambeds and along the shore. Later he discovered that these stones could be made into more serviceable implements by shaping them artificially. To be sure, his first attempts were crude, but as time went on he learned to become quite expert at chipping beautiful knives, arrow-points, axes and many other useful articles from stone. Still later he learned to polish these implements until they almost looked as though they had been shaped and finished by modern machinery.

With each forward step, man slowly but surely became master over the other animals that had ruled the earth before him for millions and millions of years.

The Pleistocene epoch shades gradually into what we call the Recent or Human Age, and all the time there have been changes and redistributions of life. The mammoth has disappeared from America, the sabre-tooth tiger has gone, the elephants have departed from Europe. Such changes are still slowly going on. The wolf, among other animals, is doomed to extinction; even races of men are disappearing. Some animals are increasing in numbers and others are changing their haunts and habits. In many cases the march of civilization, more than nature, is responsible for these changes.

The surface of the earth, though in its larger features much the same through the Quaternary, has also been changing. It is changing still; the mountains are still being worn down into the sea, and under the sea new mountain ranges may still be in the process of formation.

THE NEXT STORY OF THE EARTH IS ON PAGE 2049.

THE MOUTH and THE TEETH

EVERY living thing must feed. This is true equally of plants and of animals. In the simplest animals, such as the ameba, the eating is done by any part of the surface of the cell—which is the whole body of the animal. But in the higher forms of animal life we find a permanent mouth appearing as a part of the animal's body. When we come to the animals that have backbones, there is never any mistaking the mouth.

The backboned animals have heads consisting of two parts which we can always distinguish—the skull and the face. The face has openings in it for the entry of air and food—openings which we call nose and mouth; and the bony skeleton of the face always includes two strong, bony arrangements which we call jaws. The upper jaw is always fixed to the rest of the face and skull. We never move our upper jaw when we speak or bite; we can move it only as part of the whole head. But the lower jaw hangs from the skull and is movable.

The jaws are very strong, and the movement of the lower jaw upward is controlled by strong and large muscles, for purposes of biting. Further, whether the food is grass or fruit or the body of some other animal, it must be torn, cut and crushed. For this purpose we find that there appear in the jaws things called teeth. These develop from an infolding of the skin round the mouth; they are really skin structures, like nails, fixed in the jaws.

Teeth are of many different kinds. Some are for catching and tearing, like the long teeth of the dog and cat; others are for spearing, like the long teeth of the elephant, which we call its tusks, and which have beautiful hard outside surfaces, called ivory. Other teeth are for poisoning, like the poison-teeth of snakes, which have a channel running through them or on their under surface for the poison which the snake makes in glands below and beside its lower jaw. And most of the animals that have teeth at all have teeth for crunching, munching and grinding. These are usually in the back part of the jaws, of course, while the sharp teeth that catch or bite, or spear or poison, are in front, where they will be most useful.

The teeth of different kinds of animals can tell us a great deal about the habits of the animal the jaws belong to, even if we have nothing else to go by. You would not expect a cow to have the same kind of teeth as a tiger. Their food is entirely different. The study of the teeth of animals is of great value in understanding how animals are arranged in classes. They also help to show how different kinds of animals are related to one another. All human beings have the same number of teeth—to begin with—and the teeth are of exactly the same kind, and the same number of each kind.

As everyone knows, we have two sets of teeth. In the first set we have twenty; and in the second set, thirty-two, the full number. The first teeth of the first set begin to appear about the sixth or seventh month after we are born. The first teeth of the second set begin to appear at about the age of six; and the last four of the thirty-two do not show above the gums until we are nearly grown up. By that time we are all supposed to be wise, so they are called wisdom teeth.

The number of teeth in each jaw, and on each side of each jaw, is the same. The flat front teeth are called

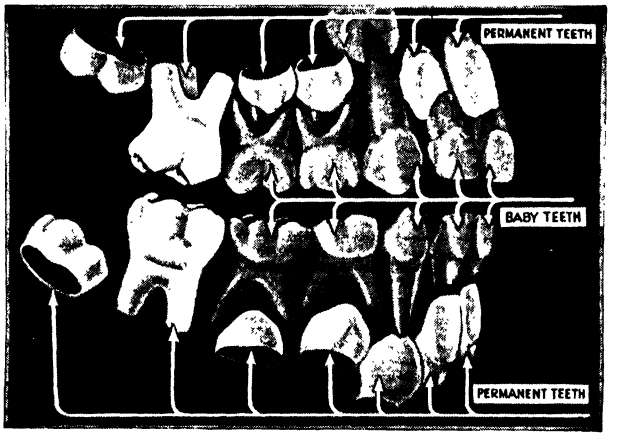


American Dental Association

We should brush our teeth well every morning and at night, too. This keeps them clean and bright.

incisors, or cutters; there are four incisors on the top jaw and four on the bottom jaw. Behind these come two *cuspids* on each jaw; these are for tearing. Behind each cuspid are two *bicuspids,* which crush the food. Behind these are *molars,* six on the upper jaw and six on the lower jaw, which grind the food. The last molar on each side of the two jaws is a wisdom tooth. In some people the wisdom teeth never appear at all.

The teeth of upper and lower jaws are not set exactly opposite each other. Thus, if a tooth is lost, the tooth that corresponds to it in the other jaw is not made entirely useless for the rest of the person's life. It still meets part of a tooth next to the one that has been lost. This peculiarity is a most valuable one; but for it, to lose one tooth would mean really losing two. When our teeth are formed, they do not grow any more. If they are properly used, they remain healthy; and it is important that we keep our teeth in good condition.



This diagram shows the teeth in both the upper and lower jaws of a child's mouth. The baby teeth begin to be replaced by the permanent teeth when the child is about six years old. When the time comes for this change, the roots of the baby teeth soften and are absorbed. Most of the permanent teeth have already been formed in the jaws before a baby is born. As these teeth grow larger, they press against the first group of teeth. They push so hard that the baby teeth gradually become loose and finally fall out of the gums.

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All healthy teeth are completely covered, in all the part that shows above the gum, by a layer of what we call *enamel.* This enamel has no nerves in it, and therefore can not feel. The case is quite different, however, when any part of the enamel of the tooth has been slowly eaten away by the acids which microbes produce in our mouths, or when the tooth is broken.

The part of the tooth underneath the enamel is called the *dentine.* It is much softer than the enamel, so that things can pierce some little distance into it, and it is filled with tiny branches of the nerve that goes to each tooth. These nerve ends are not disturbed by most of the things we eat, but sugar is one of the things that excite them, and so, if any of our teeth have their dentine exposed, we are likely to get toothache.

Very often it may be only one tooth that has its dentine exposed, yet the whole of that side of the jaw, or nearly the whole of it, may ache. The reason is that all the nerves going to the teeth along one side of either jaw are branches of one nerve, and when any part of it is disturbed, all the teeth served by that nerve are likely to become the seat of pain.

If we wish to have healthy teeth we must give them good care; and, above all, we should eat food that builds strong bodies and sound teeth. We need plenty of milk, and milk products such as butter and cheese; also meat or other sources of protein; vegetables, fruits, and grains in the form of bread and breakfast cereals. Natural sweets found in ripe fruits are better for our teeth than too many refined sweets like candy and sweetened drinks.

Scientists are making many studies of dental caries, as tooth decay is called. One study has to do with fluorine, which is an element found in some rocks and in some mineral springs and streams. Teeth painted with fluorine solution seem to resist caries to a remarkable degree. The treatment must be given in childhood. The teeth of adults, for some reason yet unknown, do not benefit from the fluorine. Penicillin and other modern drugs are now used to prevent the spread of bacteria if infection starts around a decayed tooth. Infection is much more likely to start where decay is already present.

We can do much to keep our teeth healthy by daily care. We must give them work to do by eating food that needs vigorous chewing. Teeth should be brushed properly and promptly after each meal. Proper brushing includes brushing away from the gums in

such a way that the sides and back of every tooth are cleaned. It is not enough merely to brush across the front surface. If we do not clean our teeth promptly after meals, microbes may grow on the crumbs of food. They will form acids, especially lactic acid which is able slowly to dissolve the calcium in the enamel of our teeth.

THE LIPS PERFORM A SPECIAL SERVICE FOR THE BODY

The mouth is not meant for breathing; it should be closed except when we eat or speak. The lips are the guardians of this entrance to the body. They are richly supplied with nerves, which makes them very sensitive. Grit, prickly things, and anything that is not fit for food is recognized and rejected by them.

The lips are lined with very thin and delicate skin. Within the mouth this skin changes into another kind of surface called a *mucous membrane*. The lining of the mouth—and of most of the interior passages of the body which communicate with the outside—is called by this name, because it produces a smooth thickish stuff called *mucus*. This is a most valuable material. It protects the mouth from microbes; and it is slightly antiseptic. Because of it, the inner surface of the lips and the surface of the gums move smoothly and easily against each other and do not stick. It is thus like the lubricating oil that is put into machinery so that it may work smoothly.

Into the mouth there also pours, when we eat, or see something we want to eat, a quantity of a very watery fluid quite different from mucus which is called *saliva*. That is why we say our "mouth waters" when we see something delicious. Saliva is produced not in the mouth, but in special glands that lie in front of the ear and also under the jaw. They are called salivary glands, and in poisonous serpents they produce the poison. The teeth that lie nearest the opening of these glands are usually the last to decay, since saliva is alkaline and combines with the acids that would destroy the teeth, and so they are saved.



The tongue is a wonder organ, with many uses. It is so necessary in talking that the world language comes from the Latin word "lingua," meaning tongue.



American Dental Association

Here is a model of the upper and lower jaws. Each tooth has its own job. The front teeth are incisors or cutters. The molars are grinding teeth.

Saliva softens the food; and it contains a special ferment, a very complicated chemical substance which has the power of turning starch into sugar, a step that must take place before the body can use starch. In fermenting, the starch is made into a liquid. This helps to break up the rest of the food so that it can be more easily digested—that is, fermented—in the stomach.

If we chew our food thoroughly we get plenty of saliva in our mouths. Digestion takes place in the stomach; but for good digestion we need to have the food we swallow well mixed with saliva.

The production of saliva in the mouth is under the control of the nervous system, and can be disturbed by worry or fear so

that the mouth becomes dry and we can hardly swallow. We notice this when we are excited. Long ago in India when people were suspected of having stolen something, they were made to take a mouthful of some dry food, like grain or rice, and told to swallow it. The idea was that the guilty person would be frightened and upset. Therefore he could not produce enough saliva to soften and coat his mouthful. The consequence would be that he could not swallow it. This was taken as a proof of guilt.

The mouth contains another wonderful tool, the tongue. So important is the tongue as an organ of speech that we use the word tongue when we mean language—mother tongue, foreign tongue and so on.

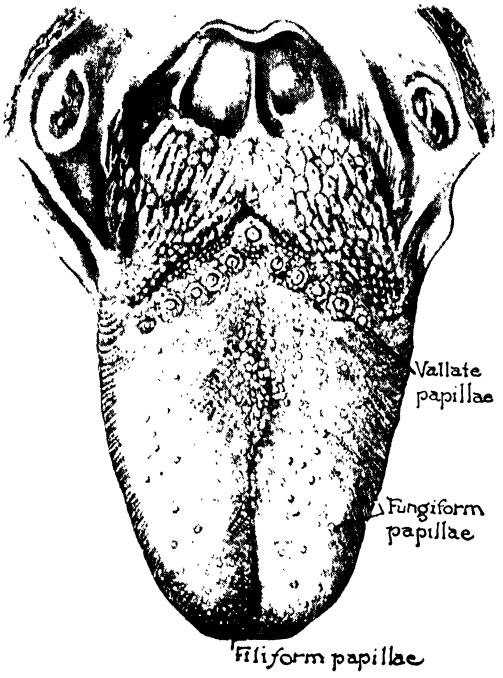
The tongue is a group of muscles—some running along it from root to tip; some running across it. Since these can be used in combination or separately, we can move the tongue in any direction; and it is due to this that we can make so many different sounds of speech.

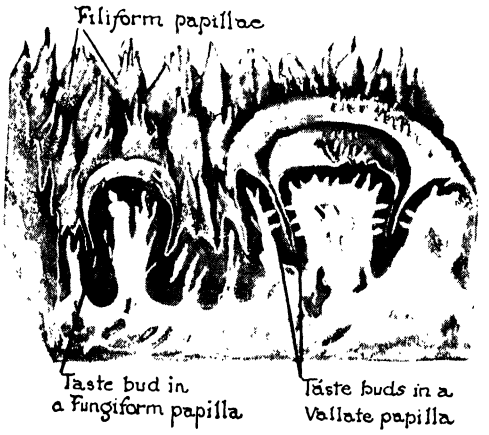
It is the clever tongue that moves the food about so that it is caught between the various teeth and cut up and chewed. It is the tongue that rolls a portion of food into a ball, slips it far back on its own surface, then tosses it into the throat, where it is swallowed. Try to eat or swallow without moving your tongue; you will find that you can not do it. It is the tongue that discovers unwanted bits, the bone in the fish, for example. So, like the lips, the tongue is a sort of sentinel.

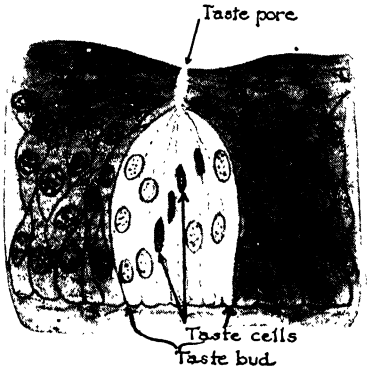
The tongue is the organ of taste. On its surface are special little points to which the nerves of taste run from the brain. These taste-buds, as they are called, are most abundant at the back of the tongue in an adult. During childhood there are many taste-buds at the tip of the tongue; but these disappear. Different parts of the tongue are different in their sensitiveness to different kinds of taste. There seem to be four principal kinds of taste, and it may be that there are special nerves, and perhaps special taste-buds, in the tongue for each of these kinds. The four principal kinds of taste are acid, bitter, sweet and salt.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 2121.

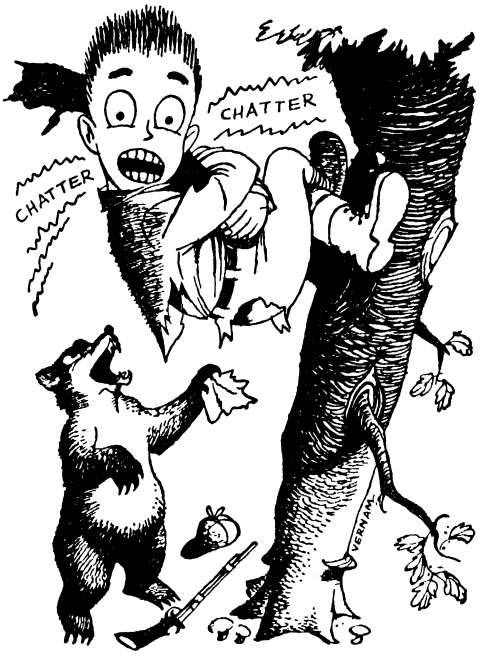
By taste and touch our tongue tells us a good deal about the food that we eat. The four principal kinds of taste which our tongue distinguishes are sweet, sour (acid), bitter and salt. These are recognized by special taste-buds which are found in different parts of the tongue, particularly at the back.







What Makes Our Teeth Chatter When We Are Cold or Frightened?



WE may sometimes notice the same thing in other parts of our bodies; but, for some reason or other, the jaw is specially liable to this kind of disturbance. What we notice is that the muscles which close the jaw are being thrown into a quick series of little contractions and relaxations. When the muscles contract, the jaw rises. When they relax, it falls by its own weight. Then the next contraction comes, and so on.

When a muscle does this we call the act a spasm. Spasms are of two kinds: either the muscle contracts and stays so, or the spasm comes in a series of little contractions and relaxations, as when the jaw chatters or when a person shivers from cold or fright.

When a person learning to drive an automobile, or an airplane, has a moment of panic, the muscles in the hands contract, but no relaxation follows. The person's hands are said to "freeze" to the wheel.

Spasms are independent of the will. We do not order the muscles to behave in this way and we can not stop them from so behaving. The causes of spasm and of cramp—which is one kind of spasm—are many. Cold and fright are the commonest causes, or stimuli. A stimulus excites the ends of the nerves in muscles, and a spasm results.

Certain poisons also cause muscles to contract and relax.

WHY DOES MUSTARD BURN OUR TONGUE?

There are a number of substances that, when applied to the skin or the tender parts of the body, cause us to feel a sensation of burning; mustard is one of these substances. It acts on the tongue or other sensitive parts as an irritant, causing the blood vessels to swell up. This is what happens in the case of a mustard plaster, where, after the mustard has been in contact with the skin a little while, we find that a red patch is produced by the swelling of the blood vessels. This causes pressure on the nerves, and irritation of the endings of the nerves, with the result that there is a sensation which we describe as burning. A number of other substances besides mustard have the same effect, and some of them are employed by doctors as local irritants.

WHY CAN'T HUMAN BEINGS GROW A THIRD TOOTH?

When we are born we have, hidden in our gums, the beginnings of all our teeth. The twenty "first" teeth are already formed at birth, and have only to get through the gums in order to be seen. A baby gets its food by sucking, not by biting, and so it is really better that its teeth should be out of the way at first below the gums. The first teeth begin to push up during the baby's first year. The last of the first set come through, generally, in the sixth year.

Deep in the gums, at birth, are most of the teeth, already formed in part, that will some day make the second set. There are thirty-two of these secondary teeth. At about the age of seven they start to push out and replace the first teeth.

We see why a second tooth appears when the first falls out or is pulled out or is knocked out. It was there at birth partly formed in the jaw, and ready to grow at the right time. But no third tooth will grow when a second tooth has been lost, because there is no other set for it to grow from.

THE NEXT WONDER QUESTIONS ARE ON PAGE 1951.



Artext Prints, Inc.

The night before he received the honor of knighthood, a young man kept vigil over his armor before the altar.

THE FEUDAL AGES

WE give the name of Feudal Ages to the medieval period, roughly from 900 to 1300 A.D. This period saw the rise of powerful monarchies in England and France. It saw the Christian kingdoms of Spain pushing back the Moors, who had conquered the land in the eighth century. It saw the Holy Roman Empire, which once included much of Europe, reduced to a German state. It saw the appearance of a cluster of Christian states, including Poland, Hungary and Bohemia, on the eastern fringe of the European continent. We tell you about these developments in other chapters of The Book of Knowledge.

Throughout the period the way of life known as feudalism played an important part. The word comes from the Old High German *fihu,* meaning "property." Feudalism, then, really means property system. From the very outset it represented the receiving or giving of property—generally land—in exchange for certain services. The man who gave the land was called the lord, or suzerain. The man who received it and offered military and other services in return was called the vassal. The land was known as the fief.

Feudalism served a useful purpose in the early part of the Feudal Ages, particularly in the tenth century. At that time Europe was in great danger. Fierce invaders threatened on every side—the Vikings in the north and west; the Saracens in the south; the Magyars, or Hungarians, in the east. The kings of those days were too weak to help their subjects; the subjects, therefore, sought protection by banding together. The lord found security by gathering around him a group of faithful vassals; the vassal, by gaining the protection of a powerful lord. It was a working out of the natural law that in union there is strength.

As time went on, the usefulness of feudalism became more and more doubtful. Yet it continued to develop with the passing of the years. At first it had represented a simple and rather loose relationship. By the eleventh century it had become a hard-and-fast system, governed by numberless laws.

As in the beginning, the feudal system continued to be based on the relationship between the lord, or suzerain, and the vassal. The lord promised to protect his vassal against his enemies, to grant him justice and to do no violence either to the vassal

READY FOR BATTLES LONG AGO



Picture from Ewing Galloway

In the days of its glory, this full-length suit of armor was worn by a Crusader. Notice the coat of chain mail.

himself or to those of his house. For his part the vassal had many obligations. These varied greatly according to the custom of the country and the special contract.

In practically all cases the vassal bound himself to follow his lord in battle, and to bring a certain number of armed men. He agreed to serve in the courts held by the suzerain. He also bound himself to make to his obligations, the vassal rendered homage to his suzerain upon receiving the fief. He knelt and, placing his hands between those of the lord, he declared himself to be the lord's man, or follower. ("Man" is *homo* in Latin; that is how we get the word homage.) The lord gave the vassal the kiss of peace and then raised him from the ground. This ceremony took place every time that



From an old print

Since fighting was the chief business of the feudal lords, they spent a great deal of time practicing the art of fighting in armor from the back of a horse. They had fun doing it, though even with blunt weapons men were sometimes injured and even killed. Here is a tournament, or mock battle, in which a number of knights are taking part.

certain payments, known as aids. They were granted on special occasions—when the lord traveled to the court of his overlord or king; when the lord's eldest son was knighted or his eldest daughter was married; or if the lord had to be ransomed after being captured by his enemies.

Fiefs were not always given by a lord to ensure the service of a vassal. Sometimes a small landowner would turn over his estate to a big landowner of the neighborhood in exchange for protection. He would "commend himself" to his new suzerain. He then received the property back as a fief, and he would undertake to serve his lord like any other possessor of a fief.

To show that he fully intended to live up a new fief was granted or an old fief changed hands.

Feudal relations were often very complicated. Vassals would sometimes turn over a part of their estates to followers, who then became the vassal's vassals, or sub-vassals. These sub-vassals in turn were overlords to smaller lords and these to smaller still. Often a feudal lord added to his estate by marriage, inheritance or in some sort of trade. In receiving a new fief he might become the vassal of a man less powerful than himself. A vassal might have several overlords. Though he swore homage to each, he was likely to choose one as his liege, or special, lord.

Upon the death of a vassal the eldest son took over the fief. He inherited the obliga-

tions toward the suzerain as well as the fief itself. In case a vassal died leaving young children, the overlord became their guardian. The orphan daughter of a vassal could not marry without the lord's consent. This gave rise to abuses, for sometimes overlords forced their wards into unhappy marriages for their own selfish ends.

The king himself was a feudal lord—the highest of all, for he was supposed to hold his lands from God Himself. In the earlier period of feudalism the king often had little power. The feudal barons who held their lands from him might have greater resources than their monarch. They generally guarded their power very sharply. Though they were bound to the king by the vows of homage they often rebelled against him.

In every country, therefore, the king sought to undermine the power of the greater feudal lords. He had made some progress in this direction by the end of the Feudal Ages, particularly in England and France. Yet throughout our period the king had to bow to the feudal system.

The duty of giving military service to one's suzerain was considered a great honor. The vassals who followed their lord in battle fully armed and mounted on horseback were called knights. The military service they rendered was called chivalry (*chevalerie* in French, from *cheval,* meaning "horse").

In time chivalry came to have a wider meaning. It came to be a summing-up of all the qualities that a knight should possess. The true knight, it was said, should be true to his lord, brave in battle, gentle to women and orphans and very devout. The ideals of chivalry were set forth in poems and romances. If all knights had lived up to these ideals, Europe would have been a happy place indeed in the Feudal Ages!



From this picture we get a good idea of the type of armor worn in the time of the Norman kings of England. The long tunic and the covering for the neck and chin are made of chain mail, interlinked rings of steel, and the helmet has a nose-protector. The knight at the extreme left wears hose of mail and carries the long shield.

The knight's training began at an early age. When he was about twelve years old, a boy of good family would be sent to the court of some great feudal baron, where he would become a page—that is, a sort of knightly apprentice. He learned how to ride and how to use weapons; he was also taught to be obedient and courteous, to play chess

and backgammon and to sing. In the course of time he would become a squire, and follow his lord to battle. While on the march he would carry his lord's shield and helmet and also a number of spare lances. (Squire comes from the Old French word *escuyer,* meaning "shield-bearer.")

When at last the young squire was a skilled warrior, he was ready for the ceremony at which knighthood was bestowed. He prepared himself for the occasion by going to confession, fasting and keeping an all-night vigil, or watch, beside his armor. At last the great moment was at hand. The young knight-to-be first swore to carry out all the vows of knighthood: to be faithful to his lord, to fight valiantly, to protect the weak and so on. Then he knelt. His lord now gave him the accolade—a light blow on the neck with the flat of a sword—and said at the same time: "I dub (make) thee knight." Young men generally became knights at the age of twenty-one or thereabouts.

The knights of feudal times spent a great deal of their time in fighting. Sometimes there were wars between rival kings; sometimes there were private wars between rival nobles. The chief sufferers were generally the peasants, whose lands would be laid waste and who would be treated most brutally. The Church tried to lessen the horrors of this constant warfare by proclaiming the Truce of God. This provided that there was to be no fighting from Wednesday evening to Monday morning, as well as on certain Church holidays. The Truce of God was often violated; yet it did accomplish a certain amount of good.

The Church also tried to direct the warlike energies of the feudal barons against the Saracens, who had occupied the holy places in Palestine. There were seven major expeditions, called crusades, against the Saracens in the period from 1096 to 1270. The crusaders won certain successes, but in the end the Saracens remained in possession of the holy places. (See our article on the Men of the Crusades.)

So devoted were the feudal lords to fighting that to fill out the intervals between wars they took part in mock battles called tournaments. In these combats men fought on horseback with blunted weapons. Usually there were a number of these mock fights. Sometimes one party of knights would engage an-



From an old print

Many tournaments were gorgeous and colorful social occasions. Knights came from all over the kingdom to enter the contest, and rich prizes were awarded to the victors. A beautiful lady was chosen queen of the tournament, and it was she who conferred the awards. In this picture, note the victor's squires holding their master's helmet and shield.



From the painting by Vaczlav Brozik

Wandering minstrels and ballad singers roamed all over Europe in the Feudal Ages, visiting the castles of great lords and the hovels of peasants, and giving equal pleasure to all with their tales sung or chanted to music.

other; sometimes there were duels between individual knights. Prizes were distributed to the victors by a queen of beauty chosen for the occasion.

From the earliest period of the Feudal Ages the more powerful lords dwelt in fortified castles. The first castles were of wood. By the eleventh century they had been replaced by great structures of stone. Some castles were built on steep, rocky hills, with cliffs on two or three sides. On the unprotected side, or sides, deep ditches, called moats, were built outside the castle walls; usually they were filled with water. If the castle was not on a hill, the moat would completely surround it.

The castle gate was reached by a bridge over the moat; this bridge was drawn up at night. Across the gateway was a grating, the portcullis, made of heavy planks. The portcullis could be raised to let people in, and lowered to keep foes out. The castle walls were high and thick, with towers from which defenders could throw down stones and boiling pitch against attackers.

Inside the walls there was a donjon, or principal tower. It contained a great hall, where the lord and his retainers were wont to gather; it also contained a prison. (Our word "dungeon" comes from donjon.) Sometimes the lord and his family lived in the donjon; sometimes in a separate residence.

Within the walls of the castle there were also workrooms, storehouses, where supplies and arms were kept, cookhouses and barracks for soldiers and servants. Generally there was a chapel where the lord and his followers attended religious services. Outside the walls there were gardens, orchards and exercise grounds for the horses. Beyond were the farm lands, pastures and forests that made up the rest of the lord's manor, or estate.

The lady of the castle had many duties. She directed the cooking and the gardening and looked after the sick. She also supervised the making of clothing for her family and servants. In the case of woolen garments everything was done at the manor—wool was carded, spun, woven and dyed, and the cloth was cut and sewn. Most of the clothing was of wool, though cotton, linen and silk were also used. The wealthier nobles sometimes bought silks, velvets and rich brocades, imported from China or Byzantium.

In the summer, when the lord was not busy fighting or taking part in tournaments, he and his lady would spend much time in the gardens and orchards outside the castle. The



From an old print

A king and one of his lords hunting with falcons.

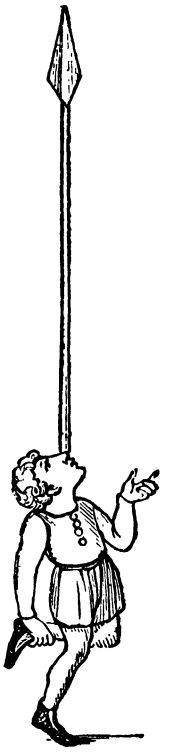
lord would often go hunting the wild boar, the stag and other animals in his vast forests. Falconry was a favorite sport. The falcon was a hawk trained to perch on its owner's wrist. It was kept blinded by a hood slipped over its head until a bird—perhaps a heron —was seen soaring in the sky. The hood was then released and the falcon would fly off in pursuit of the prey.

During the long winter, life was apt to be cramped and dull in the castle. The lord often kept one or more minstrels in his service to provide entertainment. They would play on various musical instruments—the vielle (a kind of violin), the harp, the lute, the bagpipe, the flute, the trumpet and so on. They would also sing short ballads and passages from longer poems celebrating the brave deeds of famous heroes, or the romances of knights and maidens.

In addition to the minstrels who formed part of the household, there were wandering minstrels. Entertainment was also provided by strolling performers who were known as jugglers. They tossed balls up and kept several of them in the air at the same time; they did all sorts of acrobatic tricks, performed feats of magic and even exhibited trained bears.

Not all feudal lords lived in castles like the one we have just described. The less wealthy ones dwelt in houses of stone on their manors. These houses were sturdily built; some of them were surrounded by moats. They offered a certain amount of protection against small roving bands; but they could not withstand a regular siege.

The lord kept a part of the cultivated manor lands for his own use; the rest was distributed among the peasants who tilled the soil. The cultivated land was divided into long, narrow strips. Each peasant generally had several of these strips, which might be scattered all over the manor. In addition to the cultivated land there was a common pasture for cattle and sheep.



Juggling a spear.

The peasants were divided into several classes. On some manors they included slaves. These unfortunate creatures, like the slaves of the ancient Romans, were considered as much a part of the lord's property as his cows or his horses. There were, however, but few slaves in the Feudal Ages. Most of the peasants on the manor were either serfs or freemen.

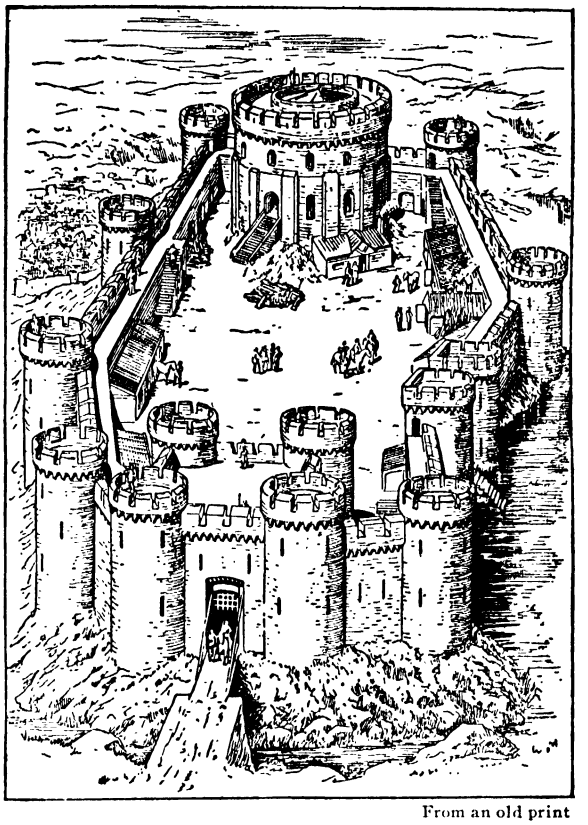
The serfs stood a few degrees above the



From an old print

A group of strolling entertainers, with a dancing bear, a dog and a monkey.

slaves, since certain rights were guaranteed to them. But they were not permitted to leave the manor; when it changed hands, the serfs went with it. They could not marry without their lord's consent. The serfs were also known as villeins (from the Latin word *villanus,* meaning a man who worked on a villa, or estate). The freeman was a step higher on the social ladder. The chief difference between the freeman and the serf was that the freeman was not bound to the soil. He could leave the manor to seek service under some other lord, if he wished.



From an old print

An English feudal castle. The big tower is the donjon keep.

Generally speaking, serfs and freemen performed much the same tasks on the manor. They were required to till the lord's fields several days a week; the rest of the time they devoted to their own land. They had to give the lord a certain amount of produce from their land, or else the equivalent of this produce in money —and money was extremely scarce. They often had to perform other services, which differed in the various regions of Europe. Peasant boys began to work in the fields when they were very young. The peasant's wife and daughter also helped in the work of the manor, in spinning, sewing, baking and other tasks. Sometimes they helped the men in the fields.

The peasants lived in a village near the lord's castle or manor house. Besides the peasants the inhabitants of the village sometimes included blacksmiths, tailors, shoemakers and others. They were generally freemen; they worked partly for those who dwelt in the castle and partly for their fellow-villagers.

The peasants—both serfs and freemen—led bleak, monotonous lives. They lived in dreary little one-room huts without windows and with a hole in the roof to let the smoke from the fire escape. They had only a heap of straw for a bed. When the harvest was good, they had enough to eat in the winter; in bad years they begged at the castle gate. They dared not kill the wild game in the forest, even though they were starving; this game was reserved for the lord and his friends among the nobles. Serfs or freemen who were caught stealing game (poaching) were liable to very severe punishment.

The Feudal Ages saw the rise of towns in practically all parts of Europe. The cities of the old Roman Empire had fallen into decay after its downfall; some had disappeared altogether. Only in Italy did they survive on a large scale. Until the eleventh century most of the people of western Europe lived on the estates of feudal lords, bishops or abbots, or else in the open country.

The towns that began to spring up in the eleventh century were originally villages on the estates owned by feudal barons or monasteries. Some of the townspeople worked on the lord's lands; others were tradesmen and artisans. They all had to pay taxes to the lord; sometimes they had to supply him with various services.

As time went on, the towns increased in size and importance. The inhabitants began to rebel against the restrictions that their lord put upon them. He found it wise, therefore, to grant to the town or towns on his estate a charter—that is, a written contract in which the rights of both the lord and the townsmen were set forth. In this way the

towns won a large measure of independence, though they still continued to owe allegiance to the lord, in name at least.

The townspeople organized trained bands of soldiers and built strong walls around the town in order to defend it against foes. The activities of the town centered around the town hall and the market-place. The streets were generally very narrow. The upper stories of the houses often jutted out beyond the lower stories and almost met over the street. We should consider these old towns very filthy. There were no underground sewers to carry off refuse. People simply threw their garbage out on the street or into open ditches. Wandering flocks of pigs would dispose of some of this garbage; the rats could be depended on to do their share.

The town's tradesmen and its artisans — blacksmiths, carpenters, tailors, bakers and so on — formed guilds, or unions, to protect their interests. It took years for a young man to learn a trade so that he might join one of these guilds. First he served without wages as an apprentice in the house of a master workman. After he had mastered the trade, he became a journeyman. Though he now earned wages, he could work only for a master workman and was not permitted to make things directly for the public. If a journeyman were industrious and saved his money, he could set up a shop of his own. He would now be a master workman, authorized to train apprentices and to hire journeymen.



The Bettmann Archive

Wine-makers paying their rent, a share of their product, to their feudal lord, in this case the head of a religious order.



The Bettmann Archive

Peasants on their way to market pay toll as they enter the city.

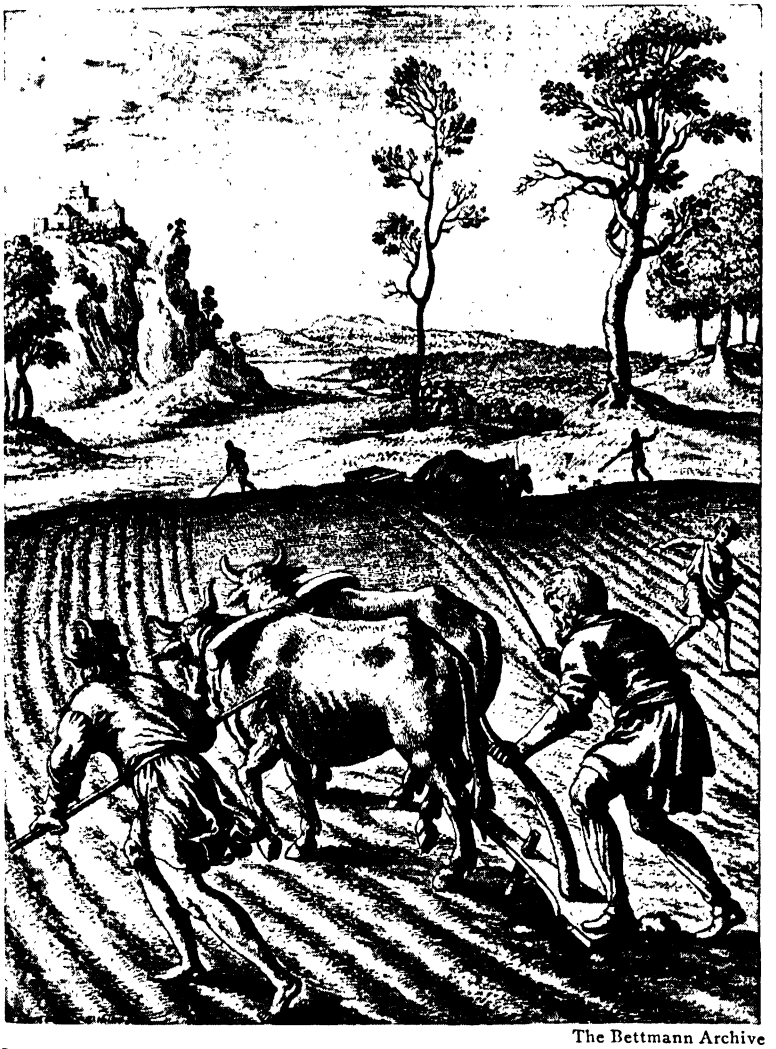
By the end of the Feudal Ages many towns had increased greatly in size and importance; they had spread far beyond the original city walls. The more important tradesmen had become wealthy; wealthier, in some cases, than the lord himself. They were anxious, therefore, to free themselves entirely from the last bonds that attached them to the feudal lord. More than one king found them valuable allies in his struggle to break the power of the great barons.

The rise of the towns was due in part to the increasing importance of commerce in the latter part of the Feudal Ages. The Crusades contributed greatly to this commercial activity. They revealed to the rude warriors of western Europe the

amazing riches of the East—the gorgeous fabrics, the costly carpets, the precious stones, the perfumes, the porcelains, the spices. The demand for these articles rose sharply; by the twelfth century they were being imported on a large scale. The bustling towns of Italy—Venice, Genoa, Amalfi and others—played an all-important part in the trade with the East.

Trade between the various regions of Europe also increased greatly. It had never ceased altogether even in the dark days of the tenth century. Peddlers roamed about the land, carrying their goods to castles, monasteries and cottages. As towns began to increase and multiply, the peddlers found it profitable to display their wares in the town market-place. Sometimes, too, they sold their goods at fairs, which attracted merchants from all parts of Europe. (See the Story of Fairs.)

By the thirteenth century there was a fairly steady flow of commerce between most of the Christian lands of Europe. A number of important trade centers had arisen. The Italian cities more than held their own. Venice, Genoa, Florence, Milan, Turin and many other towns of Italy had become very prosperous. Hamburg, Lübeck, Rostock and Bremen, in northern Germany, sent their goods to the countries on the Baltic Sea and to England. Augsburg and Nuremberg, in southern Germany, were important stopping-off places on the trade route between the northern cities and Italy. Other flourishing trading centers were Barcelona, in Spain, Marseilles, in France, London, in England, and Bruges and Ghent, in Flanders, now a part of the country we know as Belgium.



The Bettmann Archive

Men using an ox-drawn wooden plow, while seed is being sowed in the next strip. The land probably belongs to the castle on the near-by hill.

Throughout the Feudal Ages merchants were exposed to many annoyances and perils. They had to pay tolls and duties to all the feudal lords through whose lands they passed. Some of these lords, indeed, not content with a toll, would rob passing traders of all their goods. Seagoing merchant vessels also faced great dangers. There were few beacons and lighthouses to warn mariners of rocks and shoals. Pirates were numerous. Even honest merchants sometimes

forgot their honesty and robbed their fellow-merchants on the high seas.

It was to seek protection against all these perils that the cities of northern Germany—Hamburg, Lübeck, Rostock and others—founded a union, called the Hanseatic League, in the thirteenth century. (*Hanse* is an Old High German word meaning "association.") The Hanseatic League undertook to safeguard the interests of its merchants on land and sea. It reached its greatest development in the later Middle Ages.



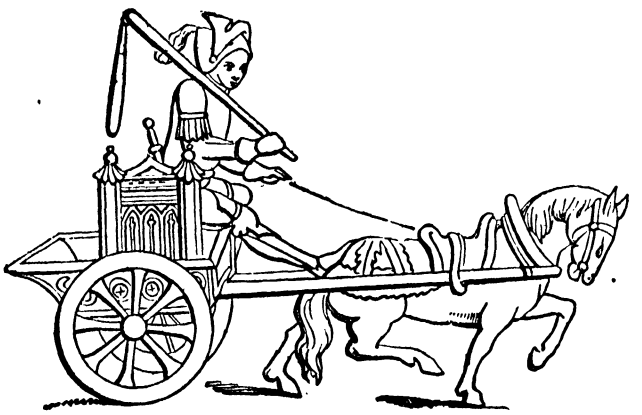


Culver Service

When a lady traveled she might ride on a pillion, or cushion, behind a man, or in a chair borne by servants.

Kings, feudal lords, peasants, townspeople—in fact almost all who dwelt in western Europe in those days were born into the Roman Catholic Church. Practically the only exceptions were the Jews, who were to be found chiefly in the towns, and the Mohammedans of Spain. Under the leadership of the popes at Rome, the Church had made steady progress since it had become the official religion of the Roman Empire in the fourth century A.D.

The Church was enmeshed to a certain extent in the feudal system. This was because it had acquired great tracts of land, generally in the form of gifts from pious people. An abbot or bishop would often find it advisable to turn over church lands to a feudal lord and receive them back as a fief. He would then be entitled to protection from the lord. But, on the other hand, he would have to render the customary services, including military service, just as any other vassal did.



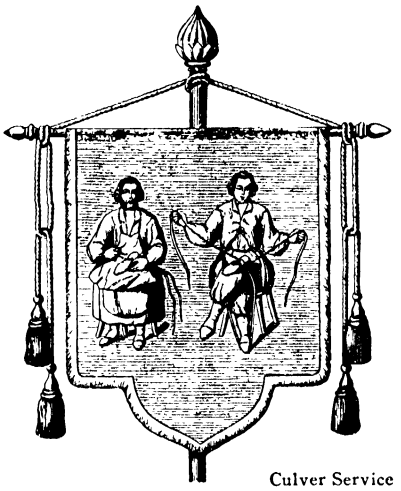
Culver Service

An early horse-drawn carriage was a cart with a chair fixed in it.

Warrior-clergymen were by no means unknown in this period; generally, however, the bishop or abbot would provide the required military service by turning over a part of his lands to one or more vassals in the form of fiefs, and the vassals did the necessary fighting. So the same bishop or abbot, you see, might be both a feudal lord and a vassal.

Even the pope sometimes held the position of feudal lord. In the year 1213, for example, King John of England turned over his kingdom to Pope Innocent III and got it back as a fief. He thus became the vassal of the Pope. He bound himself, as a part of his feudal obligation, to send a yearly tribute to Rome.

The feudal lords (including the kings who, as we have seen, were also feudal lords) often



Culver Service

Each craft guild had its own emblems. This is the banner of a shoemakers' guild.

interfered with the selection of bishops and abbots. This brought on many disputes with the Church. The most famous of these quarrels—the Wars of the Investiture—saw the popes in conflict with the emperors of Germany. (See our article on the Story of Germany.) The Church never succeeded in breaking entirely the hold of feudalism in the Feudal Ages, but as time went on, this hold gradually became weaker and weaker, until the feudal system itself finally broke up.

The Church reached the height of its power in the thirteenth century. It had supreme authority in the field of religion. It had charge of education, since the clergy were the most learned members of the Christian community. It had large estates and great wealth. It had its own law courts, which often tried offenders who in our times would be brought before the civil courts.

Yet in spite of the great power of the Church not all Christians accepted its teachings. Such Christians were known as heretics. Jews and Mohammedans were not considered heretics because they had not been born into the Christian faith. In those days pious men held that heresy (the sin of being a heretic) was more serious than treason. For, they argued, whereas treason was a crime against one's king, heresy was a crime against God.

The Church did all in its power to stamp out heresy. It tried to convince heretics of their errors; it also resorted to sterner measures. In 1208, for example, Pope Innocent III preached a crusade against the county of Toulouse, in southern France, where the heretical sect of the Albigenses was very strong. As a result of the Albigensian Crusade, as it is called, heresy was crushed in this region for years to come.

After the Albigensian Crusade the Church organized a permanent defense against heresy—the Holy Inquisition. It consisted of a number of courts which were set up to seek out cases of heresy and to punish the offenders. If the heretic confessed his guilt and gave up his heresy, he was taken back into the Church. If he refused to recant, or give up his views, he was turned over to the civil power for punishment.

Two famous religious orders were established in the thirteenth century—the Franciscans, founded by St. Francis of Assisi, and the Dominicans, founded by St. Dominic. (See the Index, under St. Francis and St. Dominic.) The members of these orders were called mendicant friars, or begging brothers, because they were content to live on the alms that pious people gave them. They went about the highways and the byways, preaching the doctrines of the Church and trying to awaken people to a more ardent religious life.

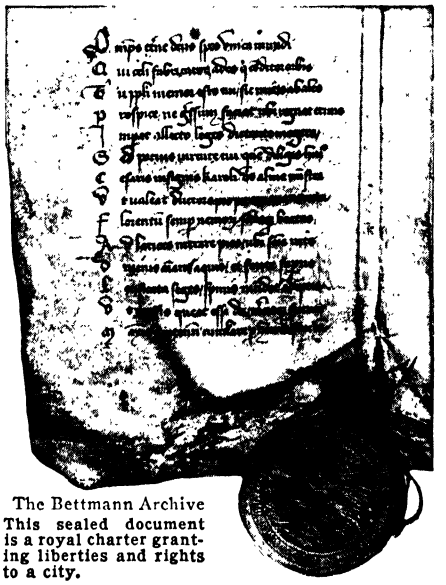
With the passing of the years both orders



The Bettmann Archive

This picture, from a fourteenth-century guild book, shows a tailor of Nuremberg, Germany. Note the scissors, and the rack with hangers for the garments.

widened their activities. The members of the Dominican Order were very carefully trained in theology, so that they might combat more effectively the arguments of the heretics. This led to their being selected by the pope for the task of conducting the Holy Inquisition. It also led to their acquiring a position of great influence in the universities of that time, where the study of theology was very important. The Franciscans likewise contributed a number of fine teachers to the universities.



The Bettmann Archive
This sealed document is a royal charter granting liberties and rights to a city.

The official language of the Church was Latin. This tongue occupied a privileged position throughout the Feudal Ages. Besides being the language of the Church, it was the language of diplomacy, of legal documents and of learning. All educated men knew Latin well and could speak it as well as read it. Practically all books that were considered learned in those days were written in the Latin language. This Latin differed from the ancient Latin in certain respects. A number of new words had been added; new ways of saying things had been introduced. The Latin of the Feudal Ages, therefore, was a special kind of Latin; we call it Medieval Latin.

Latin was a kind of universal language used by the educated people of Europe. But after all, most people in those days were not educated and knew only the native tongue of their particular region. In the areas formerly occupied by the Roman Empire the people spoke lan-



The Bettmann Archive
On market-days the towns were thronged with people: merchants, peasants, beggars, knights, friars and mummers.

guages growing out of Latin—medieval forms of French, Spanish, Italian and Portuguese. Further to the north and east the Germanic languages were spoken—the languages that later became modern German, Dutch, English, Swedish, Norwegian, Danish and Icelandic. Still further to the east there were the Slavic tongues—Russian, Bohemian, Polish —and others. In the Pyrenees Mountains the Basques spoke a tongue of unknown origin.

As we have pointed out, education in the Feudal Ages was almost entirely in the hands of clergymen. In the tenth and eleventh centuries instruction was generally given to boys in the schools attached to cathedrals and monasteries, and these schools continued to flourish throughout the Feudal Ages. They combined what we would call the upper grades, high school and college.

After the pupils had mastered the alphabet, they began the study of Latin grammar. Next they would read the PSALTER, or BOOK OF PSALMS, in Latin. After they had mastered the PSALTER they were ready for the trivium, or "three-way course": the three subjects of grammar, rhetoric and logic. The students learned grammar (Latin grammar) by studying Virgil and other Latin writers. They mastered rhetoric—the art of writing well—by finding out what Cicero and Quintilian, two Latin authorities, had to say on the subject. They exercised themselves in logic—the art of reasoning—by arguing on every subject under the sun, and particularly on theology.

When they had completed the trivium, they took up the quadrivium, or "four-way course," consisting of arithmetic, music, geometry and astronomy. The seven subjects included in the trivium and the quadrivium were known as the liberal arts. By the time a student had completed his study of the liberal arts, he was considered to be an educated man.

In those days there were no printed books. All books had to be copied by hand and they were very expensive. There were no textbooks, therefore, for pupils. The teacher would dictate to the pupils and they would write down carefully what he had said. Then they would have to learn thoroughly—in many cases memorize—what they had written down. If they made mistakes in their recitations, they were likely to be whipped,



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A monastery schoolroom of the early Middle Ages. The students in the picture belong to an advanced class, studying the quadrivium: arithmetic, music, geometry and astronomy. They were dressed in much the same way as the priests and monks who were their teachers, and many of them would follow a religious calling, as most learned men did then.

for teachers used the rod freely in those days.

Girls did not have the same educational opportunities as boys. Generally they were taught in a convent by nuns. They learned how to read and write after a fashion. They were also taught to embroider, to care for the house and to follow the services of the Church. Some outstanding women managed to obtain a good education and even to win fame for their knowledge; but such women were not numerous.

THE DEVELOPMENT OF THE GREAT UNIVERSITIES

The twelfth and thirteenth centuries saw the gradual rise of universities in Europe. They had very humble beginnings, indeed. One or more learned men would settle near some church school or other and give private lessons and lectures for a fee. In time there would be fairly numerous groups of these private teachers in some of the larger cities. They found that it would be to their advantage if they banded together.

So they would form a corporation—a *universitas,* as it was called in Medieval Latin. Sometimes, as in Paris, the masters, or teachers, alone would form the corporation. Sometimes the *universitas* would include all the teachers and all the students, as in Bologna, Italy. Our word "university" comes from *universitas.*

The oldest university was that of Salerno, Italy, which had already been established by the beginning of the twelfth century. The universities of Paris and Bologna were founded about the middle of that century. Other famous universities of the twelfth and thirteenth centuries were those of Orléans and Montpellier in France, Oxford and Cambridge in England and Salamanca in Spain.

THE UNIVERSITIES WERE SPONSORED BY THE CHURCH

Practically all university teachers were priests; and both teachers and students wore the gowns of the clergy. A number of different nationalities were generally represented in the student body, and the students ranged in age from boys of twelve to grown men of forty. Some of them led a carefree existence. They called themselves *scholares vagantes,* or "wandering students." They traveled freely from one university to another and they did not hesitate to beg their way. Many of the joyous songs they composed have come down to us.

The seven liberal arts formed the backbone of the instruction in the universities. After the students had mastered the trivium



A dinner at the court of William, Duke of Normandy.

and quadrivium they turned to more advanced subjects, such as theology, law and medicine. Different universities specialized in one or the other of these subjects. The University of Paris was famous for its theological school; the University of Bologna, for its law school; the University of Salerno, for its medical school.

Certain authorities were accepted as final by teachers and students alike. These authorities included the BIBLE and the writings of Church Fathers. In the thirteenth century they also included the works of the pagan philosopher Aristotle, a Greek who lived in the fourth century B.C. Since very few people knew Greek in those days, Aristotle was studied in Latin translation.

Aristotle had written about a great many subjects in his works—about philosophy, astronomy, zoology, botany, logic, grammar, literature and ethics, among other things. His teachings were accepted without question, except when they disagreed with the doctrines of the Church.

The universities taught a philosophy to which we give the name of Scholasticism, or philosophy of the schools. Scholasticism represented an effort to solve the deepest problems of life and death in accordance with the teachings of the Roman Catholic Church. Some of the Scholastics, as the teachers of this philosophy were called, rank among the greatest thinkers of all time:



Guests and members of the household, in order of rank, sat on stools. Only the lord and lady had armchairs.

particularly Pierre Abelard (1079-1142), Albertus Magnus (1193-1280) and Thomas Aquinas (1225-74).

After many years of study the student was examined by his teachers. If he passed his examinations, he was admitted to the corporation of teachers and became a *magister,* or "master." The word *doctor,* or "teacher," was also used for those admitted to the corporation. In the thirteenth century the title of bachelor was given to those who took only a part of the examinations and who were entitled to teach only elementary subjects. (A bachelor was originally a young knight serving under the orders of a feudal baron.) We still use the names doctor, master and bachelor in our college and university degrees.

The educational system of the Feudal Ages produced men who were very learned in some respects and very backward in others. The theological writings of the thirteenth century have never been surpassed. Modern philosophers still study the works of the Scholastics and find in them a good deal that is of permanent value. We have much to learn, also, from the writings of the learned lawyers who flourished at that time.

In certain respects, however, the education of those days was faulty. Historians mixed fact and fable. Geographers accepted all sorts of wild tales about distant lands. They believed that in these lands there were men who had no mouths and who lived on perfume, men with ears that covered their bodies, men with a single eye right in the middle of their foreheads.

The study of science was also in a backward state. Most learned men had no idea of proper scientific methods. Instead of trying to find out things for themselves, they were too apt to accept what Aristotle and other writers, ancient and medieval, had said about astronomy, botany, zoology and other sciences. In this way they continued many of the errors of the past. Many believed in astrology, which holds that the stars influence the lives of men. They believed just as firmly in a great many imaginary creatures—among others, the dragon, which breathed fire; the griffin, a monster that was half lion and half eagle; the basilisk, a serpent which could slay a man by simply looking at him. (See Animals That Never Were.)

The alchemists—the chemists of those days—used to prepare drinks that, according to them, would give one pleasant dreams or would make one invulnerable to certain diseases. They worked eagerly on the problem of discovering a drink that would make men eternally young. They spent a great deal of time, too, trying to work out the formula of the philosopher's stone, a substance that —so they said—would turn the baser metals, like iron and lead, into gold and silver. And

in all these wonderful experiments the mumbling of "magic" words and the drawing of "magic" circles played a great part. Some of them were merely tricksters.

Yet science was not altogether at a standstill in the Feudal Ages. The alchemists did many silly things, but they did find out some useful facts. In the course of their experiments they treated many substances with fire and water and carefully noted the results. In that way they came to know a great deal about these substances and thus helped to lay the groundwork for modern chemistry. It was in the Feudal Ages, too, that men discovered the compass and paper. They also discovered the lens, which serves us today in so many different ways—in glasses, in the microscope, in the telescope, in the camera.

Then too, the Feudal Ages produced a man who had an almost modern idea of science. This was the learned Englishman Roger Bacon (died 1294), who was a Franciscan monk. Bacon protested bitterly against the influence of Aristotle. "If I had my way," he said, "I would burn all of Aristotle's books, for the study of them can lead only to a waste of time, bring about error and increase ignorance." We tell you about Bacon, and about the science of his time, in the article beginning on page 588.

The Feudal Ages saw the rise of the Gothic style of architecture, which had its beginnings in the twelfth century. In England, France, Germany, Italy and Spain cathedrals were built that were real masterpieces. Everything in these cathedrals contributed to the effect of graceful beauty—the long, pointed arches, the soaring spires, the stained glass, the carved stone, the hammered iron of the gates. You will find a description of the Gothic style elsewhere in The Book of Knowledge. (See Index, under Architecture, Gothic.)

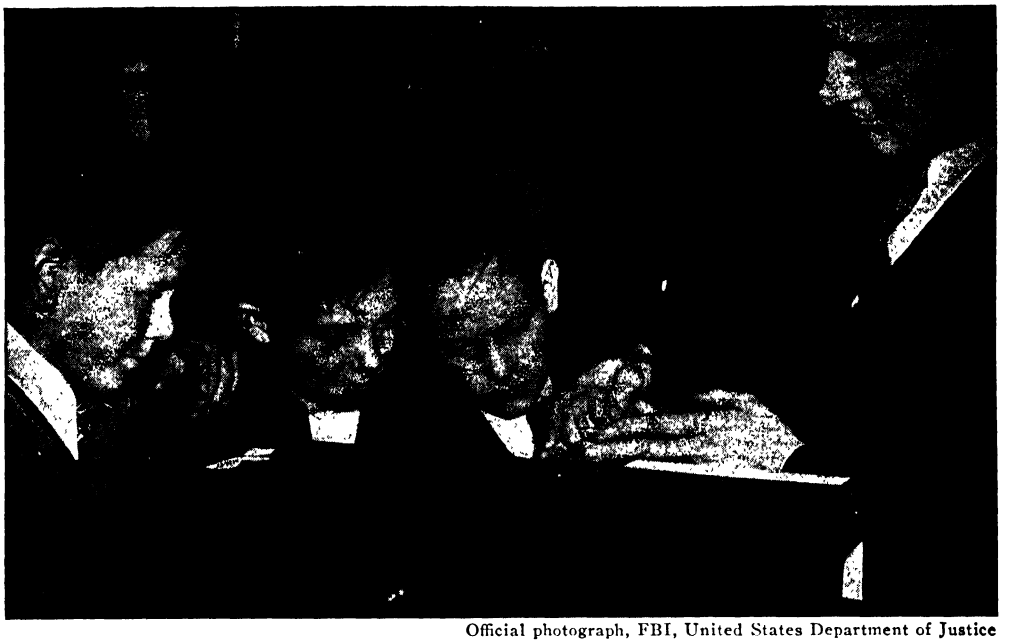
Such were the Feudal Ages. In the two centuries which followed there were great changes in the civilization of Europe. We tell you about these changes in our article on the Later Middle Ages.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 1974.



The Bettmann Archive

A great teacher lecturing in a university in the Middle Ages. Students and even learned men flocked from all over Europe to attend the lectures of some of the famous teachers. One of these students has fallen asleep.



Official photograph, FBI, United States Department of Justice

Boys volunteering their fingerprints, for the Civil Identification Files of the Department of Justice.

HOW ARE OUR FINGERPRINTS READ?

YOU have heard it said that there are no two blades of grass exactly alike. That may be true. Nature does seem to abhor monotony. Certain it is that in one respect no two human beings have ever been found to be alike. Two men may look alike to an astonishing degree. If they live in the same household, they may even develop similar manners and ways of speech. But the ridges and whorls and loops and other markings on their finger tips set each person apart as a distinct individual.

This astonishing fact seems even more astonishing when we learn that from the day of birth to the day of death, an individual's finger markings are not changed, unless through injury. These ridges do not indicate anything about a person—not race, sex, health, character nor heredity, not occupation nor ability. Yet they provide a sure means of identifying him.

The first scientist to publish any observations on the use of fingerprints as marks of identification was Dr. Henry Faulds, in 1880. Doctor Faulds was an Englishman living in Tokyo. However, Sir William Herschel, an English government servant in India had, from 1860, been using fingerprints in identifying pensioners, and also prisoners committed to jail. These men seem to have come to a knowledge of the use of finger markings, independently of each other.

Sir Francis Galton, an English scientist interested in problems of heredity, also studied finger markings. He made great numbers of comparisons, and found that no two finger prints were alike. He assembled the first collection of fingerprint records. This was a big step forward.

There had for centuries been a growing need for some sure means of identifying criminals. Written descriptions, pictures, even sets of measurements were not good enough because they were subject to too many inaccuracies. With fingerprints police officials were given unerring guides to identification.

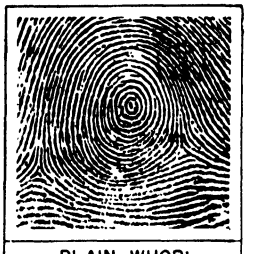
Another step forward was taken in 1901, when a system of record keeping simpler than Sir Francis Galton's was installed in England and Wales. This (the Henry system) is still the basis of the system now used by all English speaking countries.

According to the Henry system, all finger-


PLAIN ARCH

prints are divided into the following patterns:

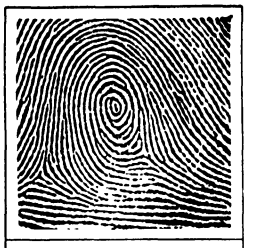
Loops
Double Loops
Central Pocket Loops
Lateral Pocket Loops
Arches
Tented Arches
Whorls
Accidentals


PLAIN WHORL

The pictures will show you some of these types. Subject to a few exceptions, by studying a definite portion of each fingerprint, called the pattern area, and by counting or tracing the ridges within the area, it is possible to classify each of the ten fingers into one of these definite, fixed groups.

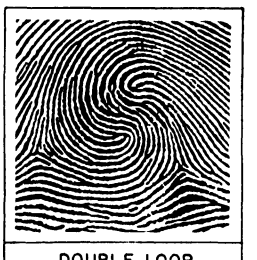

TENTED ARCH

The ten fingers are then considered as a unit, somewhat as a group of ten letters may make up a word-unit and be filed accordingly. The ten-letter word Parliament, for instance, is filed in the dictionary under P, pa, par, parl, parli and so forth. You can find it in a minute, though there are hundreds of thousands of words in the big dictionary. If there were millions, and the dictionary were in hundreds of volumes instead of one, you could still find the word in a short time. You would go to the P volumes, and look for the books that contained Par- words, then to the volume that contained Parl-words and presto! From millions of combinations of letters you have sought and found the word you want.


CENTRAL POCKET LOOP


LOOP

Now you can easily understand how everybody in the world could have prints made of his finger markings at birth, and the prints filed in a few great filing places. Then, suppose Mrs. Jackson's baby were adopted by a family named Smith. The Smiths move to another state. The baby grows to be a man, with no knowledge of his parents. The Jackson family becomes very wealthy, and Mrs. Jackson dies, leaving a million dollars to her "baby," if he can be found. Many people come forward to claim the money; but this baby, at birth, had been fingerprinted and the prints filed in Washington. None of the claimants has finger markings to correspond with that set of prints. Years pass, the search continues, finally the Jackson "baby," (now a man of seventy, and named Smith) hears of the fortune. He knows he was an adopted child; so he comes forward and has his fingerprints taken and they match! This seventy-year-old man's prints have not varied from what they were in infancy!


DOUBLE LOOP


LOOP

This is an imaginary story, but it may


ACCIDENTAL

suggest to you the thought that the use of fingerprinting has now gone far beyond its first use, the identification of criminals. However, its greatest value is still in the field of criminology. In the United States and Canada, police departments, sheriffs, federal and dominion agencies, prisons and other correction institutions all co-operate in taking and filing fingerprints of criminals. One reason why this is important is that many criminals move about constantly, from town to town and from state to state or province to province.

CO-OPERATION BETWEEN COUNTRIES HELPS TO CHECK CRIME

It is easy to learn how to take fingerprints. The cost of equipment is small. It is easy to file and to "read" them. One more necessary step is the co-operation between local filing bureaus and even between the filing bureaus of other countries. This co-operation is so active that a man who commits a major crime in London, and leaves his fingerprints but no other clue of any sort, and is caught in a minor theft in New York, and fingerprinted, can be identified and sent back to London to answer for the serious crime.

The International Association of Chiefs of Police embraces in its membership the heads of police departments of most of the principal cities of Canada and the United States. Its National Bureau of Criminal Identification assembled a large collection of fingerprint records in Washington, D. C. These were, in 1924, given to the Identification Bureau of the Federal Bureau of Investigation (FBI).

During 1947, many foreign countries—seventy-two in all—and five territories and possessions of the United States took part in the international exchange of fingerprint records. In 1947, the identification files of the FBI contained more than 104,500,000 records of fingerprints, the largest collection in the world. More than 1,000 fugitives are identified each month from these FBI records.

When a set of prints comes to the Bureau, it is first recorded, then sent to the department where experts classify it and carefully search through the master files for cards having identical markings. This searching is nowadays often done by machinery. Thousands of cards may be involved, and there are wonderful machines for the purpose that can "read" punched cards by means of the holes. The print is then rechecked to make "doubly sure" of the identification, and the record goes to the assembly section, where the complete record of the individual is put together and checked. The typing section then sends to the inquirer the information about the prints. More than 9,000 such inquiries are made daily and answered by the FBI within thirty-six hours.

The Canadian bureau of criminal identification at Ottawa in 1939 had more than 500,000 sets of fingerprints in its files. Almost every country in the world today co-operates in the free exchange of information regarding identification of criminals.

THE GROWING FILE OF VOLUNTARY FINGERPRINTS

The Federal Bureau of Investigation in Washington maintains a special file of fingerprints which are entirely separate from the Criminal Bureau. This Civil Identification Section contains approximately 5,000,000 personal fingerprint records of people who desire, for one reason or another, to have their fingerprints on file. There are many good reasons for having one's prints taken. In case of dispute regarding identification, in event of catastrophe such as train wreck, or possible kidnapping, or loss of memory, fingerprints may be the only sure means of identification. More and more people each year in the United States are sending their fingerprints and their children's to the Civil Section to be permanently filed.

Aliens registering in the United States now have their fingerprints taken as part of the registration process.

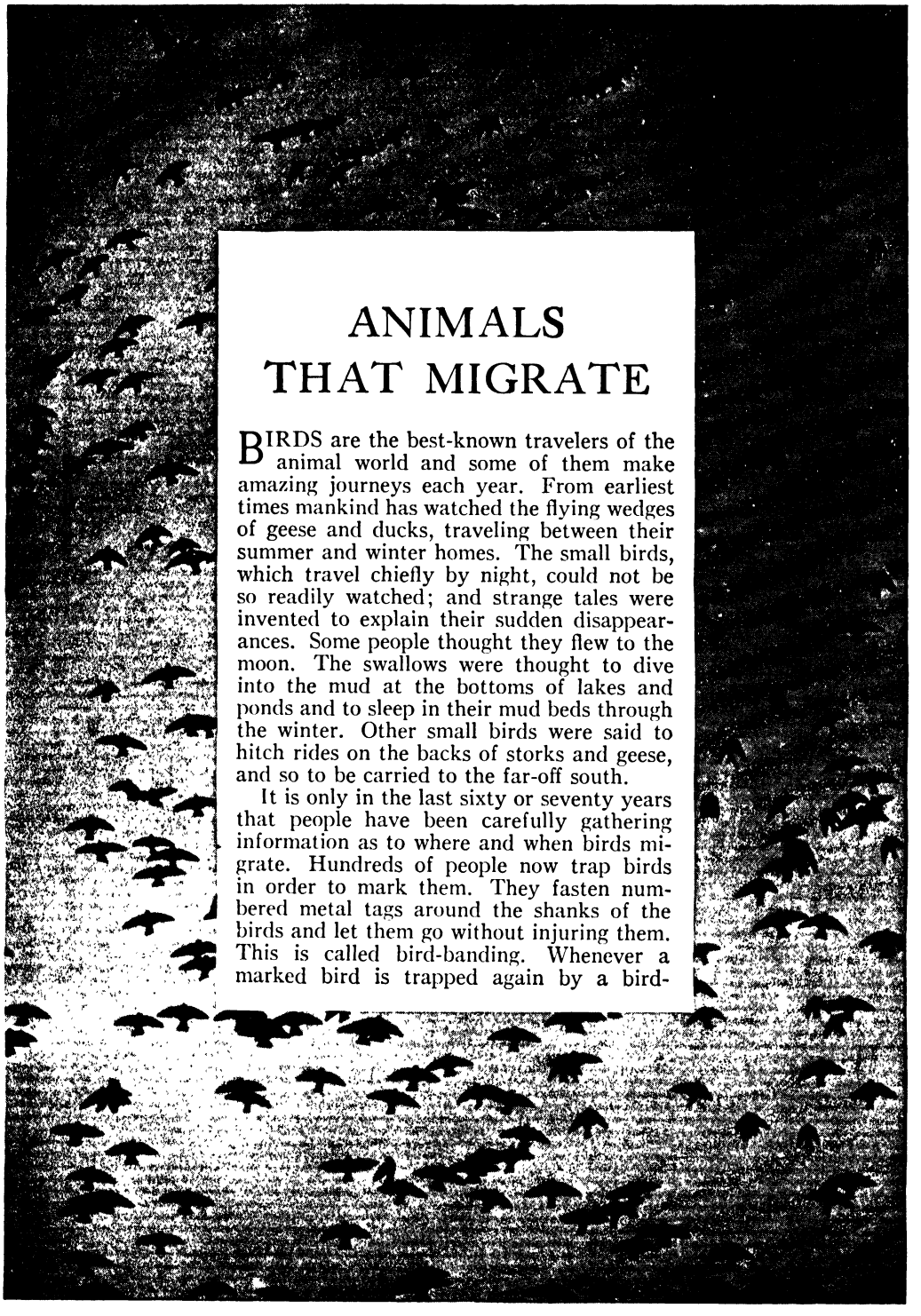
One of the largest collections of fingerprints in the world is that of Argentina. There are several million prints in these files, in Buenos Aires. But not all are of persons having police records. Some are of persons obtaining passports, others of government, bank and commercial employees, still others of people who wished to have certificates of identity, and so on.

FOOT IMPRESSIONS AND PALM PRINTS ARE ALSO USEFUL

Newborn babies frequently have their foot impressions taken, instead of fingers. Palm impressions serve the same purpose and sometimes criminals have been convicted because of palm prints left upon the scene of the crime, when their fingerprints were too blurred to be useful.

Article based on publications of Federal Bureau of Investigation, United States Department of Justice.

THE NEXT WONDER QUESTIONS ARE ON PAGE 2008.



ANIMALS THAT MIGRATE

BIRDS are the best-known travelers of the animal world and some of them make amazing journeys each year. From earliest times mankind has watched the flying wedges of geese and ducks, traveling between their summer and winter homes. The small birds, which travel chiefly by night, could not be so readily watched; and strange tales were invented to explain their sudden disappearances. Some people thought they flew to the moon. The swallows were thought to dive into the mud at the bottoms of lakes and ponds and to sleep in their mud beds through the winter. Other small birds were said to hitch rides on the backs of storks and geese, and so to be carried to the far-off south.

It is only in the last sixty or seventy years that people have been carefully gathering information as to where and when birds migrate. Hundreds of people now trap birds in order to mark them. They fasten numbered metal tags around the shanks of the birds and let them go without injuring them. This is called bird-banding. Whenever a marked bird is trapped again by a bird-



bander, or when one is killed by a hunter or found dead, its tag shows from where it came. The information from the tags, or the tags themselves, are sent to the Fish and Wildlife Service of the United States Government.

In this way many thousands of records have been gathered together and filed for study. From them it is possible to trace the routes that different birds take, and the countries in which they spend the winter.

Until the winter of 1943 no one knew where the common chimney swift spent the cold months. That December some Indians living in the Andes Mountains of Peru killed some banded swifts. The bands were sent to the Fish and Wildlife Service, and it was found that most of the birds had been banded in the central and eastern United States. Although the wintering place of most species of birds is now known, much is still being learned about our birds through the banding method.

Some true stories about the small bird travelers are as wonderful as the fables. Every autumn flocks of golden plovers gather on the Alaskan shore from the inland tundra. They take off across Bering Sea to the Aleutian Islands and then head for Hawaii, more than 2,000 miles to the south. An expert air navigator, with the best modern instruments, could hardly guide a plane more certainly than these birds fly to their goal.

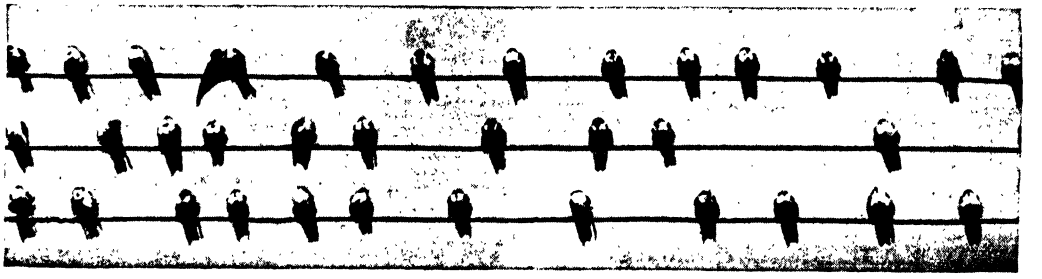
Almost as strange is the "great circle" tour of the eastern golden plovers that breed in the Canadian Arctic. These birds fly across Labrador and eastern Canada, then cut almost due south across the western Atlantic Ocean to South America. There they spend the winter (the warmer season in the Southern Hemisphere), in southern Brazil and the Argentine. In the spring the plovers come back by an entirely different route, by way of Central America and the Mississippi Valley. The round trip totals about 17,000 miles.

Almost half of the birds that nest in the United States and Canada migrate to South or Central America. Others do not go nearly so far. The Canada goose, which nests in the Arctic tundra, spends the winter in the southern United States. So do many ducks and a number of the song birds. Other birds migrate short distances, and their places are taken by individuals of the same kind from farther north.

There are robins all year around in Washington, D. C., and in other places with the same kind of climate; but they are not the same individual birds. The birds that nested there in the spring go several hundred miles south when fall comes; and their place is taken by birds that nested in the neighborhood of New York. Some mountain birds, instead of going south, move down the mountain sides to warmer levels. The California coast is visited each winter by thousands of birds from the higher and colder interior.

Many things are still unknown about the causes of bird migration, but this we do know. In the fall the days begin to shorten and the nights get colder. At the same time the insect food upon which the birds depend becomes scarce. More food is needed to keep up the warmth of the bird's body, and most birds have to go where the supplies are better. In spring, on the other hand, it gets warmer in the south, and northern birds can not stand too much heat. The days lengthen, and the longer hours of daylight stimulate activity and the nesting instinct. Food has become plentiful in their northern homes and the birds are able to return.

How do birds find their way back and forth through the pathless air? In the long flights across seas, or when young birds fly by themselves, we may have to suppose





Martin Beardslee from NAS

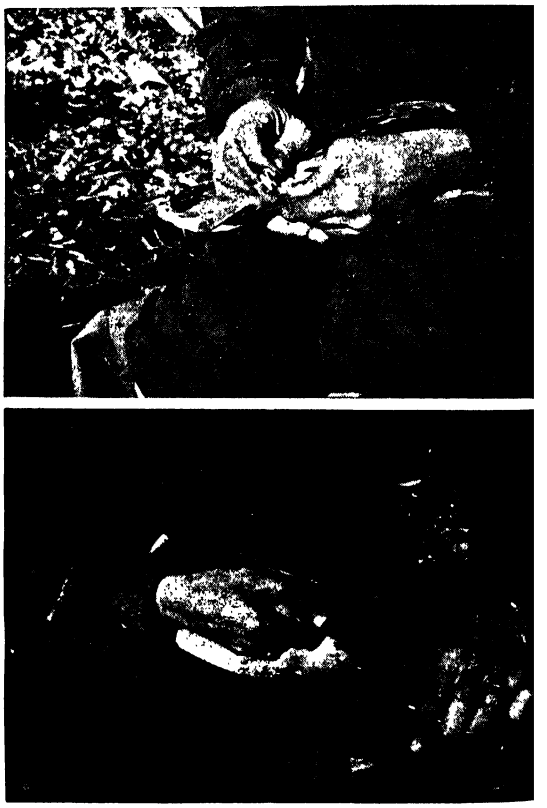
These quivering bits of sooty black fluff and feathers, clinging to the bricks of an old chimney, are baby swifts. Hatched in the spring, in eastern or central United States, by fall they will have grown powerful wings and be off on the long flight, to winter in the Andes Mountains of Peru.

they have a strange sense of direction. But for most bird travelers nothing is needed beyond good sight and memory of landmarks.

The homing of pigeons is like migration, and it has been much studied. Pigeons perform quite marvelous feats of homing, yet they depend on the same senses we do. A blind pigeon can not find its way home, even when it is only a short distance away. A young inexperienced bird can not return from nearly so far as an older, well-trained one. And in foggy weather even good homers are confused and are unable to come back.

Most routes of migration follow valleys, river systems, mountain ridges or coast lines. Older birds rarely go astray, but youngsters on their first journey are nowhere near so likely to come back to the place of their beginning.

Birds are not the only migrants. Other animals, from insects to fishes and mammals, travel also. The monarch butterfly, the large golden-brown butterfly with black and white markings on wings and body, that breeds on the milkweed, is found from Hudson Bay to Patagonia. Those that breed in the north gather in millions the first part of September and fly southward to the southern states. During the cold weather the butterflies rest, sleeping or hibernating in the tops of certain trees. With the coming of warmer weather they become active, and some of them go



Fish and Wildlife Service, U. S. Dept. of the Interior

Banding the birds. The thin marked metal strip is placed with gentle care around the bird's leg, and then tightened and locked securely.

north again, traveling thousands of miles.

Grasshopper or locust migrations have been known in many lands since early Bible times. In North America the chief migratory grasshopper is the Rocky Mountain locust. Several times since the settlement of the West, great clouds of these insects have moved eastward from their homes to invade the wheat farms of the Middle West, from Alberta to Texas. The following year the offspring of these invaders, when they were able to fly, took off on a favorable wind to return to the northwest.

We know how the salmon travel from the mountain streams where they were hatched, down to the sea, and how, when they are full grown, they travel back to their early homes to lay their eggs. Eels act in just the opposite way. They hatch in the ocean, in the depths of the Atlantic, between Bermuda and the West Indies. The young eels migrate in the spring and go up the rivers of Europe or North America, depending on the region from which their parents came. They live from five to twenty years or more in the fresh water. When they are fully grown they go back to the ocean depths, lay their eggs, and die.

Many deep-water fish, such as the herring, come to the shallow water to spawn, that is, to produce their young. A few, like the conger eel and the swordfish, travel to the deeper waters in the spawning season.

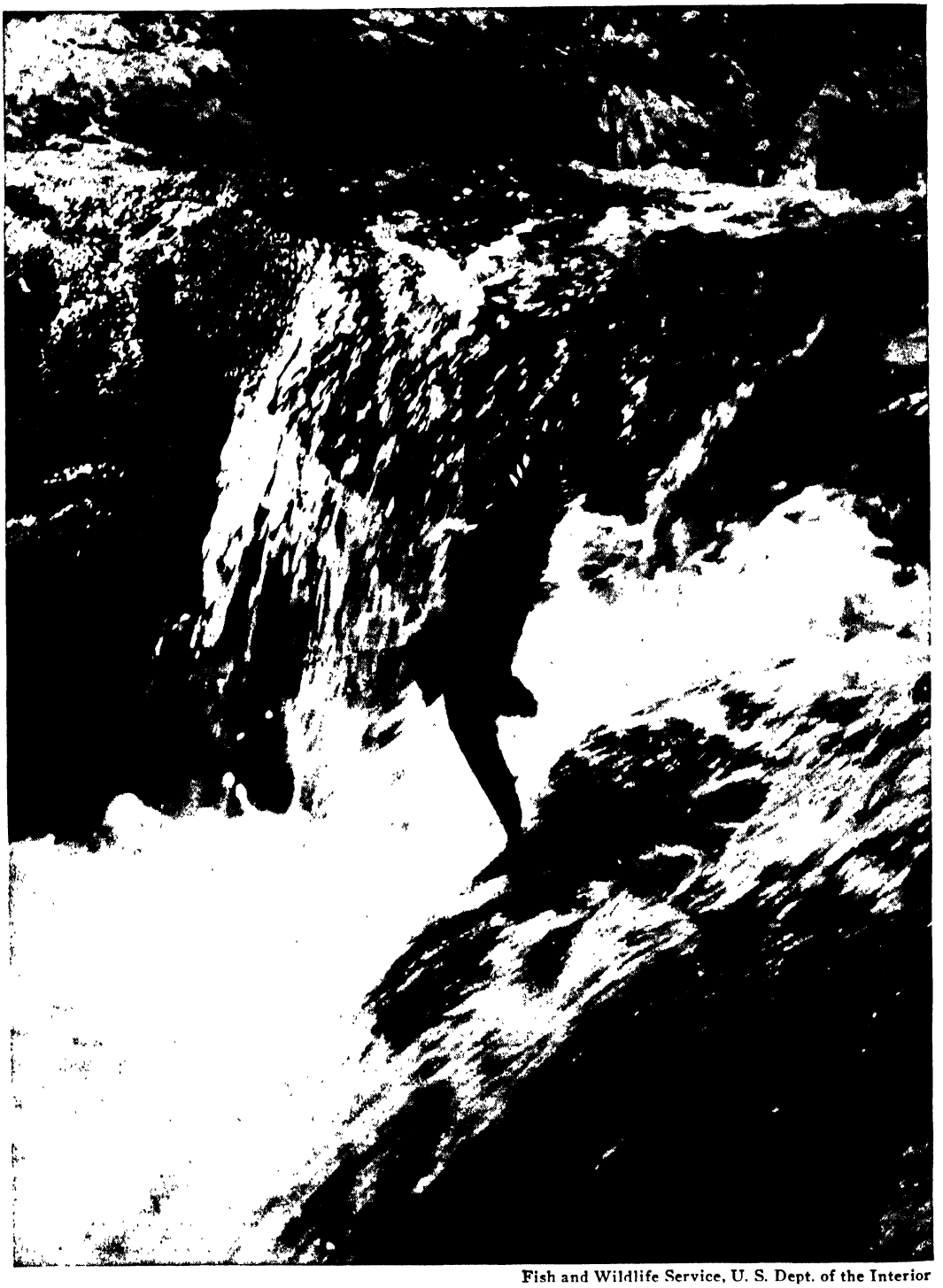
Mammals that travel back and forth seasonally are not so famous as the birds and fish, and there are not so many of them. The bison, or American buffaloes, when white men first came to the plains, moved southward each autumn in great herds, and came northward again in the spring, covering the prairies as far as the eye could see. In the late fall the mule deer and wapiti come down from the forests of the Rocky Mountains to avoid the deep snows. In the spring they go back into the mountains and have their young. But they do not travel very far,



Photo by P. J. Van Huizen, Fish and Wildlife Service, U. S. Dept. of the Interior

With one accord a covey of several different kinds of geese takes off from the Sacramento National Wildlife Refuge in California. They all face in one direction; and as each goose gains speed, its legs are drawn up close to its body. Warm weather is approaching, and so begins their long migration to Alaska and northern Canada.

A BATTLE AGAINST SURGING WATERS



Fish and Wildlife Service, U. S. Dept. of the Interior

Fighting the swift current of a falls in Litnik Stream, at Afognak, Alaska, a humpback salmon leaps with tremendous energy to get past the barrier. This is only one step in its long, tiring journey from the sea to the mountain stream where it was born. Once there, the fish lays its eggs, and then dies. The young fish have an easy journey, with the current, to the sea. But one day they, too, will return to produce another generation.

perhaps 100 or 150 miles in each direction.

The caribou that live on the barren land north of the limit of tree growth commonly make great migrations, 500 miles or more in length, swimming rivers and crossing rough country. These migrations are very irregular. Sometimes millions pass by, while other years there are only small bands. The caribou do not always go the same way. Sometimes they start moving southward early in the summer, but more often in September or early October.

Caribou have a coat of hair that gives them protection from bad weather, and many of them do not go far enough toward the south to gain any advantage in climate. Why, then, do they migrate? The answer seems to be—to conserve the food supply. Caribou depend in the winter on various lichens, the best of which is the green-gray reindeer moss. This grows in various places all the way from Greenland to Florida. In the barrens it is abundant, but if the herds were to stay in one area they would eat up all of this important food supply. Therefore it seems that the caribou's instinct for traveling is necessary to preserve both the pasture and the animals.

A number of North American bats migrate. When the young of the silvery red and hoary bats, as well as the little brown bat, are able to take care of themselves, they and the older bats often travel northward. They go slowly and deliberately, feeding on the hosts of flying insects that are coming out farther and farther to the north. Then in the autumn, with colder weather and fewer insects, the bats migrate southward, traveling rapidly. Some species go to special caves where they spend the winter in great masses, sleeping. Others go to sleep individually under bark or in sheltered spots.

Porpoises and whales usually come close to shore to mate and have their young, often in bays and lagoons. Many of the larger whales travel north during the warm season in the Northern Hemisphere, or south in the Southern Hemisphere. They winter in the tropics.

The Alaska fur seals make journeys almost



Fish and Wildlife Service, U. S. Dept. of the Interior

It is summertime and baby fur seals and their mothers practically blanket the shore of one of the Pribilof Islands. When autumn comes they will swim perhaps 3,000 miles to the south, out of sight of land.

as marvelous as those of the golden plover. During the summer breeding season the fur seals make their home on the Pribilof Islands, tiny specks on the map near the middle of the Bering Sea. In autumn the seals leave these islands and swim almost due south to the passes between the Aleutian Islands. The old bulls spend the winter in the Gulf of Alaska. The females and young fur seals go some 3,000 miles to the open ocean off the coast of California, as far south as Santa Barbara. They never come ashore unless injured or sick. The long voyage home begins in the spring.

They travel nearly in a straight line, as if guided by a compass, yet they are out of sight of land during most of their journey. The bulls have less distance to travel and they reach the islands early in May. The females, or cows, arrive in June, each carrying an unborn young seal. Young females sometimes lag behind and do not come to the Pribilofs before July or even August.



Fish and Wildlife Service, U. S. Dept. of the Interior
A mule deer, which migrates to avoid deep snows.

Animals such as the lemmings really *emigrate* rather than *migrate*. To emigrate is to leave a place for good; to migrate is to move back and forth between two places at more or less regular times or seasons.

THE MARCH OF THE LEMMINGS WHEN FOOD AT HOME GROWS SCARCE

The lemmings are short-tailed relatives of the meadow mice. They are about five inches in length and brown in color, with a black stripe down the middle of the back. How spectacular a lemming overflow, or emigration, can be was shown in 1868. Then the captain of a ship coming into Trondheim Fiord, in Norway, saw that the water was covered with small animals, swimming with all their might out to sea. Millions of lemmings were in this mass.

Usually the lemmings live on the bare tops of mountains or on the Arctic tundra, where they feed on grasses, lichens and the barks and buds of dwarf trees. Every so often the number of lemmings grows far beyond the supply of food in their native haunts. In their homeland there are relatively few enemies—owls and hawks, weasels and foxes—and these are much slower in breeding than the lemmings. Thus the lemmings become too numerous for their own good.

OVER MOUNTAINS, FIELDS AND STREAMS TO DEATH IN THE SEA

When starvation faces them in their homeland, many millions of young lemmings move away, down to the valleys and farm lands, eating up everything green as they travel. The numbers keep on growing; but now new enemies join the owls and Arctic foxes that follow them from the mountains. Sea birds leave the coast to feed on them. As the lemmings cross rivers and streams the fish gobble them up. Even the pigs, cattle and reindeer, that usually eat plant food, learn to eat the lemmings. Often disease breaks out among the hordes, and millions die of "lemming fever."

The survivors finally reach the seacoast. They do not know how wide this water is; they can not see across even small streams. So they try to swim across, but all become exhausted and are drowned.

Back in the native home of the lemmings a very few mice have remained. These again begin to build up a population, and the history of the lemming emigration is repeated. But none of the adventurous wanderers come back to their homes.

By JOHN ERIC HILL.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 2011.



General Biological Supply House, Inc., Chicago, Illinois

HOW TO CARE FOR GOLDFISH

OF all pets, these golden fishes are likely to suffer most from neglect. Children forget to change the water, or to feed them, and are surprised when they find them floating upside down some morning, dead.

Among the most common causes of death are too little water and too small quarters, and too much sun also. This explains why picturesque globes should be avoided, or at any rate kept out of strong sunshine, for the curved sides collect the sun's rays and fairly scald the helpless fish. An oblong tank, made of one piece of glass, is easy to handle when empty, can not leak, allows one to see the fish clearly, and does not break unless roughly handled. One holding about three gallons is a handy size in which several fishes two inches long may have swimming room.

Other aquaria, made of plain pieces of glass on at least two sides, fastened together with wood or metal at the corners, are not so easily handled and are apt to leak. The cement used must be carefully chosen, or when dissolved by the water it will poison the fish.

Whatever may be the form of tank chosen, it must be absolutely clean, and every trace of soap rinsed away. The carpet of sand also should be thoroughly washed and should not be that from the seashore, which is hard to rid of salt, but from a bank or a fresh-water stream. A little soil, also cleaned, may be used if well covered with sand, but is scarcely necessary, as the aquatic plants which we are going to insert need nothing but water.

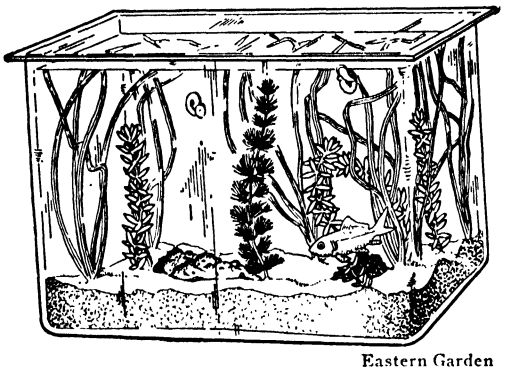
These plants, growing in sunshine, exhale oxygen. This oxygen, freed in the water, is absorbed by the blood of the fish as it flows through the gills. The carbon dioxide which is thrown out by the fish is essential to the growth of the plants, which seize upon it throughout their whole surface, assimilate the gas, and decompose it, extracting the carbon, rejecting the oxygen. This is done by the green parts of the plant containing chlorophyl, rendered active by light, and most so by sunshine. Tiny pores, or stomata, allow the rejected oxygen to escape from the cellular tissue, to be captured by the fish, as we have seen, thus completing the circle of usefulness.

Given plenty of plants to furnish oxygen for the animals; enough water to store it in (about one gallon for each fish); enough animal life to void carbon dioxide to supply the plants; and with sunlight to act as motive power, one can readily see that the water in the tank should remain in perfect condition and the whole affair be "balanced," as in a natural pond or brook or river.

Aquatic plants may be bought from florists or dragged from brooks and ponds. The water from which they are taken must be pure; not containing sewage or dead fish, for deadly poisons may be carried in this way.

Several kinds are suitable for aerating the water. A common one is the water thyme or Anacharis, a long weed with whorls of small simple leaves, growing rapidly.

Small pond weeds, the tiny duckweeds, which float in a green scum on ponds, the long narrow-leaved tape-grass that swimmers dread, but which is one of the best air-giving plants a tank can have, and, in fact, any plant found growing in a stream will add beauty and profit to the tiny pond we are building.



Eastern Garden

An attractive aquarium is a well-planned one.

While we are searching for plants we may also look up some snails. Generally some will be found in shallow quiet streams or even ditches, crawling on stones or grasses. Their shells are very fragile and must be fingered gently, and they must immediately be put into a pail or jar of water. The plants will do better, too, if they can be dropped into water. If they are not wrapped up, at least, they will dry into strings.

Plenty of snails should be taken (or if none can be found, some pretty round fellows can be bought of the fish dealers), for fish like a change of diet and will probably drag the snails out of the wide doors of their shell homes and eat them. Snails are necessary, for they clean up all sorts of minute plants and animals in our artificial pond, just as they do in the real one.

When your plants have been carried home they should be put into water with a hint of salt, and allowed to soak for a while, then rinsed. The cleaned sand is placed in the bottom of the tank, and some of the biggest plants are anchored in it along one side. This will be the back of the aquarium—a background for the golden captives. Little pebbles and smaller plants may also be put in, leaving a clear playground for the fish; then some water may be added with a sprinkling-pot. We then see how much air is forced under the water in this way. The plants will float out and we can rearrange them if we like, for they are more easily managed than when they fell over limply. Finally the tank may be filled with water. It is then too heavy to move.

PLANTS AND SNAILS DECORATE OUR TANK

The snails can now be slipped in and the whole thing left for a few days. The early morning sun will start the plants growing, bubbles will rise to the surface, and soon we can put in the fish themselves.

Although, if we are successful, we shall not need to change the water in this "balanced" tank, we shall want to clean up the refuse that collects at the bottom of the tank. This is best done with a siphon, or long tube, one end of which is in the water while the other hangs lower. We suck the air out of this latter end and the water rushes in to take its place, and keeps running as long as the two ends remain the same or until something fills the tube. The lower end must be so placed that the stream through it will fall into a dish. A little experience will enable us to steer the end that is under water over the soft heaps of dead foliage and rejected food that lie in corners and hollows behind plants, especially in the morning before the fish have stirred them up. The siphon's current is surprisingly strong, and would doubtless pull out a fish's eye, or injure its tail, so that the fish must be carefully avoided whenever the siphon is placed in the tank.

MAKING A SEA GARDEN IN YOUR HOME

So much water is pulled out by the suction that the amount left in the aquarium is naturally reduced, and one may wipe clean the exposed glass, before replenishing it. In this way the water is really constantly changed, without disturbing either plants or fishes. In summer, nevertheless, the water should be still more frequently aerated, by lifting it out in handfuls and dropping it back in splashes. Warm water parts with its air more easily than cold water does, and the fish are grateful for the air absorbed by the fountain-like spray.

When handling goldfish, it is well to remember that their scales are a valuable protection for them, and that a weak spot in their armor may mean a chance for a deadly fungus to insert itself. The slime oozing out of its skin further protects a fish from injury,

and, if possible, it should not be rubbed off. A little scoop-net is generally used in shops for removing the fish from large aquaria, but the hand is generally the safest instrument, especially for the fragile-finned varieties.

There is an insidious fungus disease flourishing on dying fishes which attacks weak or wounded fish and gradually destroys them. It is this fungus which we are endeavoring to keep out when we scrub everything so vigorously, and which we dread when bringing in new fish or plants. Such should really be quarantined. The disease manifests itself by pale patches on the fish's scales, looking rather furry, and it sometimes covers the eyes with films, or eats away the fins and tail.

If this disease appears in the aquarium, everything but the fish must be thrown away, and they must be slid into a shallow bath of salt water—one teaspoonful of salt to a gallon of water. The snails, too, if one wishes to save them, must go with the fish, and there all will have to stay until they are clean again or die, which is more probable. The tank itself will have to be scoured anew. It is best to buy fish from reliable dealers only so as to avoid getting this disease, if possible.

THE BEST WAYS TO RAISE A GOLDFISH FAMILY

There are many lovely varieties of goldfish, some having long and broad filmy tails that mermaids must covet, and it seems better to keep them in a tank by themselves. For one reason, they feed chiefly on vegetable food, although many of the prepared foods contain insects or their eggs. We must be very careful to give them only tiny portions of food, and once a day is often enough; for they do not like left-over food, and it may foul the water when it rots behind the plants.

When the sun starts the plants growing in spring, we may find the water becoming green and thick. This is because millions of tiny water plants too small to be seen without a glass are also growing there. They are really a sign that the water is pure, but the water does not look nice, and the fish seem to have difficulty in swimming and become scarcely visible. Although they probably like their green shadowy home, we do not, and therefore we shall take out more water than usual when we clean up, and put back plenty of fresh, cold and clear water.

So long as the fish are swimming quietly around, the plants are growing nicely, and no bad odor arises from the water we may assume that everything is all right and leave the fish and tank alone. They will do much better if the tank is never touched except for the sake of cleanliness.

Sometimes we find that we have specimens of both sexes of fishes in our tank, and rarely, if conditions are to their liking, the female will lay eggs. These are globular and translucent, and catch like seed pearls on all



Eastern Garden

Here are three of the many ornamental aquatic plants that can thrive in any aquarium. From left to right, they are the narrow-leaf spatterdock, the Sagittaria guaynensis and the water-sprite.

the plants. The male, who is never so gorgeously tinted as at this time, also wears white furry spots, and throws out a milky fluid, for the purpose of fertilizing the eggs. This "milt," however, sadly fouls the water, so that after the egg-laying is finished, in a day or two the tank must be emptied and refilled. If we want to raise little goldfish, we must quickly take the eggs out on their sprays of water weeds, and establish them in a little aquarium by themselves, for the parents otherwise will nose them out and eat them up, precisely as they do the egg masses that snails deposit on the tank walls. If we keep the little tank (decorative indeed with its pretty sprays of water weeds) where it will get plenty of sunshine in the morning, but not so much as to overheat the water, we may find some queer little squirming forms, all eyes, wriggling about. They will snap at the minute bits of hard-boiled egg yolk, crushed fine, with which we feed them, but so much will be wasted that the water must be changed every day to get rid of the decaying food. If everything goes well, we may raise some funny little finny creatures which will eventually eat their parents' food and grow to their parents' size. They can then rejoin their parents and we may one day have many families of these bright-colored little goldfish.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 2041.

Hansel and Grethel

A German Fairy Tale

Once upon a time, near the borders of a dense forest, there dwelt a poor man who earned his living by cutting wood.

One day, on his way home through the wood, he found a poor little girl who had been carried away by an eagle, and left high up on the branch of a tree to die. He took the little girl home to his wife, and they called her Grethel, and brought her up with their only son, Hansel. But the wife died, and the woodcutter married again. After a little while he became very poor indeed, and could hardly earn enough money to buy bread.

One night as they were lying awake, weak from hunger, Hansel and Grethel heard their stepmother say to their father:

"In a few days we shall die of hunger. If we had only ourselves to keep we might manage to live. I know what we must do. Tomorrow morning we will take the children far into the forest and leave them there."

"No, wife," said the man. "How can I have the heart to leave my children alone in the forest for wild beasts to devour?"

But the hardhearted woman talked and talked until the poor man agreed to what she proposed.

Hearing this dreadful plan, Grethel wept bitterly. But Hansel comforted her.

"Do not cry, dear Grethel," he said; "I will find a way to get home safely."

He then got up quietly, crept out of the house, and filled his pockets with little white pebbles. At sunrise their stepmother wakened Hansel and Grethel, saying: "Get up, children! We are going into the forest to gather wood"; and she gave them two slices of bread for their dinner. Grethel carried both pieces in her apron, as Hansel's pockets were full of pebbles.

As they went along, Hansel kept looking back, until at last his stepmother asked him sharply why he kept lingering and looking behind.

"I can see my little white cat sitting on the roof, and I am sure she is crying for me," said Hansel.

"You stupid!" she replied. "It is only the sun shining on the chimney pot."

When they reached the middle of the wood their stepmother said:

"Run and collect twigs, and we will make a bonfire to keep warm."

And Hansel and Grethel soon had a blazing bonfire of brushwood. Tired with their long walk, they fell asleep; when they woke up it





was dark, and they were alone. Grethel began to cry bitterly; but Hansel said:

"We shall be able to find our way home all right when the moon rises, because I dropped a white pebble every time I looked behind this morning."

When they reached home they were scolded by their stepmother for straying away; but their father was pleased to see them come back safely.

Not long afterward, however, the same poverty came upon them, and the stepmother persuaded her husband to take the children much farther into the wood. The children again overheard the cruel scheme; but Hansel was unable to get a pocketful of stones because his mother had locked the door. He bravely lingered behind, however, and dropped crumbs from his piece of bread all the way along.

"Why do you lag behind so, Hansel?" said the woman.

"I am looking at my little dove sitting on the roof to say good-bye to me," replied Hansel.

"Silly!" said she. "It is only the morning sun shining on the housetop."

Their parents left them when they were asleep, just as before. When they awoke Grethel said: "What are we to do, Hansel, for the night is coming on and we are much farther in the forest than we were last time?" Hansel replied: "Do not fear, dear Grethel; I have left all my bread in little crumbs on the wayside."

So Grethel dried her eyes and shared her piece of bread with Hansel. When the moon rose they started off; but, to their alarm, they found that there were no crumbs to be seen. The birds had eaten them all up. They wandered about the forest all through the night and the next day, finding only berries to eat; but they could not find their way home, so they lay down and went to sleep.

About noon the next day they saw a lovely snow-white bird sitting on a branch, and singing so beautifully that they listened to it for a long while. When it had finished singing it flew slowly away, looking round at the children as if inviting them to follow. This Hansel and Grethel did, and after a little while the bird perched on the roof of a tiny house.



To their surprise they found that the walls of this little house were made of gingerbread, the roof of cake and the windows of frosting.

"Oh! Something to eat at last!" cried the hungry Hansel. And the two children pulled pieces of gingerbread off the walls, and ate to their heart's content. Suddenly came a voice from within:

"Munching, crunching, munching,
Who is eating up my house?"

And the children answered:

"The wind, the wind,
'Tis only the wind!"

and went on eating hungrily.

In a minute or two the door opened, and a little old woman hobbled out.

"Poor little children," said she. "How tired and hungry you look! Come in with me, and I will give you plenty to eat and drink."

The children followed her in, and had a meal of milk and pancakes and apples and nuts. And then she put them into two pretty little beds, and they fell asleep.

Now, the old woman was really a bad witch, who had built this gingerbread house to attract children, so that she could capture them and eat them. So when Hansel was asleep she took hold of him and quickly shut him up in an iron cage. Then she shook Grethel, and said:

"Get up, lazy-bones, and help me get water and cook some food, for I am going to fatten your brother and eat him."

After breakfast the old woman went out. Grethel immediately ran and told Hansel all the old woman had said.

"The old woman must be a witch," said Hansel. "Search for her magic wand and pipe, and then help me out of this cage."

So Grethel found the wand and pipe, and they ran away together. After some time the old witch came back, and was very angry to find that Hansel and Grethel had escaped. She put on her seven-league boots, and quickly caught up with the children.

As soon as she saw the witch, however, Grethel waved the magic wand, and changed herself into a lake, and Hansel into a swan floating on it. The witch tried hard to entice the swan to the shore by offering him crumbs of bread and cake, but he would not move, so she gave it up and went home in disgust. Grethel then changed Hansel and herself back into their proper forms, and on they went. Next day they saw the witch overtaking them again. This time Grethel changed herself into a rose in a prickly hedge, and Hansel sat on a mossy bank beside it and waited.

The witch soon came up and mounted the bank to pick the rose which she knew must be Grethel. Hansel quickly put the pipe to his mouth and began to play. Now, as it was a fairy pipe, everyone who heard its music had to dance, even the old witch, and there she capered and jigged, till she was fixed firmly into the hedge, where the sharp thorns tore her clothes off and pricked her skin.

Grethel freed herself and the children once more started for home, but, getting tired, they went to sleep in an old hollow tree.

In the morning when they awakened, the sun had risen high above the trees, and it was very hot. Little Hansel said:

"Sister, I am very thirsty; if I could find a brook I would go and drink, and fetch you some water too. Listen! I think I hear the sound of one."

Then Hansel rose up and took Grethel by the hand and went in search of a brook. But the witch had found out all that had happened, and was ready to do them harm. When they had found a brook that ran sparkling

over the pebbles, Hansel wanted to drink, but Grethel thought she heard the brook, as it babbled along, say: "Whoever drinks here will be turned into a tiger." Then she cried out:

"Ah, brother, do not drink, or you will be turned into a wild beast and tear me to pieces."

"I will wait," said Hansel, "for the next brook."

But when they came to the next, Grethel listened again, and thought she heard: "Whoever drinks here will become a wolf." Then she cried:

"Brother, brother, do not drink, or you will become a wolf and eat me!"

So he did not drink, but said:

"I shall wait for the next brook; there I must drink, say what you will, for I am so thirsty."

As they came to the third brook, Grethel listened, and heard: "Whoever drinks here will become a fawn."

"Ah, brother," said she, "do not drink, or you will be turned into a fawn and run away from me!"



But Hansel had already stooped down upon his knees, and the moment he put his lips into the water he was turned into a fawn.

Grethel wept bitterly over the poor creature, and the tears, too, rolled down his eyes as he laid himself beside her. Then she said:

"Rest in peace, dear fawn; I will never leave you."

So she took off her little bead necklace, and put it around his neck, and plucked some rushes and plaited them into a soft string to fasten it, and led the poor little thing by her side farther into the wood.

After they had traveled a long way they came at last to a little cottage; and Grethel, having looked in and seen that it was empty, thought to herself, "We can live here." Then she went and gathered leaves and moss to make a soft bed for the fawn, and every morning she went out and plucked nuts, roots and berries for herself, and sweet shrubs and tender grass for her companion; and it ate out of her hand, and was pleased, and played and frisked about her. They lived thus a long while in the wood by themselves, till it chanced that the king of that country came to hold a great hunt there. And when the fawn heard all around the echoing of the horns, and the baying of the dogs, and the merry shouts of the huntsmen, he wished very much to go to see what was going on.

"Ah, sister," said he, "let me go out into the wood. I can stay no longer!"

And he begged so hard that at last she agreed to let him go.

"But," said she, "be sure to come to me in the evening. I shall bar the door to keep out those wild huntsmen; and if you tap at it, and say: 'Sister, let me in,' I shall know you; but if you don't speak, I shall keep the door fast."

Then away sprang the fawn and fricked and bounded along in the open air. The king and his huntsmen saw the beautiful creature and followed, but could not overtake him; for when they thought they were sure of their prize, he sprang over the bushes and was out of sight in a moment.

As it grew dark he came running home to the hut, and tapped, and said: "Sister, sister, let me in." Then she opened the little door, and in he jumped, and slept soundly all night on his soft bed of moss.

Next morning the hunt began again; and when he heard the huntsmen's horns, he said:

"Sister, open the door for me, I must go again."

Then she let him out, and said:

"Come back in the evening, and remember what you are to say."



When the king and the huntsmen again saw the fawn with the beaded collar they chased him; but he was too quick for them. The chase lasted the whole day; but at last the huntsmen nearly caught up with him, and one of them wounded him in the foot, so that he could hardly crawl home. The man who had wounded him followed close behind, and hid himself, so that he heard the little fawn say: "Sister, sister, let me in." Then the door opened, and shut again. The huntsman went to the king and told him what he had seen and heard. The king replied:

"To-morrow we shall have another chase."

Grethel was very much frightened when she saw that her dear little fawn was wounded; but she washed the blood away and put some healing herbs on it, and said:

"Now go to bed, dear fawn, and you will soon be well again."

The wound was so small that in the morning there was nothing to be seen of it, and when the horn blew, the little creature said:

"I can't stay here; I must go to look on."

But Grethel said: "I am sure they will kill you this time; I will not let you go."

"I shall die," answered he, "if you keep me here. When I hear the horns, I feel as if I could fly."

Then Grethel was forced to let him go; so she opened the door with a heavy heart, and he bounded out gaily into the wood.

When the king saw him, he said to his huntsmen:

"Now chase him all day long till you catch him; but let none of you do him any harm."

The sun set, however, without their being able to overtake him, and the king called away the huntsmen, and said to the one who had watched the fawn:

"Now come and show me the hut."

So they tapped on the door, and said:

"Sister, sister, let me in."

Then the door opened, and the king went in, and there stood a maiden more lovely than any he had ever seen. Grethel was frightened to see that it was not her fawn but a king with a golden crown. However, he spoke kindly:

"Will you come with me to my castle and be my wife?"

"Yes," said the maiden. "But if I do, my fawn must go with me."

"Well," said the king, "he shall come and live with you, and want for nothing."

Just at that moment in sprang the fawn, and his sister tied the string to his neck.

Then the king took Grethel to his palace, and celebrated the marriage in great state. And she told the king all her story; and he sent for the witch and punished her. And the fawn was changed into Hansel again, and he and his sister and the king lived happily together all their days.

This is another of the many delightful German fairy tales for which we are indebted to the Brothers Grimm.

THE NEXT STORIES ARE ON PAGE 2131.



Plants turn the sun's energy into food; and then we eat the plants to give us energy for play and work.

OUR DEBT *to the* SUN

SOME day there no longer will be any coal or oil for man to use. How soon can not be predicted exactly; there are differences of opinion among scientists. Yet that time will surely come—one thousand, ten thousand, or perhaps one hundred thousand years from now—if we continue using fuel at the present rate. How, then, will man do the world's work? Trains and steamships would stop, since they require coal or oil. A great many of the machines operated by electricity would cease to turn because most electric generators are driven by engines requiring steam or oil. The few that are driven by water turbines would be hardly sufficient for modern purposes. Electric cells and batteries can not do the work. The automobile would be motionless. No airplane could leave the ground. Many homes would be cold, and most factories would be silent. Of course, we should still have the wind and flowing water, such wood as could be had from forests and the fuel that can be manufactured from plants. Yet modern civilization could not get along on these sources of power alone.

Few of us realize how much we depend upon coal and oil. What are these substances and how did they accumulate on and in the earth? The Story of Coal, in Volume 3, and the Story of Petroleum (oil), in Volume 13, answer these questions in detail. For the present it is sufficient to say that coal and oil are the remains of certain plants and tiny animals which lived millions of years ago. These ancient living things used sunshine, just as plants and animals do today. Each time we burn a lump of coal, and each time we "step on the gas," we are using up the energy of ancient sunshine.

The sun is still shining and its energy is being used by living things that could some day form great deposits of coal and oil. But we can not afford to wait for that slow process. A way must somehow be found for putting to use more of the present-day sunshine; or else we must find sources of energy that do not depend upon the sun. Scientists are beginning to make progress in both directions. Let us consider first what might be done to harness the sun for doing some of the work of the world.

Day after day, the sun pours out vast amounts of energy. It is estimated that the earth's surface receives from the sun each year the equivalent of many thousand horsepower for every square mile. If we could make good use of the energy absorbed by even a dozen square miles the threat of a coal-and-oil famine would be banished forever. In the last one hundred years, the minds of many men have been busy trying to solve this problem.

In the year 1866, Emperor Napoleon III of France visited the shop of a French inventor named August Mouchot. In the yard of the shop stood a large, cone-shaped object resembling a huge lampshade. The opening of the cone was directed toward the sun; its inside was lined with a thin film of silver. At the small end of the cone lay a small copper box, blackened on the inside. The Emperor was told that this curious device was a solar engine, that is, a sun engine. The rays of the sun were gathered by the cone and reflected by the silver lining down upon the small copper box which contained water. The heat caused the water to boil. So impressed was the Emperor that he urged his government to support and finance the building of many of these solar engines. Yet, the scheme was not very successful.

After Mouchot came several other inventors of sun engines. All of them used one or more of three important arrangements for collecting the sun's rays—the conical mirror;

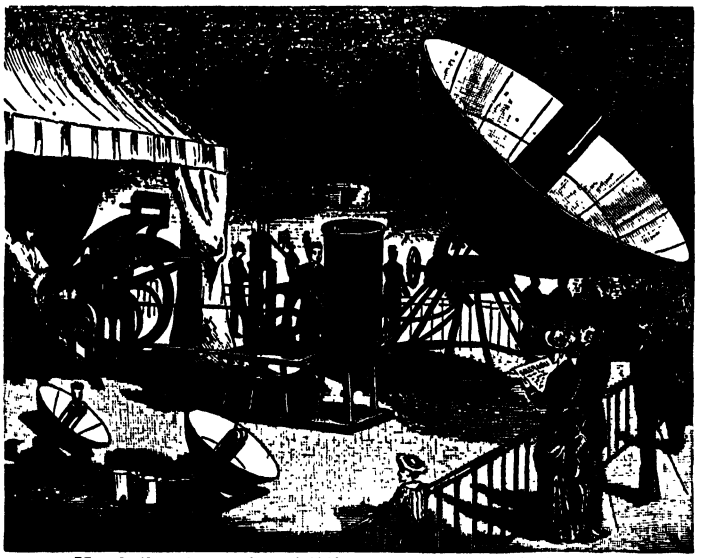
the cylindrical reflector, and the hot-box—an airtight box, black inside, and covered with two layers of glass. Heat waves pass through glass; and black absorbs heat.

A solar engine was set up in the Arizona desert in 1904. It used a cone-shaped reflector and weighed about 8,300 pounds. Seven hundred square feet of sunshine was collected, which boiled water into steam, which, in turn, operated an engine. In 1913 a solar engine erected in Egypt gathered sunshine falling on an area of 13,000 square feet. This engine developed about 55 horsepower every hour. However, the machine proved to be too costly and could not be kept running easily.

One of the most workable solar engines ever built stands atop Mount Wilson in California. It consists of a large cylindrical aluminum mirror that is free to rotate about an axis parallel to that of the earth's. A clock mechanism causes the mirror to follow the apparent motion of the sun. The rays of the sun are focused on three continuously connected oil-filled glass tubes about six feet long. Each of these tubes is covered with two other tubes which enclose a vacuum, so that very little heat is lost by the oil. As the oil gets warm it rises and soon a circulation is set up from the oil tubes to a storage tank and from the tank to the tubes. As this continues in the sunshine, the oil gets warmer and warmer, sometimes reaching a temperature of about 390 degrees Fahrenheit—which is hot enough to bake bread, cook food or boil water into steam for power purposes. Seven hours of sunshine a day are enough to keep the machine going day and night at a temperature near that of boiling water. This machine is sometimes called a sun cooker.

There have been other efforts to make use of direct sunshine. One of the most interesting is to use the sun's heat to produce cold. You are familiar with the type of kitchen refrigerator which is operated by a gas flame. The heat of this flame evaporates a special liquid called a refrigerant. The evaporated refrigerant (now a gas) is then compressed. When the gas is allowed to expand again rapidly, it produces a cooling effect which freezes the ice cubes and keeps the food cold. Similarly, the sun's heat pouring down upon the roof of a tropical bungalow can be made to evaporate a refrigerant which can then keep the air inside the bungalow cool.

Another scheme for making direct use of the sun's energy is to allow it to heat the junction of two pieces of different metals. When this is done an electric current begins to flow in the metals. The current, though small in amount, can ring a bell, light a lamp, or run a motor. The metal junctions are called *thermocouples*. Some years ago a German scientist, by using several thermocouples, succeeded in keeping an electric lamp lit by sunshine for several months. A French scientist has proposed a plant for connecting together half a million thermocouples. The junctions would all be exposed to the sun and the ends would be embedded in concrete, so as to keep them at a lower temperature. In this way, huge amounts of electricity would be obtained. Unfortunately, the cost of building the arrangement would be too great as long as there is still enough cheap coal and oil available for generating electricity.



Mouchot's solar engine of 1866, running a small printing-press.

The most likely use of direct sunshine in the near future is the opening up of desert areas. These regions have plenty of steady sunshine. If this almost boundless energy can be caught by some form of solar engine, it can be changed either into the heat energy of steam or into electrical energy. With energy available, many such deserts can be

irrigated and transformed into fertile farms and gardens. Excess electrical energy can be sent out to other regions which do not enjoy such intense and steady sunshine.

We spoke of finding sources of energy that do not depend on the sun. Men have dreamed for years of using the power of the tides; and successful experiments have been made. The greatest field for power research today is within the atom. Ceaseless activity goes on inside the atom, and an enormous amount of energy is occasionally developed accidentally when atomic particles collide. Some atoms, as you know, are breaking up and giving off (radiating) energy. Radium is one of these elements whose atoms are breaking up. Other atoms can be made to break up. We call the process atom-smashing. For some years atom-smashing has been going on in laboratories all over the world. Not until 1945 was a way found to employ the energy thus created. This use, as you know, was in the terrible atomic bomb. When we can learn how to harness the enormous energy that is now locked within the atom, we can have all the heat and mechanical power, all the electric power and light that we need. But even then we shall be dependent upon the sun for other things.

THE ENORMOUS HEAT OF THE SUN, OUR SOURCE OF ENERGY

The sun is a star some 93,000,000 miles away. It consists of many different layers of gases at a very high temperature. The temperature of the surface of the sun is estimated at about 11,000 degrees Fahrenheit The sun's interior may be 40,000,000 degrees. At these temperatures, molecules of matter could not "hang together." Even atoms break down and their particles may form other atoms. As these changes take place, small bits of atomic matter escape in bursts of heat and light. Though the rays of heat and light travel for 93,000,000 miles before they reach the earth, they can cause a pretty severe sunburn in less than fifteen minutes.

The sun is the basis of our existence and the source of all our usable energy. There are several forms of energy: light, heat, mechanical, electrical and chemical. Each form can be changed into another. The starting point for most of these changes, however, is the light energy which pours down from the sun. You have probably tried to concentrate the light rays of the sun with a magnifying glass or a mirror. The light changes into heat, which can boil water into steam. The steam can turn a small dynamo. Thus the heat energy is changed into mechanical energy. The dynamo generates electricity, showing how mechanical energy can be changed into electrical energy. Electricity can decompose water into hydrogen and oxygen. This is a change from electrical to chemical energy. Aside from certain kinds of chemical energy and the energy within the atoms of matter, all means for carrying on life activities come to us from the sun.

HOW MAN USES HEAT ENERGY TO GET ELECTRICAL ENERGY

The rays of the sun cause the water of lakes, rivers and oceans to evaporate into the air. Later the air moisture condenses and falls as rain, snow or hail. This fills the rivers, which can be dammed so as to store water at a height. When allowed to fall and press against the blades of a turbine or water-wheel, the mechanical energy is changed to electrical energy.

The sun warms the land and the water; but water heats up more slowly than land, and then holds the heat for a longer time. When the land is warmer (during the day) the air over it rises, letting in the cooler sea breezes. When the sea is warmer (during the night) the air over it rises, letting the cooler land air blow toward the sea.

You know that the earth is tilted with respect to its path around the sun. You know that because of this tilt certain regions of the earth receive the direct and concentrated rays of the sun, while other regions receive rays that are slanting and spread thinly over the area. The summer season comes to those parts of the earth which are bathed by direct sunshine, and the winter season arrives when a section of the earth receives the rays slantwise. Regions near the earth's Equator receive rays that are close to perpendicular during the entire trip. Hence such regions enjoy hot summer weather all the time.

Areas near the Poles never receive direct rays, and have periods when they receive no sunshine. So polar regions are always cold.

The fact that certain areas are always warm and others always cold, sets up huge movements of the air. As the earth spins, these air movements are caused to swerve and give rise to the well-known wind belts. It is in these moving air masses that weather conditions start. In a sense, then, the sun is responsible for our weather. It is the sun's energy which heats the land, heats the air, causes the air to rise and evaporates the water into the air. Even the electric storms are due to the sun, because evaporation pro-



Smithsonian Institution
Another kind of solar engine—the flash boiler.

duces electrical charges on the moisture particles and some of the sun's rays help to increase these charges. We owe to the sun our seasons, our climate and our weather.

Light can stimulate the retina of the eye. The eye lens forms an image on the retina and the brain interprets the stimulus as the picture which we see. Certain chemicals are also affected by light. A piece of photographic film contains small grains of a chemical called silver bromide. This silver bromide is colorless and opaque. (Light can not pass through it.) When light strikes the film, the molecules of silver bromide are changed so as to leave a black silver deposit. This is what happens when a camera lens forms an image on the film. Even when you take a snapshot, the momentary flash of light produces an effect on the silver bromide. The effect is later continued when the film is developed and the picture printed.

Contained in sunlight is a kind of ray called *ultraviolet*. This ultraviolet light is colorless and invisible to our eyes, yet it makes its presence known and felt. It is very penetrating, and is responsible for sunburn. This can be observed in the effects produced by the mercury-vapor lamp, which is a rich source of ultraviolet light. While direct sunlight can produce a burn in about fifteen minutes, a mercury lamp can cause a similar, or even more serious, burn in two or three minutes. The nature of skin burning or tanning is quite interesting. The action of sunlight on the skin, or of the ultraviolet light contained in sunlight, is to produce a substance called vitamin D on the surface of the skin. The same vitamin D can be produced in foods, such as milk or oils and fats, by exposing them to ultraviolet light. The process is called irradiation. As you know, vitamin D is necessary if our bones are to grow strong, and it is most important to general good health.

It has been shown that ordinary window glass allows most of the sun's light to pass but blocks the rays of ultraviolet. That is why we are warmed but not burned by the sun in a glassed-in porch, or sun-room. There are special types of glass which permit the passage of the ultraviolet rays. There is room for much further study and improvement in this field.

Every leaf, every blade of grass enjoys a secret which the wisest scientist does not know. For years scientists have been trying to find out how plants make use of sunshine. We know that water and minerals come up from the soil through the roots and stems of plants to the leaves. We know, too, that there are millions of openings on the under surfaces of leaves which let in air containing carbon dioxide. Then, in the presence of a green material called chlorophyl, and while the sun sends down its rays, a chemical action takes place in the cells of the leaves. As a result of this action, carbohydrates are formed and oxygen is released to the air. Carbohydrates—starches and sugars are examples of carbohydrates—are the food which the plant makes for its own use. Then we eat the plants. Thus corn, wheat, fruits and vegetables are the products which plants manufacture with the help of sunshine. They are the food for all animal life, including man. Yet we do not know all we should like to know about the chemical process in the leaf which means so much to our lives.

A GREAT RIDDLE STILL TO BE SOLVED—THE SECRET OF PHOTOSYNTHESIS

Who will solve this mystery and learn the secret of *photosynthesis*, as the chemical process is called? The scientist who succeeds will relieve the farmer of many heavy tasks and uncertainties. He will abolish forever the fear of exhausting the supply of coal and oil. He will have found a way of duplicating nature's own solar engine—the leaf.

It is estimated that one hour of sunshine, falling upon a square yard of leaf surface results in the manufacture of about one gram of carbohydrates. No wonder each plant always turns its leaves so that they catch

as much direct sunshine as possible! In an acre of plants there are about two acres of leaf surface. During a summer's growth, a wheat field may take from the air about eleven tons of carbon dioxide, and with the help of sun energy it will manufacture about seven tons of wheat.

Several scientists have already been able to duplicate the process of photosynthesis on a small scale, in the laboratory. It is as yet too costly for large-scale manufacture. Many are studying the substance, chlorophyl, whose presence is essential to the process. In the Boyce Thompson Laboratory for Plant Research, at Yonkers, New York, some very interesting experiments are now in progress. While the plant's secret is not yet' discovered, some strange results have been obtained.

Marine plant life is also affected by the light and heat of the sun. In the oceans there exists a kind of one-celled plant called the diatom. Diatoms are one-celled plants which, with the help of sunshine, can produce the starch needed for their growth. Small marine animals feed on the diatoms. Larger fish feed on the smaller ones, and so on. Thus the sun maintains ocean life.

The heat of the sun also affects all animal life. In the winter time, in the Northern Hemisphere, the sun is closest to the earth. However, since the sun's rays at this time reach us slantwise and not perpendicularly, little heat can be gathered. This absence of heat and the decrease in amount of sunlight (since the days are short) causes many animals to hibernate, that is, to go into a sleepy state for the winter. Snakes, lizards, frogs, most wild bears, ants and squirrels retire for the winter. If it were not necessary to come out occasionally for food, it is likely that many animals would scarcely be seen during the winter months. As the earth revolves about the sun, and spring arrives, the animals come out of their partial sleep. They become active. Everywhere on the earth animals tend to follow the sun. This is not just accidental. It is necessary for the preservation of their lives.

It is sometimes asked how long could life exist without the sun. Would life suddenly cease, or would there be a gradual decay? As you know, in the far north there is an almost total lack of sunlight for about six months. Does life cease during that time, to be revived with the coming of the sun? No, enough energy is stored away during the dark period to maintain the necessities of life. Animals hibernate and become dormant. Man needs more than just food and shelter. He can not afford to hibernate. Life must go on.

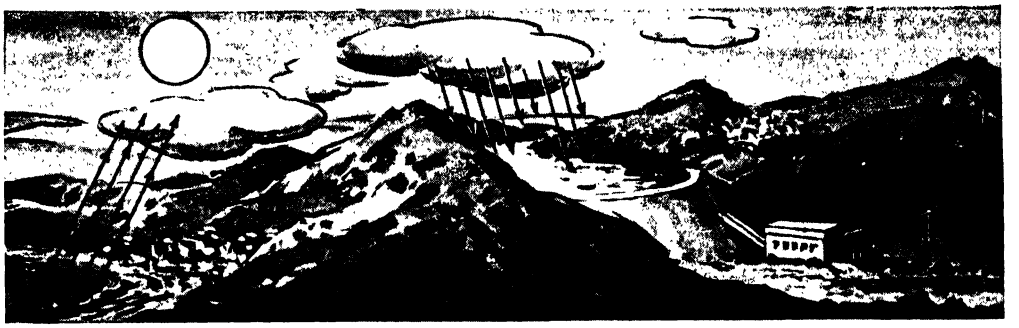
Should the sun fail to make an appearance for a single year the result would be ruinous. Plant life as we know it would vanish and animal life would soon follow.

Is there a substitute for the sun? Can an artificial sun be created? The nearest thing to an artificial sun is artificial ultraviolet light. However, it requires electricity to operate the mercury-vapor lamps, and electricity is dependent upon the sun.

Our debt to the sun is one that can not be repaid. All our lives we are indebted to the sun for food, clothing and shelter. There is only one thing we can do to repay in part this great debt. We can practice *conservation.* This means saving and not wasting. It is true that the sun's energy is apparently endless, yet we must learn to take all we need and yet leave some for succeeding generations. In this sense, conservation means careful and purposeful use. Only in this way can we repay partially our debt to the sun.

By MORRIS MEISTER.

THE NEXT STORY OF SCIENCE IS ON PAGE 1988.



How sun and water produce power. The sun draws water vapor up from the river to form in clouds. Chilled in passing over mountains, the water vapor condenses and falls as rain into the reservoir. Water falling from the dam turns a turbine in the power-house. The turbine causes a dynamo to generate electricity.

THE LATER MIDDLE AGES

AS we pointed out in an earlier article, the Middle Ages may be divided into three periods: the Early Middle Ages, or Dark Ages (476-900), the Feudal Ages (900-1300) and the Later Middle Ages (1300-1500). The period of the Early Middle Ages saw the rise of a new civilization on the ruins of the Western Roman Empire. In the Feudal Ages the system of feudalism was at its height. In the period that we are going to discuss—the Later Middle Ages—the civilization of Europe underwent great changes. By the end of the fifteenth century the Middle Ages were a thing of the past.

In the Later Middle Ages England and France, the two most powerful monarchies



Ladies' table at a banquet in a noble's castle. The masked figures at the right are entertaining the guests.

of Europe, came to blows in one of the longest wars in all history—the Hundred Years' War. It was really the Hundred and Sixteen Years' War, since it lasted from 1337 to 1453, with several long intervals of truce. The war weakened both countries for a time; yet by the end of the fifteenth century they had recovered their strength.

In Spain the various Christian kingdoms were united, and the Moors were driven out of the country toward the end of the fifteenth century. Germany continued to be divided up into a number of practically independent states and cities, acknowledging the lordship of an almost powerless ruler—the Holy Roman Emperor.

The Italians also were divided. By the end of the fifteenth century five powers in Italy stood out above the rest. They were the duchy of Milan, the Papal States, ruled by the pope, the kingdom of the Two Sicilies and the republics of Florence and Venice. Elsewhere in Italy there were a number of smaller republics.

In other chapters of The Book of Knowledge you may read in greater detail about happenings in the above countries and in the other lands of Europe in this period of the Middle Ages.

THE COLLAPSE OF THE FEUDAL SYSTEM IN THE LATER MIDDLE AGES

One of the most important developments of this fascinating period was the gradual collapse of the feudal system. Originally this system had represented the giving and receiving of land, called a fief, in exchange for certain services. The lord, the man who gave the fief, owed protection to the man who received it—the vassal. For his part the vassal owed various kinds of service, including military service.

When feudalism was at its height, a great many people were bound by its laws and customs. The king himself was a feudal overlord, and sometimes a vassal as well. Many a bishop or abbot was a feudal lord, or vassal, or both. Even the serfs, who ranked among the humblest members of society, had a place in the feudal relationship. They and their children after them owed the toil of their hands and some of the products of their fields to the lord on whose estate they dwelt. (See our article on the Feudal Ages.)

THE REVIVAL OF COMMERCE BRINGS ABOUT INCREASED CIRCULATION OF MONEY

In the early Feudal Ages there had not been much trade or commerce, and money was not much used. Lords and vassals alike paid their debts in goods and services rather than in money. But as time went on there was a great revival of commerce in Europe. More and more money was coined to meet the requirements of merchants and bankers.

Now when money became plentiful, many a feudal lord thought it would be a fine idea to give money instead of land in return for military service. In that way he would keep all his lands instead of dividing some of them up among a number of vassals. And so, in the fourteenth century, there arose the system of money fiefs.

MONEY BECOMES MORE IMPORTANT IN THE FEUDAL RELATIONSHIP AS TIME GOES ON

In granting a fief of this kind, a lord would give a vassal a large sum of money. In return the vassal and his followers would give military service for a definite period—six months or a year or five years. Later the lord took a further step. Instead of hiring warriors through a middleman—the vassal—he would hire them directly.

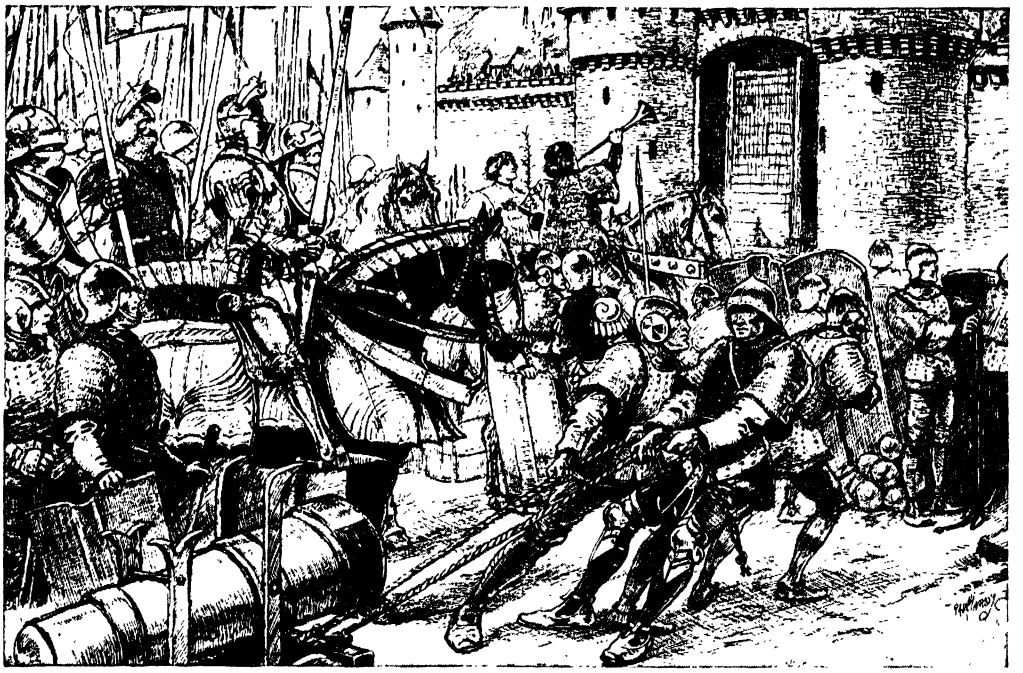
Even in the most flourishing period of feudalism a number of fiefs reverted, or returned, to the feudal lords every year. In some cases it was because the vassals had not fulfilled their obligations; in other cases because they had died, leaving no heirs. In the earlier days of feudalism the fiefs that reverted to the lords were generally assigned to other vassals. But after money fiefs were introduced, once a lord regained a fief, he usually kept it. And so, as time went on, the feudal overlord, or the king, would have fewer and fewer vassals, more and more land.

MANY SERFS ACQUIRE THEIR FREEDOM IN THE LATER MIDDLE AGES

The number of serfs bound to the lord also grew less. Some of the serfs were emancipated, or freed, outright, generally for a sum of money. In other cases emancipation was a gradual process. First, the lord would consent to receive a fixed sum of money yearly from the serf instead of requiring so many hours a week of service or so many bushels of wheat or beans. The serf would still have to remain on his lord's estate. Little by little the lord would give up his control over the serf until at last the man became free.

In some cases a serf would run away from the estate on which he lived and would make his way to some town. If the lord did not claim him within a year and a day, the serf automatically became a freeman.

The emancipation of the serfs was a very long and slow process. In some parts of



Scene at the siege of Calais. This French port, on the English Channel, was captured in 1347 by King Edward III of England after a siege of eleven months. The men in the foreground are bringing up a cannon—a siege weapon which was introduced at about this time. Cannon did much to bring about the downfall of feudalism.

Europe serfdom continued to flourish until long after the Middle Ages; in Prussia, for example, the serfs were not freed until 1807. Elsewhere, as in France, the serfs were freed, but continued to owe certain kinds of service to their former lords. A great number of serfs, however, had been completely freed by the end of the Middle Ages.

As time went on, therefore, there were fewer and fewer people who were bound by feudal relationships. The overlord did not realize that when he bestowed money fiefs or freed his serfs, he was endangering his own standing as the uncrowned king of his domain. He did not realize that the day would come when he would be a king without subjects; which is to say, no king at all.

The position of the feudal lord was also weakened because of a very great change in the art of war. In the high days of feudalism the lord and his knights were supreme on the field of battle. There were archers and pikemen and other foot-soldiers in those days; but they were used in a rather half-hearted sort of way. It was the clash of the mounted knights of the two opposing armies that decided the battle.

But all this changed in the Later Middle Ages. Certain bright military leaders found that they could use foot-soldiers in such a way as to be a match for the haughty knights in armor. They could mass hundreds of pikemen in the front ranks and thus set up a wall of steel that the knights could not penetrate. That is what happened in the Battle of Courtrai in 1302, when the French army was routed by the Flemings. Or else these clever generals could place archers behind an obstacle made up of stakes set firmly in the ground. A band of attacking knights would be slaughtered by a shower of arrows while trying to make their way past the stakes. That is what happened when the English defeated the French in the Battle of Crécy in 1346.

Later, when cannon and muskets became fairly common, the knights had to yield still further ground to the foot-soldiers. Cavalry still continued to be used in battle. But it came to serve more and more as a support to the infantry. It was no longer the backbone of every army.

The lord's castle had been the foundation of defense. Battering rams and catapults and other siege engines could be used against some castles with considerable effectiveness; yet the stronger castles could not be seriously damaged by machines. Many a feudal lord

defied his monarch from the safety of his castle walls.

In the fourteenth century a new type of siege engine was introduced—the cannon. The early cannon were crude affairs. They were apt to do as much damage to the gunners as to the target. But in the fifteenth century they were greatly improved. Castle walls that had defied the battering ram and the catapult could not stand up under the pounding of cannon. By the end of the century the castle was no longer considered a secure means of defense.

And so the feudal lord was no longer the mighty man he once had been. Gone were the days when a charge of his mounted knights would scatter foot-soldiers with ridiculous ease. Gone were the days when he would be safe behind his castle walls.



This helmet was worn by an Italian general of the fifteenth century.

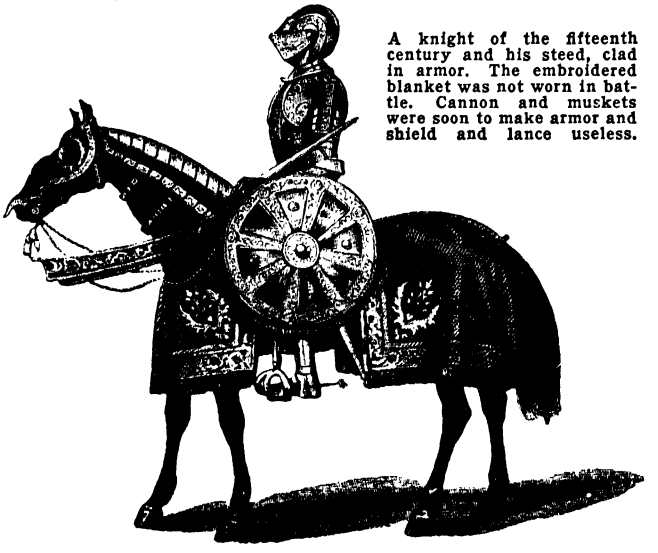
The kings of Europe had been strongly opposed to feudalism for centuries. How could a king be a powerful monarch when he was but an overlord of barons, each of whom was supreme in his own district? In the early part of the Feudal Ages, however, there was not much a king could do about it. Since money was scarce in those days, he received a comparatively small income from his royal domains, not enough to maintain a standing army. So he had to rely on the services of the great nobles to whom he had given fiefs. If, for example, he wished to fight another king or go on a Crusade, he had to call on his feudal vassals for soldiers. If the vassal barons did not want him to be king, he might have to give up his throne, or fight for it.

But when commerce increased and money began to circulate on a large scale, the king was able to increase his income greatly. He managed to find a number of new sources of revenue. He laid heavy taxes on commerce; he raised money from prosperous towns; he obtained contributions from the clergy. He made the nobles pay him in money instead of providing him with military service.

In the course of time the king became more and more independent of the great feudal barons in raising troops and carrying on the affairs of state. He began to maintain large standing armies of mercenaries—soldiers who would serve under any flag for money. The king with his great revenues could easily outbid the nobles for the services of these men.

In the Later Middle Ages the monarch turned against the feudal lords in earnest. By the end of the fifteenth century the kings of England, France and Spain had almost completely stamped out the political power of the barons and had made the crown the real power in the land. The Duke of Burgundy had brought about a similar result in his Netherlands possessions. In northern and central Italy most of the feudal lords had been conquered by the city-states. Feudalism did not disappear from all the lands of Europe. Certain feudal institutions continued to exist in Germany and several other countries; but these institutions did not play a very important part.

The great nobles did not disappear from the scene with the downfall of feudalism. Now that they no longer represented a threat to his power, the king found the barons an ornament to his court. They brought to it the prestige of many generations of noble ancestors. The lesser nobles sank into a condition that in some cases bordered on poverty.



A knight of the fifteenth century and his steed, clad in armor. The embroidered blanket was not worn in battle. Cannon and muskets were soon to make armor and shield and lance useless.

The towns increased in



The Bettmann Archive

Most women of the upper classes in medieval times were expert needlewomen and wove beautiful fabrics. Here we see a group of ladies in a castle of the fourteenth century. The lady at the left is spinning; the one in the center is embroidering; the one at the right is weaving a tapestry—a wall-hanging with a picture.

importance in the Later Middle Ages. Their industries grew by leaps and bounds. Formerly goods had been manufactured in the little shops of master workmen, who belonged to one or the other of the guilds. (See Index, under Guilds.) Each of these master workmen would have only a few apprentices and journeymen, or workmen. But now a single armorer or goldsmith or tailor might have dozens of master workmen working for him. Sometimes a single factory would have a hundred and more employees.

Thus big industries were established in many European towns. The Flemish cities of Ghent and Ypres and the Spanish city of Barcelona were famous for their textiles; Milan and Bordeaux and Toledo, for their iron and steel products; Venice, for her exquisite work in glass and gold. The more prosperous townsmen became large-scale manufacturers and merchants and bankers. Much of the wealth of the country fell into their hands.

The townsmen, or burghers (from the Anglo-Saxon *burh* or *burg*, meaning town or fort), did not fit into the original pattern of feudal society. This society had recognized only three classes—nobles, clergy and peasants. Only two of these classes, the nobles and the clergy, really counted. In the feudal councils summoned by the king only the nobles and clergy were represented. The king would no more have thought of admitting a peasant or a workman to an assembly of this kind than he would have thought of admitting a horse or a cow.

But as the burghers increased in wealth and importance, they could no longer be ignored. They began to be invited to the councils, which were later to become parliamentary bodies. By the early fourteenth century, townsmen were represented in practically all the *cortes* held by the king of Spain. They were also prominent in the English Parliament and the French States-General.

The king called upon the rich burghers to attend his councils chiefly because he needed money and they had it. So they would generally tax themselves liberally; but in return they would demand and obtain a number of privileges. Since the king considered them

as natural allies in the fight against the feudal lords, he showed them great favor in many ways. He chose many of them to administer his affairs and to preside over his law courts.

Only the wealthier townsmen were favored in this way in the Later Middle Ages. The poorer people in the towns—sometimes even the members of the lesser guilds—generally led a dismal life. They made hardly enough to keep body and soul together. The peasants, including the serfs who had become freemen, were also badly off. The feudal lords who rented their fields to the peasants were generally harsh taskmasters; and the peasants were often brutally treated in the cruel wars of those days. The soldiers would trample the fields and steal the food or anything else they saw.

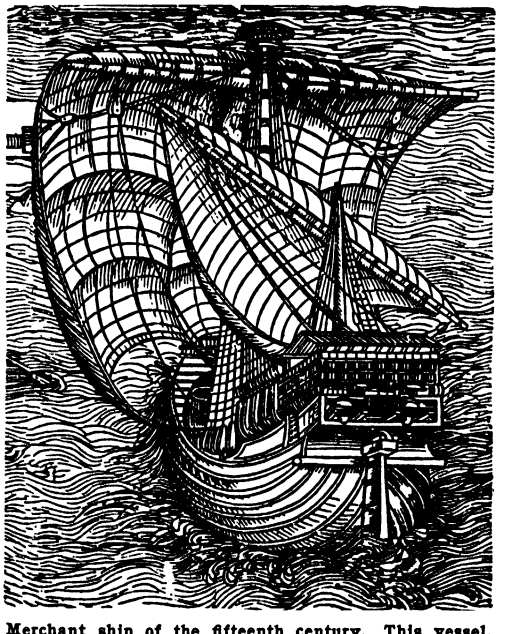
In despair peasants and poor townspeople rose again and again in the fourteenth century. The two worst outbreaks occurred in France and England. The French peasants, driven frantic by the constant pillage of the Hundred Years' War and the harsh treatment of their landlords, turned against their oppressors in 1358 in one of the most terrible uprisings of all time. This was called the Jacquerie (from the French name Jacques Bonhomme, given in contempt to the peasants by the nobles).

The movement spread through vast areas of France; the peasants slew and burned and committed all sorts of outrages. Then at last the members of the nobility gained the upper hand. "The nobles slew so many of the peasants that they became weary at last," to quote the words of Jean Froissart, a French writer of the fourteenth century.



Both pictures, Metropolitan Museum of Art

Medieval houses in Nuremberg, Germany. Town houses were narrow and often had overhanging upper stories, often with workshops on the ground floors.



Merchant ship of the fifteenth century. This vessel, called a galley, used both sails and oars.

In England the Great Revolt, or Peasants' Revolt, of 1381 almost overthrew the government. A mob made up of peasants and of workers from country towns poured into London, where they were joined by many poor Londoners. Under Wat Tyler and other leaders they overcame all opposition. They burned many buildings and slew a number of wealthy people. The king, Richard II, was in great danger until he pretended to be Tyler's friend. The uprising was put down at last with great severity.

There were also revolts in Flanders, Italy and other countries. They reveal strikingly the hopeless condition of the poor in those days. Yet they led to no improvement in the treatment given to peasants and poor workers, whose only hope continued to lie in the generosity of some kindly individual.

Throughout the Feudal Ages the Roman Catholic Church had played a prominent part. It had been recognized as supreme in religious matters; the greatest thinkers of the age had bowed to its authority. It had held



The T. F. Healy Collection

Charles IV, Holy Roman Emperor (reigned 1346-1378), entering Avignon, which was the seat of the papacy from 1309 to 1377. Avignon, now a French city, was then in Italian territory, just beyond the border of France.

in check feudal lords and monarchs alike. It had had charge of education. It had possessed vast lands and great wealth.

In the Later Middle Ages, however, the position of the Church was greatly weakened. Its troubles began toward the end of the thirteenth century, when it came into conflict with two powerful monarchs—Edward I of England and Philip IV of France. Both of these kings decided that the Church must pay taxes to the state. The pope, Boniface VIII, protested. In a famous papal bull, or letter, he declared it unlawful for a state to tax church property. But the kings of England and France made their clergy pay taxes in spite of the papal bull.

From now on Philip was a bitter enemy of the Pope. In 1303 matters came to a head. In September of that year William of Nogaret, an agent of the French king, led an armed band to Anagni, in Italy, where Boniface was staying. They seized the aged Pope and treated him with great brutality. The people of Anagni were very angry and made Boniface's captors release him. The Pope died not long afterward.

In 1305 Philip succeeded in having a Frenchman, the Archbishop of Lyon, elected pope. The new pope, who took the name of Clement V, summoned his cardinals to meet in Lyon, and there the papal court was set up. In 1309 it was moved to Avignon, which is now in France but which at that time was just beyond the border of France, in Italian territory. Thereafter, until the year 1377, the popes remained at Avignon. (One pope, however, went to Rome in 1367 and stayed there for three years.)

The papal court at Avignon was a brilliant one. The palace was filled with chamberlains, councilors, chaplains and diplomatic representatives from all the nations of Europe. Between twenty and thirty cardinals were always in residence at Avignon, and each had a princely establishment. Yet the shadow of the French king hung over all. The popes of this period were all Frenchmen.

Of course it was considered that Rome, the see of St. Peter, was still the real headquarters of the Church. It was the scene of the Church's early sorrows and triumphs; the pope, it was felt, belonged in the Eternal

City. Therefore Church historians give the name of Babylonian Captivity to this period in the history of the papacy. (The phrase Babylonian Captivity refers to the exile of the Jews in Babylon.)

In the year 1377 Pope Gregory XI, who had been elected in 1370, definitely returned to Rome, and the long Babylonian Captivity of the Church was at an end. However, new troubles were in store for the Church. Gregory died in 1378, and was succeeded by an Italian, who took the name of Urban VI. Some of the Cardinals were bitterly opposed to Urban. They declared the papal throne vacant, and they proceeded to elect a new pope—a Frenchman, who was called Clement VII. He set up his headquarters at Avignon. Urban, the valid pope, continued to carry on his religious duties at Rome.

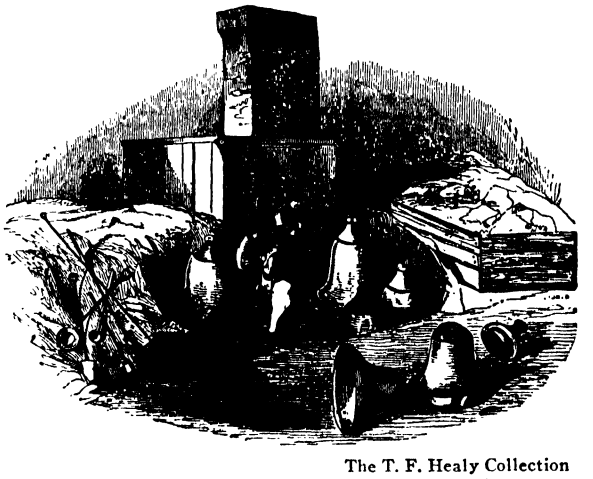
This brought about a split in the Church that is known to history as the Great Schism (siz'm) of the West. It lasted for almost forty years. The Church, which had been so powerful because it had been united, was now deeply troubled by these two factions—and for a while there were three parties. It was not until 1417 that the Schism came to an end with the election of Pope Martin V.

The monarchs of Europe took advantage of the divisions within the Church caused by the Babylonian Captivity and the Western Schism to strengthen their position. As for the heretics—the Christians who did not accept the teachings of the Church—they became much bolder than ever before.

One of the most famous of these heretics was the Englishman John Wyclif, or Wycliffe (died in 1384). Wyclif criticized many of the doctrines of the Church and took the side of the state against the Church on some questions. His followers were known as Lollards (from a Dutch word meaning one who mumbles his prayers). Lollardism was at its height about 1400; it had supporters among all ranks of society. It was stamped out of England by 1417, largely through the efforts of three English kings—Richard II, Henry IV and Henry V.

The Lollard heresy was taken up with great enthusiasm in Bohemia, a Slavic state which pushed into the heart of Germany like a big wedge. Wyclif's writings were eagerly read. His foremost Bohemian disciple, John Huss, or Hus, gained a great number of followers, who were known as Hussites. Huss was tried, condemned and burned at the stake as a heretic, in 1415; but the Hussite heresy did not die with him. His friends took up arms, and in the course of the Hussite Wars that followed (1420-36) much of eastern and central Europe was laid waste. At last the Hussite Wars ended in a compromise.

Because of the long residence of the popes at Avignon, away from Rome, the Great Schism and the Hussites, and the breakdown of feudalism, the authority of the Church had been shaken. One result of this was the growth of a critical spirit. Rome never quite recovered the hold she had had on men's devotion and love.



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A bell foundry of olden times. The big bells shown here were destined for the belfries of churches and other buildings.

Another result of the weakening of the Church's hold on men was the development of a new outlook on life. Hitherto, under the influence of the Church, men had accepted otherworldliness as the ideal way of life. To live up to this ideal fully one had to scorn the things of this earth and fix one's thoughts on higher things, on the things of the spirit.

To be sure, otherworldliness had been for many men an ideal rather than a practical rule of conduct. Throughout the Feudal Ages there were people who busied themselves with worldly pursuits and who sought their happiness here on earth. Yet these worldly people often had an uneasy feeling that they were doing wrong. Some of them, like good St. Francis of Assisi, in time repented of their conduct and turned to the religious life.

But in the Later Middle Ages men began

to turn more and more from the ideal of otherworldliness. Some people, indeed, set up another ideal—the open and frank enjoyment of worldly things. They hailed the delights of great literature, of beautiful works of art, of good food and drink, of fine clothing. Nor did they care whether this kind of pleasure had anything to do with their happiness in the world to come.

The movement that we call the Renaissance, or rebirth, had much to do with this pleasure-loving spirit. The Renaissance was a gradual unfolding of interest in literature and art; it was based in large part on works by the ancient Greeks and Romans. The Renaissance began in the fourteenth century with a revival of interest in the writings and civilization of the ancients.



An incident of the Great Revolt, or Peasants' Revolt, of 1381 in England. This uprising, led by Wat Tyler and others, almost overthrew the Government. Here we see some of Tyler's men burning St. John's Monastery, in the town of Smithfield.

We must not imagine for a moment that the men of the Early Middle Ages and the Feudal Ages knew nothing of classical antiquity. To be sure, the Greek language was all but unknown to the men of Europe during these periods. Only a few men—very few indeed—knew Greek, some because of their contacts with the Byzantine Empire (see our article on the Byzantine Empire). The writings of the Greek philosopher Aristotle, so popular in the twelfth and thirteenth centuries, were not read in Greek but in Latin translations, which in some cases were very bad.

But a number of people knew Latin throughout the Middle Ages and in certain periods the more learned members of the community knew it very well. Most educated men were familiar with various Latin classics, including works by Cicero, Virgil, Horace and Ovid. However, medieval scholars generally studied the works of the great Latin writers as models of pure Latin or for information.

They made little effort to study the background of ancient culture, nor did they enter into the pagan spirit of what they read. In fact, they vigorously condemned whatever they considered contrary to the teachings of the Church. They attacked the belief in gods and goddesses. They also attacked certain worldly tendencies that were to be found in a great many ancient writers.

Under the influence of the Renaissance, some students began to follow the Latin classics and, somewhat later, the Greek classics as guides in the art of living. They began to think more about building beautiful homes, living in luxury, wearing ornate clothes and searching for happiness here upon this earth.

Because of this urge, and because it was the fashion to know more about art and literature, and also because the use of money and the increase in trade were fast increasing the wealth of Italian cities, a wonderful thing happened. A new era began—a time of creative genius, in Italy and later in Western Europe and England. Great masterpieces were produced in writing, sculpture, painting, architecture. The name Renaissance is often given to the whole period

(roughly from the fifteenth century to the seventeenth) though many of the masterpieces produced were not based on ancient models.

We tell you more about this fascinating period in other articles. See Renaissance in the Index.

The Renaissance in literature and art tended to arouse men's interest in the world around them. This interest was heightened as men came to know more about the world in the Later Middle Ages. The geographical discoveries of this period were chiefly due to man's concern with the East—land of wonder and of almost fabulous wealth.

In ancient times men knew of China and India and the Spice Islands. The products of these lands—their precious stones and fabrics and spices—had found their way to the shores of the eastern Mediterranean and from various small towns and cities along these shores to the homes of Roman aristocrats. This traffic had ceased for a time after the fall of the Western Roman Empire in 476. But it had been revived six centuries later by the trading cities of Italy. The Crusades brought the men of Europe in touch with the treasures of the East, and increased the demand for these treasures.



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A musical moment in a monastery of the late fifteenth century. The instrument shown here is a spinet, one of the forerunners of the piano.

Yet the knowledge that men had of the East was still scanty. A great step forward was taken when Marco Polo, a Venetian merchant, told his fellow-Europeans of his travels in the far reaches of the world. He had spent many years in China at the court of the great Kublai Khan, and he had traveled extensively all over the East in the last decades of the thirteenth century.

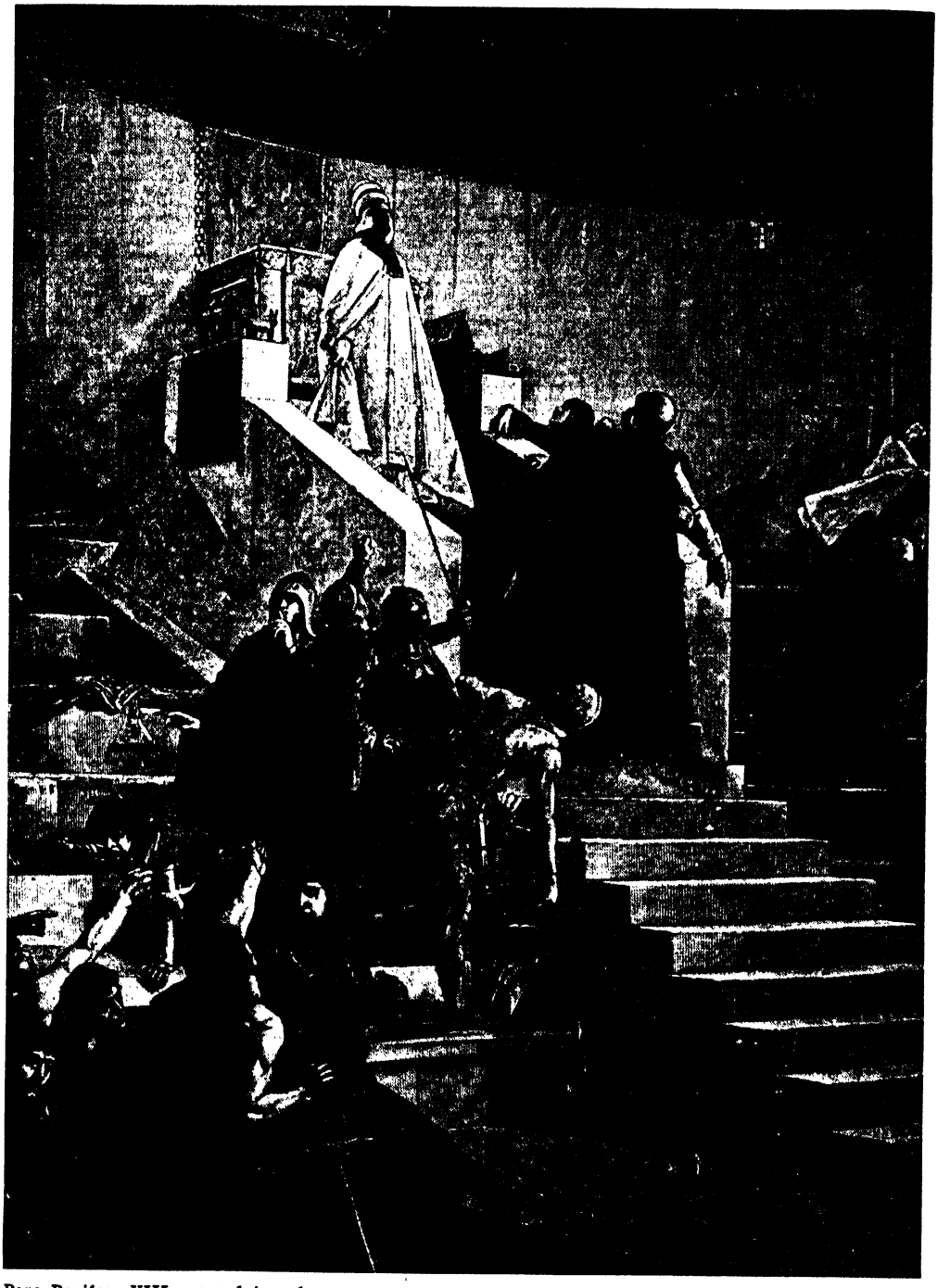
Taken prisoner by the Genoese on his return, he dictated his story to one Rusticiano in order to pass the time away. The narrative, called the BOOK OF VARIOUS EXPERIENCES, was written in French by Rusticiano and was given to the world in the early years of the fourteenth century. Later it was translated into Italian and Latin and other European languages. Copies of the work were scattered far and wide and fired the imagination of men.

The Church also contributed greatly to the knowledge of the mysterious East. In the thirteenth century it had begun to send out missionaries to the lands that lay beyond the Black and Caspian seas. These missionary efforts lasted well into the fourteenth century. The missionaries told of the lands they had visited in numberless reports, letters and narratives.

Thus far men had taken the overland route in their journeys to the distant countries of the East. It had been necessary to brave burning deserts, swift rivers and unfriendly natives in order to reach India or China. Thoughtful men now began to wonder if they could not make the journey to these far-off lands more quickly and in greater safety if they went by sea.

Little by little in the course of the Middle Ages men had come to realize that the open sea was not a dreadful place, infested by huge sea serpents and other terrible creatures, but a watery road that could take them to many distant lands. By the fourteenth century daring mariners had passed through the narrow Strait of Gibraltar and had discovered the island groups that lay beyond—the Madeiras, the Azores and the Canaries. The Portuguese, who had occu-

POPE BONIFACE VIII AT ANAGNI



Pope Boniface VIII engaged in a long struggle with King Philip IV of France over the King's decision to tax the property of the Church in France. In September, 1303, Philip's agent, William of Nogaret, led an armed band to Anagni, in central Italy, where the Pope was staying. William and his followers seized the Pope and held him in captivity for several days. At last the inhabitants of Anagni made the Pope's captors release the aged pontiff. But the experience had so broken his health that he died a few months afterward. A few years later the seat of the papacy was moved from Rome to Avignon, which was then near the French border.

pied the Madeiras and the Azores, now began to make their way down the western coast of Africa.

In the year 1486 the Portuguese navigator, Bartholomew Diaz, rounded the southernmost tip of Africa—the Cape of Good Hope—and sailed up the eastern coast as far as Zanzibar. Twelve years later another Portuguese, Vasco da Gama, made his way around the Cape of Good Hope, went north as far as Zanzibar, sailed east across the Indian Ocean and landed at Calicut. The sea route to India had been opened at last.

In the meantime a mariner from Genoa, Christopher Columbus, had proposed another route to the Indies and the land of Zipangu (Japan). Like most navigators of the day Columbus realized that the earth was round and that India and Japan lay on the other side of the globe from Europe. He thought, therefore, that he could reach these lands if he sailed west across the Atlantic instead of going around the Cape of Good Hope. His reasoning was sound enough; but he did not realize that the twin continents of the Americas barred his way to the lands of India and Japan.

We tell you elsewhere how Columbus obtained the help of Queen Isabella of Spain; how he set sail at last; how he landed in an island of the West Indies, firmly convinced that it was an East Indian island; how he then made his way to Hispaniola, which he thought was Japan. Though Columbus made three other expeditions to the lands that lay in the Western Hemisphere, he never realized that he had not carried out his original purpose of finding a sea route to the East. (See Men Who Made the World Known.)

By the first years of the sixteenth century, however, the men of Europe had come to realize that to the west there lay a New World—a vast and immensely rich land—that was theirs for the taking. Explorers and colonists and adventurers from different lands and from all ranks of society began to set sail for this New World.

And so by the end of the fifteenth century a great break with the past had taken place. Feudalism had collapsed; strong central governments had been set up in a number of European countries. The authority of the Church had been weakened. The Renaissance had brought about a new outlook on life. Great geographical discoveries had widened the horizons of men. By the beginning of the sixteenth century the door of history had closed upon the Middle Ages. (See the chart on pages 1986 and 1987.)

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 2096.



The Bettmann Archive

The Hussite leader John Ziska and his generals on the eve of battle. In 1415 the beloved Bohemian religious reformer, John Huss, was burned at the stake, though Emperor Sigismund, whose domains included Bohemia, had promised that no harm would come to him. Huss's followers, called Hussites, took up arms against the Emperor. In the fierce fighting that followed, Ziska won fame as a military leader. He died in battle in 1424.

	ENGLAND	FRANCE	GERMANY
1300		1302. First meeting of Estates General.—Flemings defeat French at Courtray. 1306. Jews expelled from France.	
	1307-27. Reign of Edward II.	1307. Knights Templar arrested by order of Philip IV.	
			1309. Teutonic Knights establish headquarters in Prussia.
	1314. Scots defeat English at Bannockburn.		1314-47. Reign of Louis IV, emperor of Holy Roman Empire. 1322. Louis IV defeats rival emperor at Mühldorf.
1325	1327-77. Reign of Edward III.	1328-50. Reign of Philip VI; first Valois king.	
	1337. Opening of Hundred Years' War between France and England.		
	1346. English defeat French at Crécy.		1346-78. Reign of Emperor Charles IV.
1350		1350-64. Reign of John II. 1356. English defeat French at Poitiers; capture King John II. 1358. Jacquerie (revolt of peasants). 1364-80. Reign of Charles V.	1356. Golden Bull of Charles IV establishes definite method of electing emperor.
			1370. Hanseatic League signs treaty of Stralsund with Denmark, and reaches height of its power.
1375	1377-99. Reign of Richard II. 1381. Peasants' Revolt.		
	1399-1413. Reign of Henry IV; founds Lancaster dynasty.		
1400		1407. Burgundian and Armagnac parties in open civil war.	
	1413-22. Reign of Henry V.		1410. Teutonic Knights defeated by Poles and Lithuanians at Tannenberg.
	1415. English defeat French at Agincourt.		
	1420. Treaty of Troyes; Henry V of England becomes regent of France and heir to throne.		1419-36. Hussite Wars.
	1422-61. Reign of Henry VI.	1422-61. Reign of Charles VII.	
1425	1429. Joan of Arc raises siege of Orleans.		
		1429. Charles VII crowned at Reims.	
		1431. Joan of Arc burned at stake at Rouen.	
	1436. Charles VII recaptures Paris from English.		1440-93. Reign of Emperor Frederick III; last emperor to be crowned at Rome.
1450	1450. Rebellion of Jack Cade.		
	1453. Bordeaux, last English stronghold in France, falls; end of Hundred Years' War.		
	1455. Beginning of Wars of Roses. 1461. Earl of Warwick drives Henry VI into exile; Edward IV becomes king.	1461-83. Reign of Louis XI.	1466. Peace of Thorn; Poland annexes West Prussia.
1475			
	1485. Henry Tudor defeats and kills Richard III at Bosworth Field; becomes king, under name of Henry VII, and founds Tudor dynasty.	1477. France annexes Burgundy. 1481. France annexes Provence. 1494. Italian expedition of Charles VIII.	1493-1519. Reign of Emperor Maximilian III.
1500			

SPAIN	THE CHURCH	OTHER IMPORTANT DATES	
	1303. Pope Boniface VIII imprisoned at Anagni at command of Philip IV of France.	1302. Robert Bruce crowned king of Scotland.	1300
	1309. Pope Clement V fixes seat of papacy at Avignon; here popes remain for almost seventy years. 1312. Clement V abolishes order of Knights Templar.		
1326. James II of Aragon annexes Sardinia.			1325
1340. Alfonso XI of Castile defeats Moors at Salados.		1328. Independence of Scotland recognized by Treaty of Northampton.	
		1348-50. Black Death (bubonic plague) rages in Europe.	
1350-69. Reign of Peter I (the Cruel), king of Castile.			1350
1367. The English "Black Prince," Edward, defeats enemies of Peter the Cruel at Nájera.			
	1377. Pope Gregory XI returns to Rome. 1378. Rival popes claim supreme authority; beginning of Great Schism.		1375
1385. Portuguese defeat Castilians at Aljubarrota.		1386. Swiss defeat Leopold of Styria at Sempach. 1396. Turks defeat Sigismund of Hungary at Nikopol. 1397. Union of Colmar: Denmark, Norway and Sweden united under Queen Margaret of Denmark.	
	1409. Council of Pisa.		1400
	1414-18. Council of Constance. 1415. John Huss burned at stake for heresy.		
1416-58. Reign of Alfonso V, the Magnanimous, king of Aragon.	1417. Great Schism comes to an end.		
			1425
	1431-49. Council of Basel.		
1435. Alfonso V of Aragon defeated and captured by Genoese in sea battle of Ponza.	1439. Union of Latin and Greek Churches decreed at Council of Florence.	1444. Turks defeat Hungarians at Varna.	
1442. Naples is annexed to Aragon.			
		1450. Francesco Sforza becomes duke of Milan. 1453. Turks take Constantinople, overthrowing Byzantine Empire.	1450
1465. Isabella becomes queen of Castile.		1456. Gutenberg prints "Mazarin Bible" at Mayence.	
1469. Prince Ferdinand of Aragon marries Isabella.		1462. Ivan III becomes grand prince of all Russia.	
			1475
1479. Ferdinand inherits crown of Aragon. He and Isabella become the "Catholic king and queen of Spain."		1476. Swiss defeat Charles the Bold of Burgundy at Granson. 1486. Diaz rounds Cape of Good Hope.	
1492. Moors surrender Granada, thus ending their rule in Spain.—Jews are expelled from Spain.		1492. Columbus discovers America. 1498. Vasco da Gama reaches India.	
	1493. Pope Alexander VI issues bull dividing the New World between Spain and Portugal.	1499. Peace of Basel: Switzerland becomes practically independent.	
			1500



THE KEY TO THE DOOR OF SIGHT

YOU are standing at a window in a country house on a winter night. There is a bright moon in the sky. Its light shines down upon the snow, making the snow look almost purple. Yet you know the moon itself has no light; and you know that by day the snow looks white. You can follow the path of a moonbeam, from the sky, through your window and across your darkened room.

You draw the shade, a thin curtain of dark cotton cloth; and now you can not see the moon. The light which passes so easily through firm, rather thick glass is stopped by thin cloth. It is stopped by your eyelids.

No man has ever been able to explain fully moonlight or sunlight, or any other kind of light. For thousands of years men have known that light can pass through some materials and not through others. They knew that light has some relation to color and to heat; and, in fact, they knew a good deal about the way light acts. But no one could answer with complete satisfaction the question—What is light?

The ancient Greek Pythagoras thought that tiny particles streamed into the eye and somehow caused us to see. A hundred years later Plato thought that light might be a "divine fire," streaming forth from the eyes, and joining with streams from the sun and moon, and other light-giving objects. Aristotle, pupil of Plato, wondered whether light might be a strange power, or quality, that traveled through a substance, or medium, which his followers called the "pellucid" (from the Latin *per,* through, and a *lucere,* to shine).

Sir Isaac Newton, more than two thousand years after Pythagoras, inclined to the idea of tiny particles traveling at great speed. Christian Huygens, who lived at about the same time as Newton, developed Aristotle's medium into a mysterious something without weight or appearance or odor—he called it the ether, and he thought that the ether must spread through all space in the universe. Huygens thought that light is a wave-like motion of the ether. We shall come back to the beliefs of Newton and Huygens later in this article.

Let us now examine some of the ways in which light behaves. Here we shall be more at home. We can see for ourselves how light behaves; and after following the observations of the scientists we may then understand how they have come to their theories about the nature of light. As we have stated in earlier chapters of this department, science marches forward on stepping-stones of newly discovered or proved facts. If new

facts disprove an earlier theory, the theory must be changed or discarded.

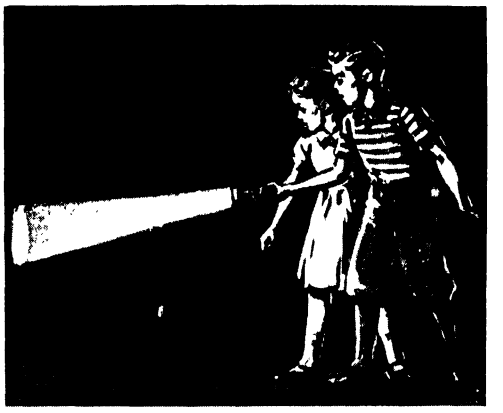
Light Travels in a Straight Line

You have seen the beam from a searchlight, or from a flashlight, cutting a path through the night. A moonbeam across a lake will do the same thing. From the headlights of your father's car, lines of light shoot straight forward into the darkness. They do not go around a curve or turn a corner. (There are, however, very special flashlights, such as those made of Lucite, a plastic, which do carry light around corners or in a spiral.)

We call a very narrow line or thread of light a ray. A number of rays together make a beam. If light is made up of tiny grains, or corpuscles, traveling at great speed, then a ray is a row of corpuscles moving forward, each one on the heels of the one before it. If light is a wave-motion in a medium, then a ray is the path taken by a fraction of the wave as it moves forward.

When any object gets in the way of a beam of light, a shadow is cast the other side of the object from the light. When the shadow of a tree points east, the sun is in the west, and you know it is afternoon.

Light a candle or lamp and set it on a table or shelf so that the light shines over your shoulder upon a screen of white paper. Now hold a ball between the light and the screen. What do you see? Yes, a dark, round shadow on the screen. Still holding the ball, move back from the screen. Now there are two shadows, a dark one in the center and one less dark around it. The black part in the middle, from which all light is excluded, is called the umbra, the Latin word for shadow. The gray part is called the penumbra, or almost a shadow.

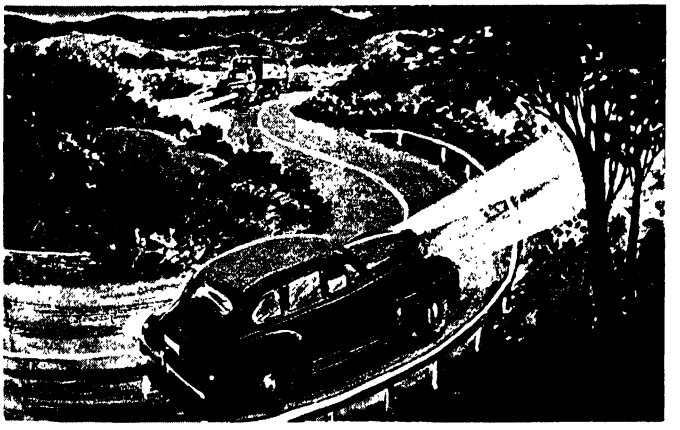


When you direct a flashlight beam onto the wall, the light travels in a straight line; it does not bend.

Eclipses are shadows caused in this way. Consider an eclipse of the moon. The sun is the candle, or lamp. The moon is the screen. When the moon gets in the earth's shadow, it is blotted out, or eclipsed.

As the earth wheels its way through space, one side of it faces the sun; the opposite side sends a long shadow outward into space. The shadow consists of a deep part, or umbra, and a penumbra.

Now consider the sun's eclipse. This happens when the moon comes directly between the sun (the candle, or lamp) and the earth (the screen). During an eclipse you can see the shadow of the moon passing over the sun. It is never quite big enough to cover the sun entirely; there is always a rim of sunlight around the outside of the moon's shadow. Total eclipse is caused where the umbra falls on the earth; partial eclipse results when the penumbra falls.



A ray is a very thin line of light. When a number of rays are bunched together, they are called a beam. Like all light, beams from a car's headlights do not bend around curves; they travel in a straight line.

How Do We See?

When we look at the sun, or a candle flame, or an electric lamp, or any other source of light, we see light. We may not understand light, but we know that we are seeing it.

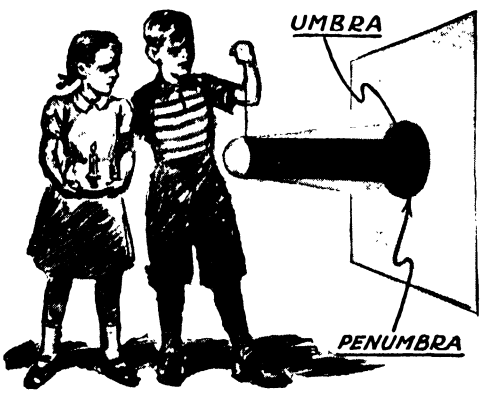
But now let us look at a table or a chair or a book, or any other object that is not a source of light. If you are to see it, light must fall upon the object and be returned from the object into your



Whenever something gets into the path of light rays, there is a shadow formed behind it. If the shadow of the tree falls east, the sun must be in the west.

eyes. At the back of each eye is a screen, the retina. The light from the table or chair or book is thrown upon that screen, and the screen sends a picture message to the brain. The brain has received a true image of the object. This is vision, or seeing.

Light behaves differently when it falls upon different kinds of objects, depending on the way they are made, and what they are made of, and depending on the light itself. Sunlight, and most other light that we see, is a mixture of rays; and the different rays behave differently.



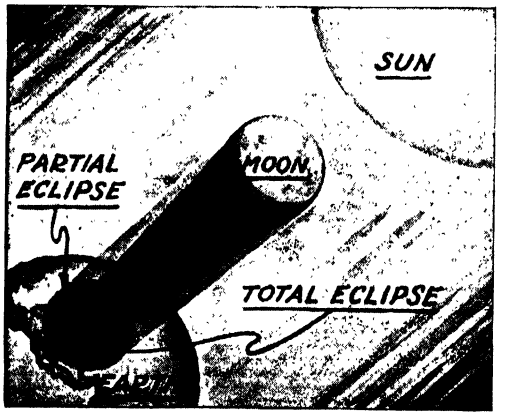
The shadow is formed because the ball is in the path of the candlelight. The center of the shadow (umbra) receives no light; the rest (penumbra) receives some.

Absorption of Light All objects absorb, or swallow up, some of the light that falls upon them. Dark-colored objects absorb more, pale-colored objects absorb less light. They all send back some rays to our eyes; otherwise we would not see them.

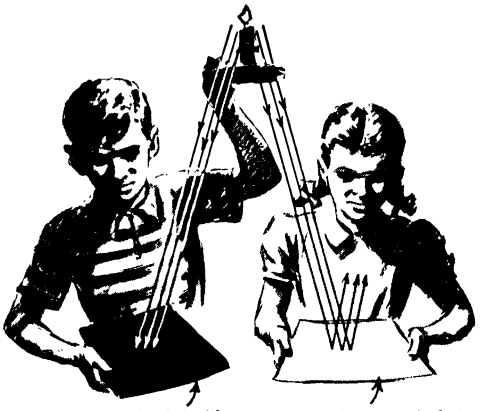
Reflection of Light We call the rays that are sent back reflected rays. Some objects, those which are not very smooth, reflect the light from all the little humps and valleys in their surfaces. As the rays bounce back they collide against one another, and are scattered, or diffused. The image which reaches our eyes is soft. The bark of a tree, most cloth, a carpet and the garage door are examples of surfaces that send back diffused light. Of course, even on such bumpy surfaces, extremely strong reflected light may seem sharp to our eyes.

The surface of a mirror is highly polished, and therefore the light-rays after reflection remain in the same direction and give a clear image. Glass, an oily or watery surface and smooth metal are good reflectors.

Let us study reflection a little more carefully. The light-rays hit a mirror. A few are absorbed, the others bounce sharply back, and we gain a real image of the mirror. But that is only half the story. You know that you can "see yourself" in a mirror, or in a pan of still water, or a pond, or a brightly polished metal plate. You stand in front of the mirror or metal plate, but you seem to be standing behind it. You lean over a pond, and you seem to be looking up from below the surface. The rays of light that reach your eyes seem to come from behind the mirror, or from down in the pond. Actually, this is what happened. Rays of light from the sun struck your face and some of them were reflected. The reflected rays struck another reflecting surface and were re-



The diagram shows an eclipse of the sun. Here, the moon is interrupting the sun's rays before they hit the earth. In the black area (umbra) we have a total eclipse, in the gray (penumbra) a partial eclipse.



Because black material absorbs light, and white material reflects it, we are cooler in hot weather when we wear white or light-colored clothes.

flected once more. This time they entered your eyes, and you saw an image, but not a direct, or real image. It was an unreal, or virtual, image.

The image seems to be as far behind the mirror as the object is in front of it. You can note this for yourself. Stand before a mirror. Back away; the image seems to move farther off behind the glass. Step forward, and with every step the image comes up a step toward, as it seems, the back of the mirror. Bright and smooth surfaces like a mirror are good reflectors.

The ray that strikes a reflecting surface is called the incident ray. The angle at which it meets the surface is called the angle of incidence. As the ray bounces back it is called the reflected ray. The angle at which it bounces back is called the angle of reflection. *The angle of incidence is always equal to the angle of reflection.*

Refraction of Light

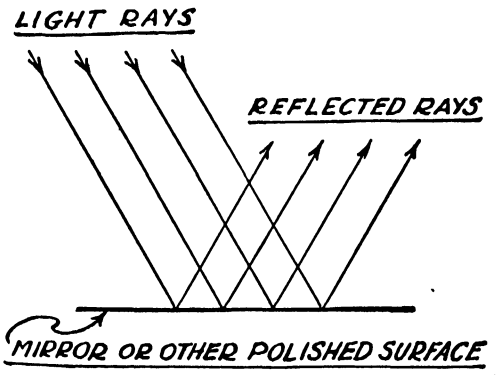
All objects, as we have said, absorb part of the light that falls on them; and all objects reflect part of the light. In addition there are materials that permit some rays to pass through. When light meets glass, water or cellophane, many of its rays will go through without stopping, but they will change their course. The rays will be bent. This happens when the rays go from one medium to another that is more dense, or less dense. Water and glass, of course, are more dense than air.

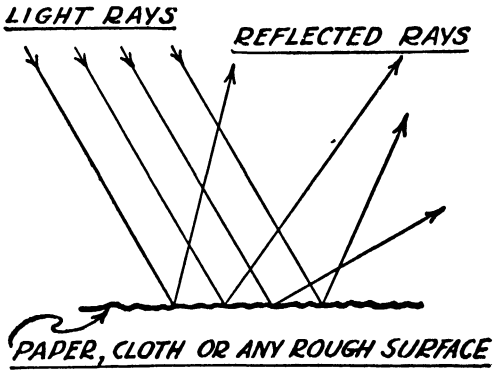
When your bar of soap is at the bottom of your bathtub, you do not "see" it where it actually lies, but farther up. Light passing from a less dense to a more dense medium (air to glass or water) is bent "toward the perpendicular." In passing from a more dense to a less dense medium (water to air) the light is bent "away from the perpendicular." See pictures at top of page 1993.

The bending of light-rays is called refraction. The eye does not take account of refraction; the rays appear to be traveling in a straight line. But try this—hold a stick of wood in water, so that part of it is in the air, and part in water. What happens? The stick appears to be broken, or bent.

As you know, the density of air is almost constantly changing. Hot air is less dense than cool air; and this gives rise to some interesting light effects. The shimmering look of objects along a road on a hot day is due to refractions of light-rays traveling through different layers of atmosphere.

A desert mirage is formed in this way. Rays from distant objects when traveling through changing air temperatures are re-





A smooth object presents a surface that is the same all over; light hits each part at the same angle and is reflected at that identical angle. On a rough object, the little hills and valleys present varying surfaces to the light; the rays are reflected at many different angles. We say this light is diffused.



Seeing yourself in a pond shows how light can be reflected from your face to the water, and back to your eyes. The image is called virtual, or unreal.

fracted. An unreal image is formed. Travelers in the desert have followed those illusions, or mirages, until they dropped dead from exhaustion.

The opposite effect is sometimes observed in the ocean. Unreal images that appear to be floating upside down in the sky are formed of objects on the surface of the ocean.

The sun appears to set later than it really does, due to the refracting of the rays in the atmosphere, which becomes denser the nearer to the earth it lies.

When light is refracted by passing from one medium to another, some reflection also takes place. In other words, at the edge of the new medium some rays are refracted, others are bounced back, or reflected. Rays going from a dense medium, striking the edge of a rare (less dense) medium, may not be refracted at all, but may bounce back into the dense medium. This is total reflection.

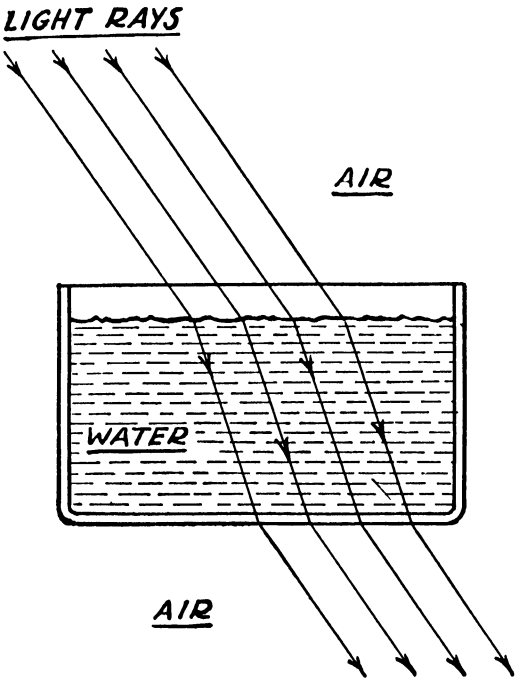
A substance that allows light to pass through freely is called transparent. Glass, water and the atmosphere are transparent.

Many substances allow some light to pass through, but not enough so that we can see forms and colors through them. We call these substances translucent. Alabaster, a teacup of thin china and certain gems are translucent. Ordinary glass is transparent, but frosted glass is translucent. In fact, every transparent substance can be made translucent by roughening its surface, so as to scatter the rays that strike. Ice is translucent. The little ice crystals are of irregular shape, and light in passing through them is reflected and refracted—in different directions—some light is even absorbed—and so we do not get a good image.

SOMETIMES YOU CAN SEE YOURSELF IN A GLASS WINDOW JUST AS IN A MIRROR

You have probably observed that a window makes quite a good mirror if there is darkness on the other side of it. This is why. Glass is transparent, but some of the light which falls on it is always reflected. When hardly any light enters from one side, the reflected rays from the lighted side become prominent; and so we get a virtual image of the objects in the room.

This "double nature" of glass is used by magicians in their disappearance acts. A large glass plate is put across the stage (it will not be seen if its edges are invisible). The "disappearing" object is placed behind the plate. As long as that part is illuminated it will be seen; but if only the front of the stage is illuminated and the part behind the





Left—Light rays are bent, or refracted, when they pass from air to water to air again, as shown above. This is explained in the text. Right—The part of the stick that is in the water appears bent, due to refraction of light.

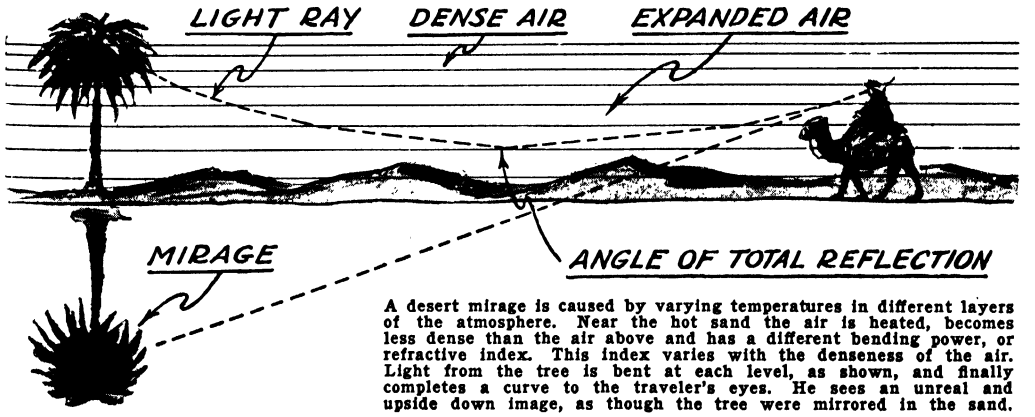
plate is darkened, only the light reflected by the glass plate will be seen and the object will have disappeared.

A substance that does not permit any light to pass through, but absorbs and reflects all of it, is opaque. A mirror, a brick wall, a black coat, a tree trunk and a turquoise are opaque.

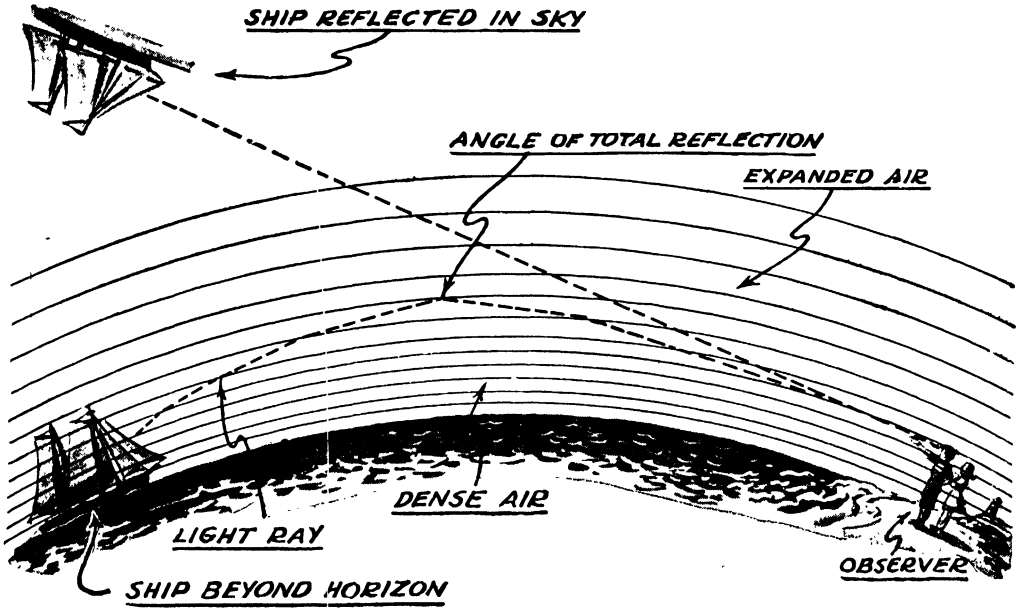
We have seen that clear glass is transparent, since it allows much light to pass through; but ordinary clear glass is also opaque to certain rays. Some of these rays are valuable for the health of animals and plants, since they provide vitamin D. Special glass can be made that permits these rays (ultraviolet rays) to pass through. Plants grown near windows made of such glass will thrive better than plants grown behind ordinary glass.

Now, having observed some of the ways in which it behaves, we ask again: What is light?

At the beginning of the last century there were two opposing theories which claimed to answer the question. One was the Corpuscu-



A desert mirage is caused by varying temperatures in different layers of the atmosphere. Near the hot sand the air is heated, becomes less dense than the air above and has a different bending power, or refractive index. This index varies with the denseness of the air. Light from the tree is bent at each level, as shown, and finally completes a curve to the traveler's eyes. He sees an unreal and upside down image, as though the tree were mirrored in the sand.



Sometimes you may see the image of a ship in the sky when you can not even see it over the horizon. In this case layers of warm, less dense, air are above the cool air; light is bent as shown, and a false image is seen.

lar Theory of Newton. According to it, corpuscles (the word means little bodies) are shot off from the object to be seen and enter our eyes. They transmit energy, as stones do when thrown by boys; much of this energy is heat energy. The corpuscles will travel only in straight lines. When they strike an object some bounce off again—they are reflected. Others enter the object and stay there—they are absorbed. When they hit a transparent substance some corpuscles pass through it; but if the new substance is denser, the light corpuscles are slowed down by the thicker crowds of molecules in the heavier material, and they seek a shorter path. If the new substance is less dense, the light corpuscles get a spurt of speed, and they can spread out, so they take a longer path. So far, the Corpuscular Theory gives a satisfactory explanation of the nature of light.

However, let us take a closer look at the Wave Theory of Huygens. Imagine an airplane flying over a large, still lake. The water is perfectly smooth. Into the center of the lake a stone falls from the plane. The stone violently pushes aside enough water to let itself pass through. The water is pushed out in a ring, and pushes against more water, in a wider (but less violently disturbed) circle. That circle, pushed from behind, pushes against water ahead, and so we see circle after circle pushing outward from the place where the stone dropped. Each circle is wider than the one before, but weaker in its push. While these widening circles are forming, the stone has passed through, and the water displaced by it has flowed back. Now the push is removed from the second circle, and that water flows back. And so it goes—a forward and backward flow, from the center to the outermost rim. The outermost rim will be the weakest one in force, or energy.

A large stone dropped into the lake will cause large ripples, or waves; a small stone will cause small ripples. Waves can be of any size, depending on the first push.

That is a picture of Huygens' Wave Theory of light. The stone cast into the water stands for the source of light, the water-waves stand for light-waves, big and little. The length of a light-wave is the distance between two crests, or high parts. Now you see why Huygens invented the ether. There had to be some substance for the light energy to push against.

Suppose there is a buoy floating in the lake. The advancing water-wave will travel to the buoy and nudge it—unless the wave-length of the ripples is so small that the nudge is too slight to be noticed, or unless the wave-length is so long that the crest is formed on the other side of the buoy. In

somewhat the same manner, very short and very long light-waves fail to make an impression on the human eye.

If light is a wave, here is what happens in the case of reflection. A line of advancing wavelets along a ripple is called a wave front. As part of a wave front hits a reflecting surface at an angle, it bounces back; the next part hits and bounces back, and all the following parts, until finally the whole wave front has been reflected.

LIGHT ACTS LIKE A MARCHING ARMY IN THE WAVE-THEORY EXPLANATION OF REFRACTION

Here is what happens in the case of refraction. When the wave front meets a transparent medium, it passes through. When it meets a more dense transparent medium it slows down and swerves around. Consider an army of soldiers passing from smooth ground to rough land. In the same length of time the men on the rough ground will travel a shorter distance than the men on the smooth ground. They slow down, yet they are not permitted to change the length of their stride. So they quickly seek a shorter path; and the whole column swerves toward the perpendicular—which is the shortest way through the rough field. The opposite thing happens in passing through a less dense medium; the column gains speed, and swerves to a longer path, away from the perpendicular.

Thus Huygens' Wave Theory explains some of the ways in which light behaves, and Newton's Corpuscular Theory explains others, but neither explains all. Newton himself seems to have known that his theory did not tell the whole story. He wondered whether light might consist of corpuscles traveling in a wave-like motion.

The score of both theories was 1:1 when new facts were discovered.

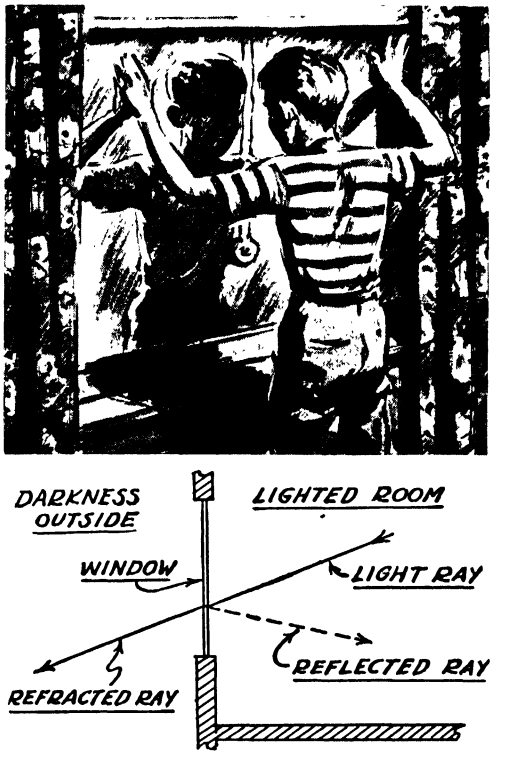
Light from a candle or other source is allowed to go through a hole P in a screen. Then it is allowed to go through holes A and B in a second screen, and from there to fall on a third screen so that the lights from A and B overlap. The third screen will show alternate bands of light and darkness.

See the picture on page 1997. This curious effect is not explained by the Corpuscular Theory, but is explained by the Wave Theory. Imagine the waves resulting from dropping two stones a little distance apart in a pool. There will be points where the crest of one wave meets the hollow of another. At such a point there will be no light. There will be interference. At other points, two crests will meet and reinforce each other. At such a point there will be light.

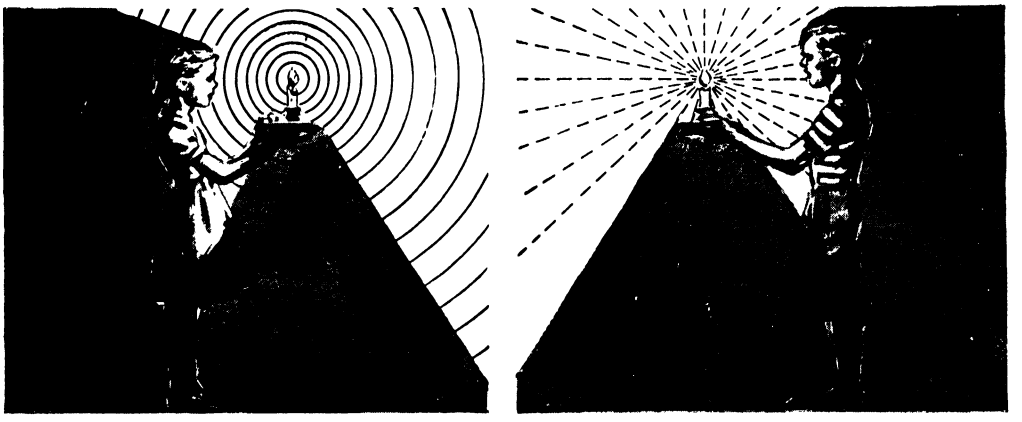
Another curious effect, called diffraction, was known even at the time of Newton. When a narrow beam of light is sent through a small hole, the light will spread out a little, but not very much. Why does it not spread out until the whole room is lighted? The answer is—interference of light-waves at the sides of the beam.

Until about 1675, people believed that light is instantaneous—that is, seen at the very instant it is sent out. But the Danish astronomer Ole Roemer proved that it takes time for light to travel. He set the velocity at 192,000 miles per second. Later, more exact experiments were made, by Jean Bernard Léon Foucault and by Albert Abraham Michelson. The speed of about 186,000 miles per second is now accepted by scientists for light traveling through space, a little less for light traveling in air. Foucault found that the speed of light in water is only three-fourths that of its speed in air.

After these experiments, it seemed that the Wave Theory must be the true explana-



If there is no light from outside, the inside light that is reflected by the glass is strong enough to produce an image. Thus, the boy sees himself.



Left—Light from the candle is spreading out according to the Wave Theory, just as waves of water flow when you throw a stone into a pond. The "water" for the light waves is called ether. Right—The Corpuscular Theory says that light energy is transmitted by little bodies (corpuscles) which shoot from the candle to our eyes.

tion of light. However, there was still a difficulty. A wave is the pushing forward and flowing, or springing, back of particles in a substance. Water-waves need water; sound-waves need air or some other substance. (If you ring a bell in an airproof box, you can hear nothing. The clapper of the bell will beat against the sides, the sides will tremble, but no vibrations will travel to your ears.)

Light, however, does travel in a vacuum. We know that the earth's atmosphere thins out into "empty" space some miles above the earth; yet light from the sun and other stars and reflected light from the other planets travels enormous distances through space. If light is a wave—the pushing forward and flowing back of particles—what are these particles? Huygens, as we said, invented a peculiar substance called the ether. It had no weight; it exerted no force, it was perfectly elastic; it was invisible; it existed everywhere, throughout all space, where there was no other substance. You can imagine that such a substance could not be proved. People again began to doubt the Wave Theory of light.

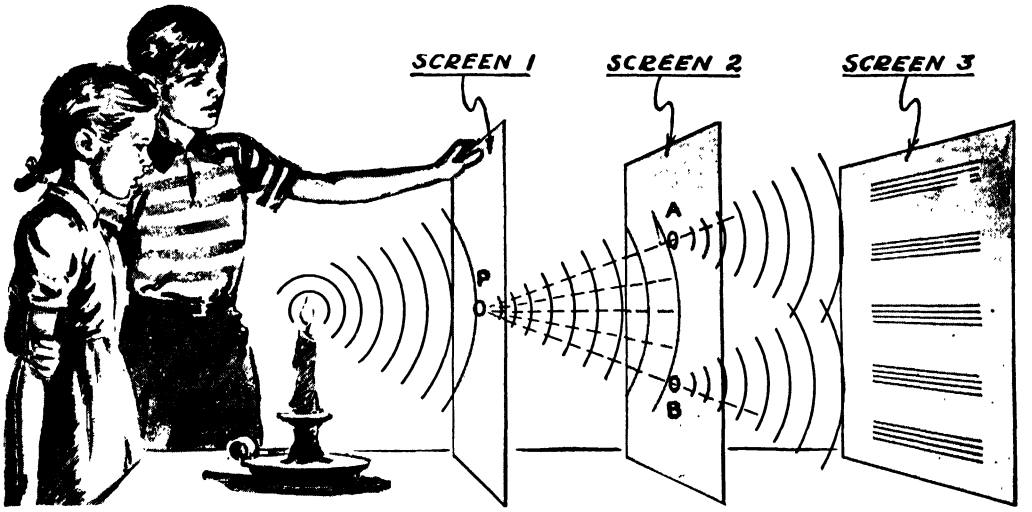
Then came studies in another field, the polarization of light.

Imagine two little girls playing with a rope. The rope can swing sideways and up and down. Now suppose that the rope is made to pass through a grating with vertical bars. The wave-motion of the rope can take place only in the vertical, up-and-down, direction—it is said to have been polarized in the vertical direction. If, in addition, there is another grating with horizontal bars, the waves will pass through the first grating but not through the second one.

There are certain crystals such as quartz and Iceland-spar which polarize light. The atoms of these crystals are so arranged that no light can pass except that vibrating in a certain direction. If in addition to the first crystal another one is set up, light will pass through the second only if it lies in the same direction as in the first crystal. No light will pass if the second is at right angles to the first. The first crystal is called a polarizer and the second an analyzer.

In other words, if you stop the up-and-down waves, and then stop the sidewise waves, you stop the light. But how can this be, if light-waves travel through an ether, whose particles can be pushed back and forth, up and down, left and right? It would not make any difference whether the two crystals were crossed or not. Some light-waves (namely those caused by ether particles vibrating in the direction of motion) would still pass through. And so it would seem from this that the Wave Theory had received another defeat.

Almost a hundred years ago a Scottish physicist, James Clerk-Maxwell, brought forward a new theory of the nature of light. Other scientists before him had tried to find a relation between electricity, magnetism and light; and many experiments were performed which showed a relationship among those three branches of physics. Clerk-Maxwell stated that electromagnetic action travels through space at the same speed as light, 186,000 miles per second. He found that both light and electromagnetic force travel in transverse waves, that is, waves sideways to the direction of travel, not in the direction of motion. He said that light-



The Wave Theory explains the result of this experiment, but the Corpuscular Theory does not. When light moves as shown, screen 3 will have alternate bands of light and darkness. As explained in the text, if two wave crests hit, the light is strengthened; if a crest hits a hollow, they interfere, and there is no light.

waves and electromagnetic waves travel through "the ether"; but by ether he did not mean an elastic substance whose particles are pushed forward and flow back, like water in a pool. Ether was to him a convenient word for space.

It is not easy to understand Clerk-Maxwell's work until you have first studied electricity and magnetism. But consider an electric magnet lifting a bar of iron. You know that the magnet has the lifting power only while the current is moving through the wires. You know that while the current moves through the length of the wires the lifting power is exerted in the other direction —sidewise. The power leaps across air or across a vacuum, in mysterious lines, or waves, of force. Waves of water, spreading out in ever widening circles have pushing force; electromagnetic waves around a magnet have pulling, or attracting, force.

A German, Heinrich Hertz, made many experiments to test out Clerk-Maxwell's ideas; and Hertz found them to be correct. Hertz found that electromagnetic waves could be reflected, refracted, diffracted and polarized as light-rays can. The mystery of light seemed to be solved at last. Scientists were satisfied that light is a wave-motion which is electromagnetic in nature, but with shorter wave-lengths than ordinary electromagnetic waves. Then another difficulty arose.

When strong light strikes certain metals, such as selenium and potassium, little particles, electrons, shoot out; and an electric current may be set up by the movement of these electrons (which are negatively charged) if a positively charged plate is placed near by.

The stronger the light, the greater the number of electrons forming the current. Now we know that as we move a light farther away, it looks gradually dimmer, As we move an electromagnetic away, its lines of force gradually exert less power. And we know the rate at which the light and the electric force are lessened—they are lessened by the square of the distance. Light two feet away is one-fourth as bright; three feet away it is one-ninth as bright, and so on. This rule does not apply to the energy of electrons shot from a metal plate by light. The energy is not strengthened or weakened gradually, but by tiny spurts, or pulses, with little pauses between.

Max Planck, a German physicist, in 1901 put forward a new theory of light. It is called the Quantum Theory, which is a sort of modern Corpuscular Theory. According to this, light exists in the form of small bundles (quanta) of energized matter, called photons. For a while Planck's Quantum Theory and Clerk-Maxwell's Electromagnetic Wave Theory competed. Each explained some things about the behavior of light which the other could not explain. Sir William Bragg, famous British teacher and lecturer, used to say "We teach the Wave Theory on Mondays, Wednesdays and Fridays, and the Corpuscular Theory on Tuesdays, Thursdays

and Saturdays." The contest was that close.

Modern scientists have come to a sort of agreement. They say that light is composed of tiny grains of energy. Can you imagine such a thing? Try to do so. Here is the borderland between matter and energy, the wonderland of modern science. These energy grains are said to be moving in waves. The wave-motion causes certain behavior in a beam of light—diffraction, reflection or refraction, for instance. The waves are called probability waves. In other cases, light seems to show a corpuscular nature. In free space and in a transparent medium light behaves like waves; while in other media, such as metals, light behaves like corpuscles, or grains. And thus science returns to the guess of Newton, who, almost three hundred years ago, thought light might have the nature of corpuscles and the motion of waves.

By GERALD TAUBER.

THE NEXT STORY OF SCIENCE IS ON PAGE 2633.

A LITTLE DICTIONARY OF TERMS USED IN STUDYING LIGHT

Absorption of light. The soaking up of light by a medium. When this happens the absorbed light-energy usually becomes heat-energy. You can prove this by feeling the window sill when the sun is shining on it.

Angle of Incidence. The angle at which a ray or beam of light strikes a surface. The angle at which a ray bounces back, or is reflected from a surface, is called the *angle of reflection.* When light strikes a reflecting surface, the angle of incidence is always equal to the angle of reflection.

Diffraction. The apparent bending of light-rays when meeting an obstacle, or passing through a small opening, or near the edges of an opening. The effect is (probably) due to the interference of light-waves that cross one another, or merge.

Dispersion of light. The breaking up of light so that the effect of different waves can be seen separately, instead of in mixture; in other words, breaking light into its colors, as with a prism. Raindrops sometimes do this; then we have a rainbow.

Frequency. The number of complete waves reaching a given point per second. The longer the wave-length, the lower the frequency. Red waves have the lowest frequency, violet the highest frequency of the light we can see.

Image. The picture formed by light-rays on the retina of the eye. When this picture of an object is brought to the attention of the brain, we say we "see" the object. This is a real image. An unreal image is caused by reflection; it may be a mirage (see below), or an image of an image, as in a mirror.

Mirage. An unreal image sometimes formed by the bending of light going from one medium to one of greater, or lesser, density, and being reflected.

Opaque substance. A substance that does not permit light to pass through. A brick wall and a turquoise are opaque.

Photons. Tiny particles of light, or light corpuscles. They are sometimes called photo-electrons.

Polarization of light. Blocking off some of the rays of light so that only those going in a certain direction will be visible.

Quantum. A bundle, or surge, or pulse of energy. The plural of quantum is quanta.

Reflection of light. The bouncing back of light from a surface, as from a mirror, still water, some polished metals, oily surfaces and so on. An unreal image is formed by the reflected rays.

Refraction of light. The bending of light as it goes from one medium to another of greater or lesser density, as from air to water or glass.

Mathematical or Physical Theory. A mechanism or principle which gives an explanation of all known facts in that particular field. It must be changed or discarded if contradictory facts or results are found.

Translucent substance. A substance that permits some light to pass, but does not permit objects to be seen through it clearly. Frosted glass is translucent.

Transparent substance. A substance that permits all or most of the light to pass, so that forms and colors of objects may be seen through it. Ordinary window glass is a transparent substance; so is cellophane.

Velocity. The speed of light. The velocity through space, and through air, is about 186,000 miles per second. The velocity is less in denser media. In water it is about three-fourths the velocity in air.

Wave-length. The distance from the crest of one wave to the crest of the next. Color depends on wave-length; colors range from red (long) to violet (short). Some red rays are too long for human eyes to see; these are called infrared. Some violet rays are too short for us to distinguish; these are called ultraviolet. White light is a mixture of all the wave-lengths. See also the article on Color, page 2791.



A quaint picture of the game of Bat and Ball, from a fourteenth-century manuscript.

BRITAIN'S ART BEGINS

IN the realm of art England's place is not at all proportionate to her wealth and might. A very distinct place she has in that realm, but it has nothing to do with her empire of world-greatness; it centres in the little island of Britain. Painting for its own sake—the making of pictures out of pure love of beauty of line and color arrangement—has not come naturally to the British people. Their love of beauty has found its fullest and most glorious expression in words, in exquisite poetry and noble prose. Lacking creative power in painting, they have either pictured scenes that might have been put into words—illustrative pictures—or have followed the models provided by nature, reaching the highest success in the fields of portrait and landscape painting.

England had her earliest lessons in painting in about the fifth century, from Ireland. And until the fifteenth century the monasteries were the schoolrooms and art workshops of England and Scotland.

The Irish monks had a rare and peculiar genius for the illumination of manuscripts—the earliest art of the British Isles—and they set the Scottish and English monks working in their way. The Book of Kells is the outstanding work of Irish genius. Among others produced under their influence is the famous Lindisfarne manuscript, now in the British Museum. After a time the English illuminators develoPed characteristics of their own. From about the tenth to the fifteenth centuries their work was more important than any other of its class throughout Europe.

During this period came the greatest disaster that ever happened to medieval art and letters in England—the Black Death. The population of the country at that time, 1348, was between four and five millions—about two-thirds the size of London to-day—and of these about one-half died during the plague. For a long time the usual routine of life was broken, the habit of work destroyed, and in the years of the plague rare and beautiful manuscripts were lost.

The Black Death did not kill English art, but put back its development. Worse results came from political troubles—the Wars of the Roses and the breaking-up of the monasteries. Later came the Puritan rebellion, during which many valuable pieces of work were destroyed because men thought they savored of the "Old Religion."

Before the sixteenth century dawned the real and beautiful English art of the earlier days had died, and for over two hundred years genius, though not really dead, was sleeping. The only active expression it had was the work of miniature-painters, who had inherited the beautiful skill of the illuminators.

HOLBEIN, WHO PAINTED THE FIRST FINE PORTRAITS IN ENGLAND

Just a few pictures have been left of the confused years before Holbein, from Augsburg, painted in England. The famous portrait of Margaret Beaufort, by an unknown painter, is one of them. Another is the picture of Richard the Second and Saints, at Wilton House, and there is the remarkable picture of the same monarch at Westminster.

Holbein arrived in England about 1526 and became court painter some ten years later, as you may see on page 1345. There are many portraits of English people in various collections which were, without any doubt, done under his influence. A great deal of poor work has been kept, but, apart from Holbein's, very little good. A portrait of Edmund Butts, by John Bettes, in the National Gallery, is one of the few pictures of merit.

EARLY WORK OF DISTINCTION DONE IN MINIATURE

After the work of the monks came to an end there was for a time no good miniature-painting in England, until Holbein by his example set the artists going again. Holbein's portrait miniatures were very fine indeed. Hilliard, one of Holbein's followers, painted some tiny portraits of great delicacy and charm. After Hilliard came the Olivers, father and son. A wonderful full-length miniature portrait of the Earl of Dorset, by Isaac Oliver, is treasured in the South Kensington Museum. In it can be seen how marvelously dainty is the effect, at the same time how rich and strong is the drawing and color of this gifted maker of little pictures. Another fine piece of work is the portrait of Sir Philip Sidney, at Windsor Castle.

Hilliard and the Olivers painted in the style Holbein had brought to England. Afterward came Cooper, whose manner was more like Van Dyck's, of which you are told on page 1586. Most of Cooper's pictures are in private collections. These men were the first great masters of the British miniature school, and they had much influence on the artists who followed them. They kept throughout their work a fine quality which promised distinction yet to come in British art.

The generations between the death of Holbein in London, in 1543, and Van Dyck's settling there, in 1632, are linked together in a slender way by the names of artists such as George Gower, sergeant-painter to Queen Elizabeth, Sir Nathaniel Bacon, a nephew of the great philosopher Francis Bacon, and Cornelius Jonson. Most of their work is preserved in private collections.

VAN DYCK OF ANTWERP FOUNDS A STYLE IN ENGLAND

When Van Dyck became artist to the court and aristocracy of Charles I he not only set the fashion in a kind of painting that was very different from the style Holbein had brought to England, but established a school in which can be faintly seen the beginnings of a national art. His best pupils were still, for a time, foreigners. Among the other men who worked with Van Dyck and were influenced by him were William Dobson, "Old" Stone, Lely, and Jameson the Scotsman. Dobson's best portrait is that of Endymion Porter, in the National Portrait Gallery, London. There are many of Jameson's pictures in various collections in Scotland. He was sometimes called the Scottish Van Dyck. But of all the men who fell under the influence of Van Dyck's genius the most important is Sir Peter Lely, as it is through him, although he came from Westphalia, we can trace the line of descent, so to speak, of truly English qualities in art.

He became painter to Charles II, and his pictures reflect the lightness and artificiality of the Restoration. He was not a great artist, for he lacked strength, as we can see in even his most famous pictures. But he kept a certain quality that makes his work interesting from the point of view of history.

Kneller, a German who followed Lely, was weaker still, and he was worse than weak: he was false. He cared nothing about good work, and only posed his sitters in an attractive way and made them look beautiful. Unfortunately, Kneller became a society darling. It was the fashion to be painted by him, and he imposed his style on a whole generation.

A PICTURE OF A THOUSAND YEARS AGO



David Playing the Harp, from a Saxon psalter of a thousand years ago.



An initial letter, from an 11th century book.



An illuminated manuscript of the 14th century.



The Virgin, from a 12th century psalter.

PORTRAITS BY KNELLER AND LELY



Sarah Jennings, by Sir Godfrey Kneller.



Dr. John Wallis, by Sir Godfrey Kneller.



Kneller's Portrait of Marlborough.



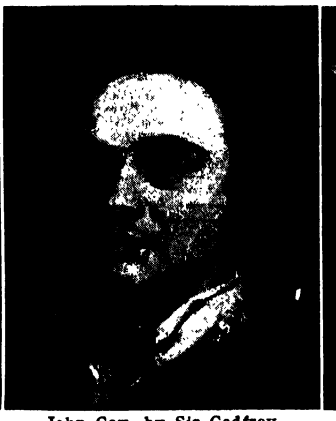
Mary Davis, by Sir Peter Lely.

The photographs of these pictures are by Hanfstaengl, Emery Walker and others.

PAINTERS OF THE STUART TIMES



Lely's famous portrait of Nell Gwyn.



John Gay, by Sir Godfrey Kneller.



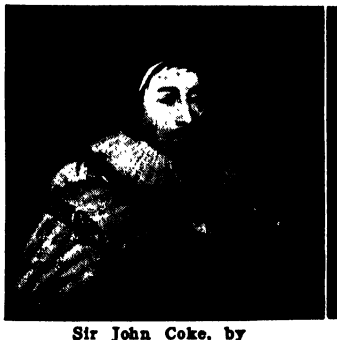
The Duchess of Cleveland, by Sir Peter Lely.



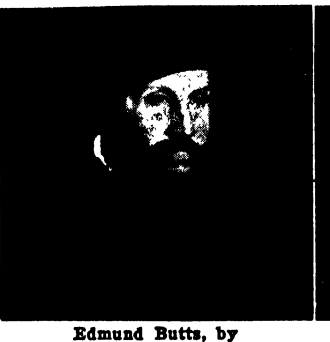
The Earl of Essex, by Isaac Oliver.



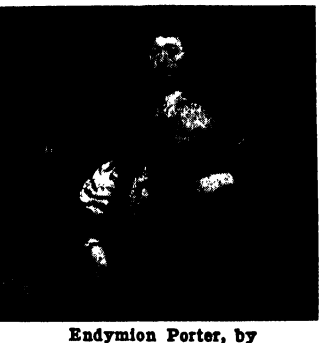
Comtesse de Grammont, by Lely.



Sir John Coke, by Cornelius Jonson.



Edmund Butts, by John Bettes.



Endymion Porter, by William Dobson.

No man could be successful unless he painted in Kneller's way.

ENGLAND'S LITERATURE, A GLORY GREATER THAN HER ART

These were truly dark days, as far as painting goes. We have to take long views over the past and follow the story of national development in order to understand the English genius. English art in the reign of Elizabeth was like a baby coming to the foot, as the old nurses say, walking uncertainly in leading strings; but the literature of England was one of the wonders of the world. Imagination, sense of loveliness, feeling for the divine in a human world, all that the old limners had put into their manuscripts was expressed in these centuries in poetry. The genius of the nation ran clearly in that one crystal stream.

There has been no landscape painted in England yet to equal twenty lovely lines from Shakespeare's pen. No English artist has conceived a picture of the coming-on of old age that stirs something in the soul as do certain verses by George Peele, or a picture of radiant youth half as lovely as one of Thomas Campion's poems. And when English art came at last into its kingdom, it gloried in pictures of English people and English green fields.

At the beginning of the eighteenth century the art of England had become degraded into something weak and false. All that Kneller and his fellow-artists cared about was to paint portraits which should flatter the sitters. The style Van Dyck introduced had not lived two generations after his death, the fine distinction of his work having been lost in poor imitations. On the walls of people's houses hung paintings of simpering ladies and posing gentlemen in elegant garments.

HOGARTH OPENS A NEW DOOR IN ENGLISH PAINTING

Hogarth was the man who saved English art. He came on the scene so astonishingly at the right moment that his existence seems as much of a miracle as his genius. He lived from 1697 to 1764, and you will find a story of his life by looking it up in the Index.

Hogarth tells us that when he was a child, shows of all sorts gave him extraordinary pleasure, and that he loved mimicking. "My exercises when at school," he says, "were more remarkable for the ornaments which adorned them than for the exercise itself." Because of his bent for drawing he was apprenticed to an engraver. Even after he had painted a number of pictures, his engravings were better understood and liked than his paintings and had a better market. His paintings themselves, in their fine and careful finish, showed the effects of his skill as an engraver.

It is easy to see that England at that time had no native tradition in art to limit or hamper a man who had original ideas. That page of history was still blank; so Hogarth, while he did not meet with prompt understanding or approval when he began to set a new fashion in painting, had less to work against than would an artist belonging to a country with a long art history or a settled school of painting.

A TIME OF FRESH INTEREST IN STORY-TELLING ARTS

In the England of his day men were very much interested in the stage and its drama. In the way of literature, too, a new kind of writing was being produced, to meet the needs of others besides the learned and the great. The middle classes, coming into independence and importance, were deepening the tone of common sense in life, and were claiming more attention. Stories of real life which they could appreciate and enjoy took the place of formal poetry and dignified prose. Indeed, Hogarth was but a young man when Robinson Crusoe, the first novel giving details of real life, was published and received with great enthusiasm by a multitude of eager readers.

In Hogarth's pictures the feeling for drama and story-telling is so strong that his position as a truly great painter has sometimes been lost sight of. Among other influences of the time, the stern attitude of Puritan morality is reflected on his plates and canvases. He not only tells a story, but it is a story with a moral, pointing out some evil or folly of the days in which he lived. He was painter, dramatist, satirist and preacher all in one. He wrote of himself: "I have endeavoured to treat my subjects as a dramatic writer; my picture is my stage; my men and women my players, who, by means of certain actions and gestures, are to exhibit a dumb show."

The men and women in his "dumb show" were actual men and women of his London, for he was well acquainted with the city and its people. He was a keen

observer and had a lively sense of the absurd in a situation; in other words, he was born with the faculties of a satirist. Put with these faculties an instinct to express himself as a painter—an artist in pigment.

For Hogarth had such control of his brush; such natural taste in arrangement, light and setting; such charm of color; such a sense of values, that Whistler has spoken of him as the only *great* English painter. He is now recognized as the father of all modern realism in painting.

Pulling aside the curtain of sentimental pretense, he showed on his stage a sturdy representation of things that were wrong, with a healthy hope of getting rid of the wrong and bringing about better conditions. Middle-class, lower-class and upper-class life were set forth in his picture dramas or novels—people who wore rags and lived in garrets, and people who dressed in silks and dwelt in mansions. Each of his separate "Conversation" pictures gives a whole story in one scene. For instance, in a picture called The Enraged Musician an old music-master, his hands over his ears, is bending from an open window scolding furiously at the noise-makers in the street outside—a knife-grinder, a ballad-singer, a milkmaid, a boy with a drum, children at play, and other folk contributing to the distracting din which we can almost hear as we look at the picture.

Then there are whole series of tableaux, the most famous of which is Marriage à la Mode. This in six paintings presents a tale of a loveless marriage, the bride's father, who has money, having arranged the match with the groom's father, who has social rank. We can read the story in these paintings as plainly as if it had been told in words. Marriage à la Mode is in the National Gallery, London, and another famous series, The Rake's Progress, is in the Soane Museum.

You will think of Hogarth's pictures as genre works; and so they are, of a sort, but very different from the Dutch genre painting, where the artist was interested in a scene, not because it would tell a story, but because it had pictorial value in itself.

Hogarth, then, had originated a new idea in painting; but he was a painter of portraits, too, some of which stand very high in rank as works of art. Look at the portrait of himself with his dog Trump and his palette on which he had drawn the double-curved "line of beauty." It is just above, on this very page. There you see him as he was—a little man, not unkind, but combative and more than a little stubborn. Because he chose not to copy foreign painters but to work out his own way, and because he stormed against picture-dealers for selling poor copies of great masters, made by inferior artists, he was accused of criticizing the masters themselves. To one of his friends he explained: "The connoisseurs and I are at war, you know; and because I hate *them,* they think I hate *Titian*—and let them!"



Portraits by Hogarth—Polly Peachum, The Artist and His Dog, and The Artist's Sister.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 2077.

ST. FRANCIS OF ASSISI

TO WHOM ALL CREATED THINGS WERE KIN

IN a green Italian field one summer day, almost seven hundred years ago, a small man, clad in a worn, patched robe, raised his head to the sky and called to the birds flying above him. Hearing his voice, they paused in their flight and glided to earth. Birds from the trees flew down to gather at the feet of this man. They seemed to bow and nod as he spoke to them.

"My little sisters the birds, much do you receive from God your Creator, and always and in every place you ought to praise Him. He has given you freedom to go into every place, and also did preserve your seed in Noah's ark, so that your kind might not perish from the earth. Again, you receive from Him the element of air which He has made for you. God feeds you and gives you the rivers and the fountains to drink from; He gives you the mountains and the valleys for your refuge, and the tall trees wherein to build your nests. And as you can neither spin nor sew, God clothes you, you and your children. Your Creator loves you much, since He has given you so many marvelous gifts. So beware, little sisters of mine, of the sin of ingratitude, but ever strive to praise God."

When the preacher had ended his sermon, the air filled with the glorious songs of the birds. They soared into the sky, then divided into four parts like a cross. One group flew to the north, another to the south, the third to the east, and the fourth to the west, bearing the message they had heard to the four corners of the earth. The shabby little man left the field and continued his journey.

This man had not always been such a picture of poverty. Once he had been the most elegantly dressed young man in Assisi. His father, Pietro Bernardone, a wealthy merchant, hoped that his son Francis would also become a merchant. Francis did not object to this and started working for his father. He loved fun and was a leader of



Saint Francis Preaching to the Birds, by the Italian painter Giotto.

the young people at the feasts and festivals. He wasted a good deal of money on rich dress, yet he always could spare a coin to any poor beggar who crossed his path. Francis had a careless, kind heart. He was afraid of only one thing, lepers.

One day, as he rode through the countryside, he saw a figure walking toward him on the road. Suddenly he realized that the man was a leper. With a start Francis spurred his horse to avoid meeting with this fearful being. Then, a new courage filled his soul. He sprang from his horse and threw his arms about the leper. This incident marked a change that was taking place deep within Francis' spirit.

This man who loved gaiety and laughter and freedom so well had to spend a miserable and lonely year as a prisoner of war, and his imprisonment was followed by a period of illness. He had time to think, to become acquainted with his own soul. When he came back to the busy life of Assisi, his family and friends soon learned that Francis had turned a very important corner. Forgotten were the parties, and the beautiful clothes and the wasted hours.



St. Francis of Assisi and St. Clare, by the sculptor Paul Landowski.

There were at this time in Italy many small old churches falling into decay—people were growing worldly and selfish and had little time for the simple, sincere devotion of the early Christians. Francis went from town to town, repairing the old churches with his own money and his own labor, aided by a few friends. When his father refused to give him any more money, he and his little band lived as beggars. They even took a vow of absolute poverty, promising to own nothing, lest the love of possessions corrupt their shining purpose.

Many people laughed at Francis and his band; but he preached in the market-places, begging men to be true to their own highest natures. He touched the hearts of multitudes. Singly, by tens and by hundreds, his band grew, until 5,000 men from all walks of life—rich and poor, young and old, ignorant and learned—put on the beggarly robe and became followers of Francis. The Pope blessed the rule of life which Francis planned, and the Franciscans, as they were called, formed the Friars Minor (Little Brothers).

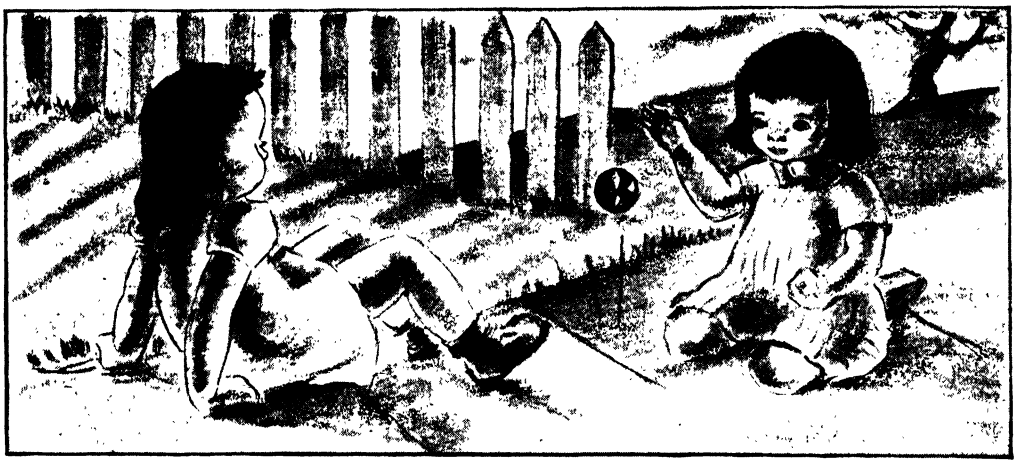
A lovely girl, Clare Ortolana, under his advice, organized a women's branch of the order: these women became known as Poor Clares.

Some there were who listened to Francis and almost wanted to follow him; but they could not say farewell to their homes or their dear ones, or their duties. For such Francis suggested a rule less rigid. This membership became known as the Third Order of Saint Francis. It, too, grew and flourished.

Francis of Assisi lived from 1182 to 1226. The religious orders that he founded have since spread over the globe. They have made many contributions to the world's knowledge and civilization. Yet it is not as founder of the Franciscans that Francis is most widely known today. He is remembered for his love of nature. The birds were his little sisters, the sun and winds were brothers, the moon and waters were sisters, and all created things were kin. He found a joy on earth more real and lasting than men can ever know who give their hearts to possessions. The poet Emerson might have been thinking of Francis when he said:

> Cheerily know, when half-gods go
> The gods arrive.

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 2319.



WHY DOES A BALL BOUNCE?

THERE are two kinds of balls that bounce, those that are solid, like a solid rubber ball or a golf ball, and those that are hollow, like a tennis ball.

No matter whether the ball is solid or hollow, its bounce is due to the fact that it is elastic. A thing is said to be elastic when it tends to return to its former size or shape after being pressed down or stretched. Rubber is a very elastic substance, as you know. Press a rubber ball on the ground. It loses its perfect roundness, but the instant you take away the pressure of your hand, it springs back into shape. Throw it sharply on the ground; it loses shape against the ground but springs back so sharply that it bounces.

Now a great law of science is that nothing is ever lost and that everything has to be paid for.

When the ball starts bouncing it has a certain amount of motion in it, which is force, or power, or energy. When it stops, that has gone. Either we must show that the energy has gone somewhere and has not been destroyed, or, according to the great law of the persistence of power, the ball should bounce forever. If it did not bounce forever, the law would be false. It is, however, quite easy to show that the ball does lose the power with which it started. What, then? Why does it stop bouncing? And what happens to the energy when it stops?

To begin with, the ball is moving, both up and down, through the air, and forcing millions of particles of air aside. All the motion it gives to the air it loses.

If a ball were bounced in a space as far as possible emptied of air, it would bounce far longer than it does in the atmosphere, just as a top will spin longer in the same circumstances. Suppose that, instead of bouncing the ball on something hard, we bounce it on a pillow or on loose sand. It will not bounce long in such a case. Its power has gone to move the pillow or the sand as well as the air. The ball itself is not completely elastic, nor is the ground. If the ball and the ground were completely elastic, and there were no air to move, and the ball never turned and rubbed the ground in falling, it would bounce forever.

In the case of a hollow rubber ball, it is not by any means the rubber only that explains why the ball is so elastic. The ball is filled with a mixture of several gases, which we call air. The air is elastic. It is pressed in upon itself when the ball hits the ground, but quickly tends to go back to its old space in the ball. We can see how much the air bounces if we compare an ordinary soft rubber ball with another one which has a small hole in it .

The air is expelled from the hole when the ball is bounced, and we find that the ball bounces very little, because its elasticity is so poor. But the other ball bounces exceedingly well, because, when it is bounced, the air in it is not squeezed out, but only compressed for an instant.

WHY DO WE EVER STOP GROWING?

What we call growth is the power the cells of the body have of taking nourishment into themselves and so becoming larger, and of dividing and giving rise to other cells like themselves. This power, however, is limited, and every kind of cell can grow only within the limits of its own law—the law of growth. No matter how much food or exercise is taken, the law of growth prevents any number of cells becoming more numerous or larger than a given limit. When the body is young the growth is very active, but as the body grows older the limit of growth is gradually reached, and growth stops.

WHY DOES A BOY'S VOICE BREAK AND NOT A GIRL'S?

When a boy's voice breaks, it is because his voice-box is suddenly becoming larger. As a girl grows up to be a woman, her voice-box grows steadily in proportion to the rest of her body. In men, the larynx, or voice-box, is much larger in proportion, and the vocal cords longer, than in women. The result is deeper and louder sound from the larger voice-box.

The change in the voice-box begins to take place when a boy is about fourteen or fifteen year of age. It is not really necessary for a boy's voice to break; that is to say, it is possible for his voice to get steadily and evenly lower. But, as a rule, this does not happen, and the reason is, not that there is anything the matter with the boy's voice-box, but simply that he has not learned how to work it.

The muscles are getting bigger and heavier, the cords are getting longer, and this is happening very quickly, and, of course, it must mean that a new skill has to be acquired, just as if one has learned to play perfectly on a very small violin, and then has to play on a full-sized one. The boy has not the proper control over his voice, and so he sometimes speaks in a low pitch and then in a high one.

WHAT IS THE FORCE IN LIGHTNING THAT KILLS A MAN?

We use the word lightning to mean two distinct things—the flash seen when electricity passes strongly from a cloud to another cloud or from a cloud to the earth; and the electricity that causes that light. The flash is quite harmless, but the electricity is very different. If this strikes the ground close beside a man it will do him no harm; but if it actually passes to the earth through his body it may kill him. If the lightning charge is sufficiently strong it will affect the brain and the nerves that run from it to the heart. Two of these nerves, one on each side of the body, are capable of stopping the heart altogether. The electricity, in passing, excites these nerves to such an extent that they stop the heart, and the person dies from shock.

WHY DOES LIGHTNING STRIKE SOME THINGS AND NOT OTHERS?

We know that if lightning can choose between a lightning rod and the rest of the roof of a house, it will go down the rod. Electricity will always choose the easiest path, or what is called the path of least resistance. Thus, if an electric current can pass to the earth through a tree it will do so, because the tree helps its passage downward. That is why we should never stand under a tree in a thunderstorm. But, for choice, electricity will always pass through anything made of metal, for the whole group of metals are good conductors of electricity. We do not know *why* metals conduct it so well, but we do know that that is the reason why lightning chooses them.

You have probably noticed the points on the roofs of houses, churches, barns, hospitals, schools and so on. These points are only part of the lightning-rod system. The simplest kind of system consists of points, as we have said, placed along ridges, chimneys, dormers and other high parts of the roof. The points are connected with at least two cables, which run down diagonally opposite corners of the building to rods that go into the ground. Usually the ground rods are driven to a depth of ten feet, or even more. The effect of a system like this is to "raise the surface of the earth up above the building" so that the lightning—which is a tremendous electrical discharge—will not travel through the building but will be safely carried down the outside of it to earth.

The parts of a good modern lightning-rod system are made mostly of copper and copper alloys. Points placed on chimneys are coated with lead to prevent their being eaten away by the acid substances in smoke. The Underwriters' Laboratories have developed specifications for the various parts of a lightning-rod system and the way in which it should be installed. If a system meets with their approval, they issue a Master Label. A wise householder or farmer makes certain that his lightning-rod system is installed according to these specifications.



American Museum of Natural History
A baby chimpanzee expresses its wish plainly.

DO ANIMALS TALK TO ONE ANOTHER?

No other creatures can talk one-thousandth part so well as we do. But no one who knows animals doubts for a moment that many kinds of animals can talk to each other —only they do not use our kind of talking.

Monkeys, for instance, make many kinds of sounds with their mouths, which have different meanings; they do not express ideas or make assertions; but they express their feelings. A baby expresses various feelings with its mouth long before it can talk, and many animals can express fear, joy, anger and many other feelings with their voices, and their fellows can understand them. That is talking of a kind.

But though monkeys probably come nearer to us in talking—though still very, very far away—than any other animals, many insects, which are very simple and humble creatures compared with monkeys, can talk wonderfully in their own way. This is especially true of the social insects, such as ants and bees and wasps. If they could not tell each other what they felt and wanted, they could not live together in societies, or communities, as they do. The insects have long "feelers," with which, as it seems, they can touch each other and make certain things understood.

WHY DOES A RIVER CURVE AND TWIST RATHER THAN RUN STRAIGHT?

The course of a river bed depends on the lay of the land. If this changes, the course of the river will change. The water runs downward to the sea, pulled by the earth's attraction as near as it can get to the center of the earth. It chooses the easiest downward path across plains or through valleys. If it encounters a mass of rock or a rise in the ground, it flows around the obstacle. Even where a river appears to run straight there is a change in level downward toward the sea. It requires a special instrument to measure the actual downward drop of a river toward sea level.

WHY DOES THE STREAM RUN FASTER IN THE MIDDLE?

The water at the side of the stream is constantly being held back by rubbing against the banks, just as the bottom of a wave is held back when it reaches the shallow water near the shore. And so, compared with the water near the sides, the water in the middle of the stream runs more swiftly. It is held back a little by rubbing, or friction, between it and the slower moving water at the sides; but the friction between water and water is very much less than the friction between water and anything solid, such as the banks.

When we watch the blood running in a blood vessel, we see exactly the same thing. In the middle of the stream we see the tiny red and white cells tumbling fast over each other as they scurry along. But near the walls of the blood vessel they move much more slowly, for they are held back by the friction of the wall, even though it is beautifully smooth. And just the same thing happens with smoke going up a chimney, and in many other cases. We should always try to think, when studying such a question as this, of other cases where the same principle of friction is really at work.

WHY IS A RUNNING STREAM PURER THAN A STAGNANT POOL?

Water is the great supporter of life; it is the great dissolver of gases and solids from the air above it and from the ground beneath it, and these gases and solids help to support life. Stagnant water very quickly becomes filled with living creatures and with the products of their lives. We call it impure.

Even the water we call pure contains a great number of other things in it besides water, and that is especially true of running water, which is rich in gases and often contains minerals also. It is probably not very long since running water existed in the form of rain, which is much the purest of all the water's natural forms, although it contains a certain amount of dust and a certain quantity of the gases in the air dissolved in it. The gases in running water make it pleasant to taste.

THE NEXT WONDER QUESTIONS ARE ON PAGE 2125.



American Museum of Natural History, New York

This painting by Charles R. Knight shows Eohippus, the small four-toed horse which roamed what is now Wyoming long ago, before the Age of Ice. This shaggy little animal was the ancestor of our modern horses.

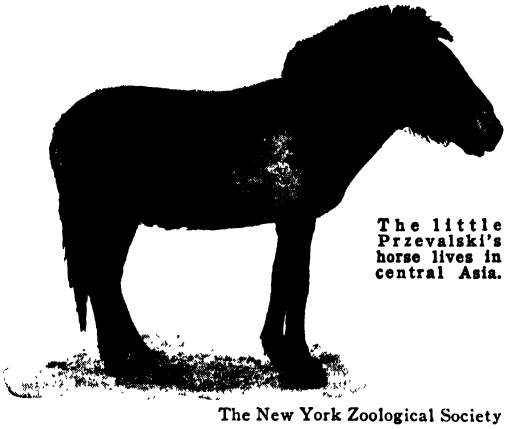
THE HORSE FAMILY

IN this family we have man's faithful friend, the horse, and also the donkey, the wild asses and the zebras. These are all near relatives. The horse and its cousins have only one toe on each foot, the one corresponding to our middle finger or toe. The rhinoceroses and tapirs belong to the same order Perissodactyla, the odd-hoofed mammals, but while their middle toes are the most important, other side toes are present. In the horses these side toes are represented only by small splint bones. Although the animals of this group are now so different, they were long ago much more alike.

Everyone loves a horse and admires him in action. Whether he is an Arab or Thoroughbred, eager for the race, a great Percheron or Clydesdale, throwing his weight against the collar as he hauls a heavy load or draws a plow through the fresh earth, or a child's shaggy Shetland pony, as proud of his pretty trappings as is his little rider, every line of a horse's body shows that he is built for strength and power.

Next to the dog, the horse is the most faithful four-footed friend we have, and no other animal has given us truer service or can show greater devotion to his owner. Even among the nations that despise the dog as unclean, the horse is loved for his faithfulness and intelligence, and a tired and hungry rider will always see that his patient horse is cared for before attending to his own wants.

The history of the horse and its relatives has been traced back far into the past. The story is very complete, for in times past these animals were common and widespread. Teeth and bones are found in great abundance in fossil beds, consequently few animals of the past are so well known. The discoveries were like pieces of a puzzle that fitted together, giving a complete picture. But the first bones that were found were certainly puzzling to the finders.



The little Przevalski's horse lives in central Asia.

The New York Zoological Society

More than a hundred years ago some

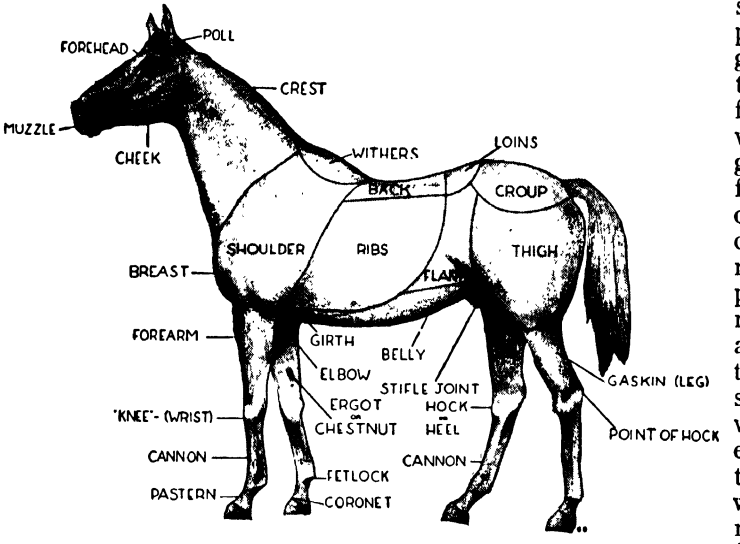
teeth and part of a skull were found in England. The teeth did not look much like those of a horse; indeed, they were thought to belong to an extinct monkey. Years after the first discovery of the English ancient horse, bones and teeth of very similar horses were found in New Mexico and Wyoming. Finally, a complete skeleton was discovered of this "dawn horse," or Eohippus, as it was called.

Eohippus was a slender little beast, only sixteen inches high and rather dog-like in shape. Its head was long, with large eyes. The front feet had four toes while the hind feet had only three. Small splints represented the other toes; we are pretty sure that the dawn horse was descended from an ancestor with five toes on each foot, like most mammals. Eohippus walked on hoofs, the enlarged, thickened finger and toe nails; its feet had already developed many of the important changes suiting the animal for running.

The descendants of Eohippus gradually became larger. Their side toes grew less and less important, until finally they disappeared; while the middle toes increased in size and came to carry the horse's whole weight. The bones of the feet grew longer at the same time, and so did the lower legs. If you look at the picture of the horse on this page, you will see joints marked "knee" and "hock." They are really the wrist and heel, although they seem to be in the legs. The fetlock is the joint at the base of the finger or toe. The nail has grown into a thick hoof to protect the tip of the toe, and underneath it there is a tough cushion called the "frog," so that the heavy animal will not be jarred when his weight is thrown on his toe-tips in his gallop over hard ground. The elbow and true knee, called "stifle joint," are up against the body, for the upper parts of the legs are short. These conditions all make the horse the greatest runner of the mammals and the one most suited to carry men swiftly over plains and rolling country.

While the legs were growing longer, the neck lengthened, too, so the horses could reach down to crop the short grass. Eohippus lived in the forests that covered much of North America when mammals first became the common land animals. The dawn horse had chewing teeth somewhat like ours, with rounded hillocks, or cusps, on the grinding surface, and they were short between the roots and these surfaces. Such teeth are suitable for chewing vegetation, but they are not good grinders for grass. They would wear out too quickly.

The teeth of the modern horse are long, square prisms which grow from the gums as fast as they wear off. The grinding surfaces consist of complicated enamel ridges, supported by cement as well as by the dentine. These substances wear more easily than the enamel, which remains projecting a little above the rest of the tooth. This keeps the surface like an ideal millstone, sharp to grind the grass and grain on which horses feed. A female horse has thirty-six teeth—six incisors (cutting teeth) in front, in both upper and lower jaw, and six grinders on each side of each jaw. A male horse has all these, and four more—a small canine (dog-tooth) between incisors and grinders on each jaw.

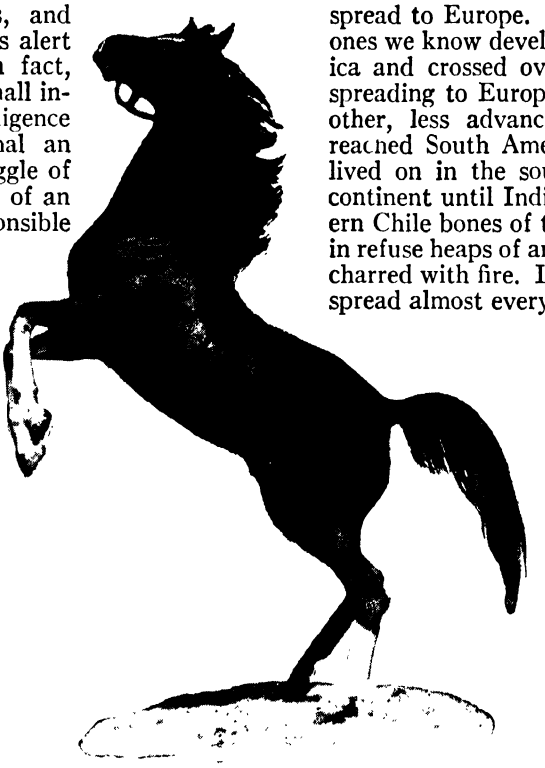


This picture shows the different parts of the body of a modern horse, and gives the name of each part. The hoof is really the horse's toenail.

You have heard people say that a horse's age can be told by its teeth. This is partly true. A colt has a set of milk teeth by the time it is six months old. During the third year these begin to drop out, and at the end of the fifth year the colt has all its permanent teeth; these continue to grow and to change until the animal is about ten years old.

Although the teeth of the modern horse are so different from the teeth of Eohippus, we now have a series of fossil teeth that includes all the in-between stages, showing clearly how the modern horse's teeth have developed from those of the ancient kind. To hold the long-crowned teeth and to give attachment to the great chewing muscles, the horse's head and jaws became larger.

While the horse family was going through all these changes, getting better feet and teeth, it had many enemies. Nearly any hunter—carnivorous (flesh-eating) mammal or large bird of prey—would have been able to make a meal of Eohippus, and many less swift or less alert dawn horses were, in fact, killed and eaten. A small increase in speed or intelligence would give the animal an advantage in the struggle of life. Thus the enemies of an animal often are responsible for improvements in the species. (The weaker members of the family are killed. The stronger ones or the cleverer ones live to carry on their race, and so the race grows stronger or cleverer.) As horses grew larger their enemies became fewer. The larger cat-like mammals still lay in ambush or stealthily stalked them, while dog-like animals in packs chased them throughout their long history. Even today the wild asses and wild horses of Asia fear the wolves, while the African zebras have the lion for their chief enemy. These beasts of prey have changed, too, becoming swifter and more powerful through the ages. Both zebras and lions thrive in the same sort of country.



Courtesy, Selby Stud

This Arabian stallion, Image, lives on a farm in Ohio.

Meanwhile, as we read in the Department of the Earth, the earth had been changing. Mountains were raised up, great inland seas disappeared and flat plains covered with grass replaced many forests. The horses, now having teeth better able to chew grass, found they could live on the open areas. Enemies were easier to spy, and it was easier for the horses to make full use of the ability to run fast. Many different sorts of horses developed during these long ages, some large, some small, some with short legs and some with longer ones.

The world was not always the same place that it is today. At various times North America, home of the horses, was connected with Asia by land, where Bering Strait is now. Before the time of Eohippus there were some ancient horses in Europe. It is supposed that they reached there from North America, wandering over to Asia by way of Alaska. Later some of the three-toed horses spread to Europe. Then horses like the ones we know developed in North America and crossed over to northern Asia, spreading to Europe. At the same time other, less advanced, types of horses reached South America. Some of these lived on in the southern parts of that continent until Indians came. In southern Chile bones of this horse were found in refuse heaps of ancient Indians, partly charred with fire. Later still, true horses spread almost everywhere, to Africa and Burma, for instance. None ever reached Australia, for throughout the Age of Mammals that continent was separated by deep seas from the rest of the world.

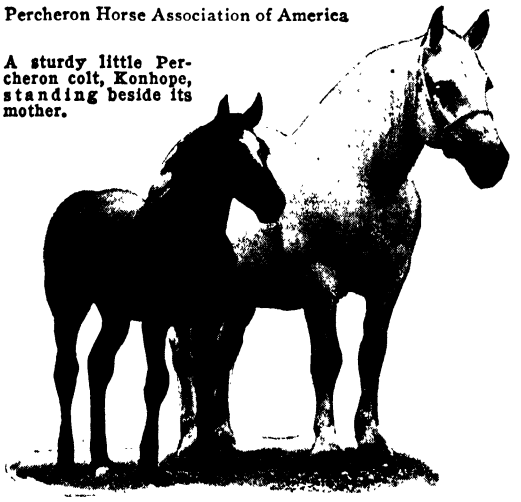
Just before the end of the Ice Age, something happened to make the wild horses of North America disappear, although throughout their long history this had been the land in which they thrived. What it was no one knows, but they all disappeared. The sea had washed over the bridge of land connecting Alaska with Siberia, and no horses could come back to the land of their ancestors. Until the Spanish explorers came to Mexico in the sixteenth century, their knights mounted on fine steeds, none of the Indians had ever seen a horse. Not long after the conquest of Mexico, a number of horses escaped from their European owners and herds developed from these few, spreading north in the course of years. They found good country for their

needs and soon numbered many thousands. The same thing happened when horses were taken to South America, too, and in Australia, wherever grassy plains existed to provide good homes for horses.

Let us go back to the period before the Ice Age. After reaching the Old World, horses spread and multiplied. Those in different parts grew to be quite unlike each other in appearance. The true horses were of at least two species. One of these was heavily built, with big heads, thick necks and stiff, upstanding manes, what we call "hog manes." These coarse, ugly horses lived on the plains of central Asia and on the plains and forests of Europe. Up until a few hundred years ago, herds of these wild horses are said to have lived in the Polish forests, and closely related horses still roam the upland plains of Asia. Przevalski's horse, named from its discoverer, Nicholas Przevalski, is this type; sometimes we can see one in the zoo, looking like a big-headed ugly pony, dark grayish brown in color.

In North Africa, another type of horse developed. It had long, fine legs; a long, graceful, arched neck; large eyes, and a long, pointed head. This was the stock from which the Arab and Barbary steeds, famous the world over for their beauty and speed, are descended.

Percheron Horse Association of America



A sturdy little Percheron colt, Konhope, standing beside its mother.

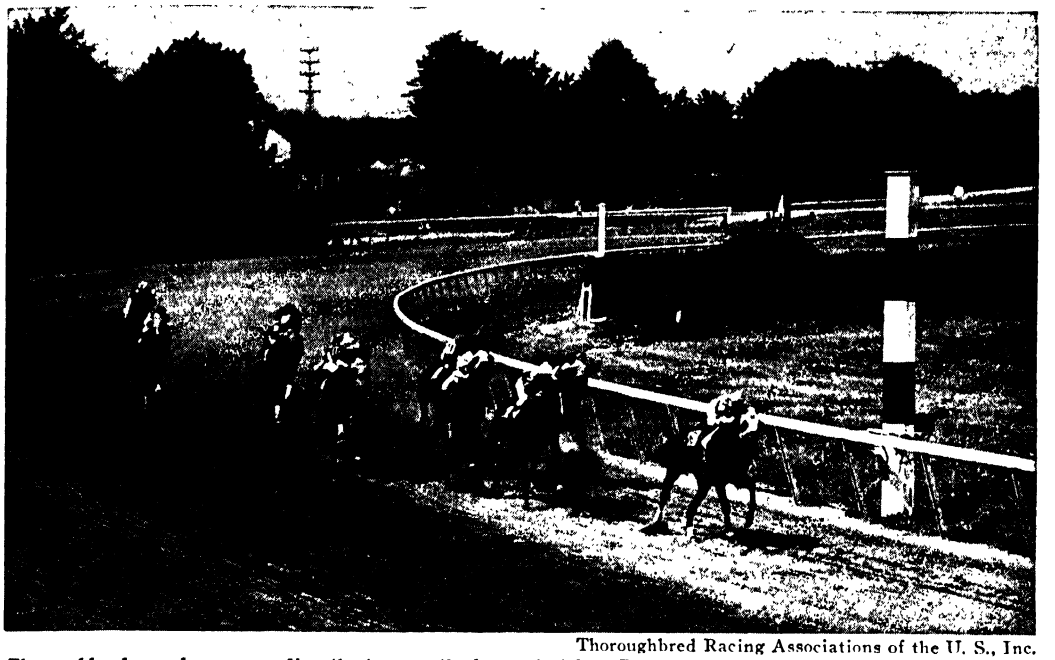
Wild horses live in large herds—several dozen mares, or females, with their young colts, headed by an old stallion, or male. Young males are driven out by the master horse, but when they grow up one may come back and defeat him, taking the leader's place. Although horses usually run from their enemies, when cornered or fighting another horse they bite fiercely, kick and strike powerful blows with their front feet.

After man domesticated these horses, through careful breeding and selection, many different types were developed. The heavy cart or draft horses were derived from the European wild horses, such as were drawn by the cave-men in France and Spain. The horses of the Mongolian tribesmen, the Cossacks and the Chinese are also descended from such animals. Most of the carriage horses and saddle horses are partly of African and partly of European descent.



U. S. Department of Agriculture

Draft mares like these are much used on farms for plowing and dragging the fields and for other heavy work.



Thoroughbred Racing Associations of the U. S., Inc.

Thoroughbred race horses rounding the turn on the home stretch at Belmont Park, a famous track near New York.

We do not know when ancient men first made friends with horses. For a long time men hunted them for food; in one place in Europe which was inhabited by men of the Stone Age, bones of thousands of horses have been found. Although we do not eat horse meat in this country, much of the meat used by the poorer people of Europe is still that of horses.

It is not hard to imagine how the first horse was tamed. It is natural to keep young animals as pets and to raise them for food. Some ancient man may have trapped a foal with its mother or a young colt that could be easily tamed. Probably it was some time after this that peoples in central Asia taught horses to draw carts. Then they were hitched to war chariots. The tribes with war chariots would have a great advantage over those on foot. Later, around 2000 B.C., horses were used to draw chariots in Mesopotamia and Egypt. The Assyrian horses were of the European or Asiatic type, with heavy heads, while those of the Egyptians were of the lighter, more beautiful type, which probably developed in northern Africa.

Horses were not ridden at first, nor were they tamed for use as early as donkeys. Perhaps men learned first that they could ride donkeys, then they tried the swifter, more powerful horse. This knowledge spread throughout the world wherever horses were found, to China and Britain and through North Africa.

Once horses were used in battle to draw chariots and to carry riders, it was found that a tribe with horses could conquer peoples without such an advantage. Horses themselves entered into the spirit of battle; "he smelleth the battle from afar," said an ancient writer. The spirit and courage of the horses in a cavalry charge is something to marvel at. The Greeks had both cavalry and chariots, and by the time the Romans brought the known world under their rule, horses were possessions of all the peoples of Europe and Asia.

When Julius Caesar landed in Britain he found the Britons—horse, foot and chariot—arrayed against his landing. These horses of the British Isles had most probably been brought across the Channel in open boats when the Celtic people came. Although horses had reached England during the Ice Age, when the isles were connected with the continent, they had later been exterminated; and so new stocks had to be brought there.

You will notice that little has been said so far about the Arab horses. It was only about two thousand years ago that the Arabian tribes got horses, probably from Egypt. They throve in Arabia and when, about 630 A.D., the Arabian tribes set out on

their career of conquest, they were mounted on swift, hardy horses far superior to those of their enemies. Thus they were able to sweep through North Africa, the Middle East and Spain. Not until they met the heavily armored cavalry of the French, under Charles Martel, were they stopped.

The Arab horses were carefully selected and cherished by their owners. Many modern Arabian horses have pedigrees going back to the days of Mohammed the Prophet. Horses were members of the family, fed on the best food the Arabians could supply. They were and are, splendid creatures, intelligent and docile, with great powers of endurance. Arab poets often sang of their horses. Listen to this, the song of an Arabian poet who lived nearly 1,400 years ago, telling of the qualities of an Arab mare dear to his heart:

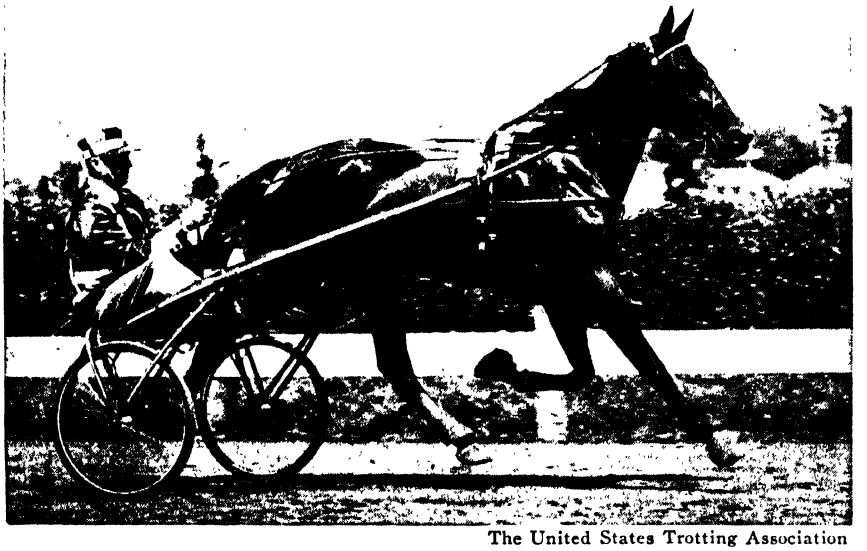
Spare is her head and lean, her ears pricked close together,
Her fetlock is a net, her forehead a lamp lighted,
Illumining the tribe; her neck curves like a palm branch,
Her withers sharp and clean. Upon her chest and throttle
An amulet hangs of gold. Her forelegs are twin lances,
Her hoofs fly forward faster ever than flies the whirlwind,
Her tail-bone borne aloft, yet the hairs sweep the gravel.

The Arabs did not want to sell their prized horses, especially the better ones, but about 1700 several were taken to England. From these the famous English racers, hunters and carriage horses have been derived. American race horses are mostly descended from the English, but some Arab horses were brought to America direct from Arabia. Careful selection for speed and points of appearance has changed the modern racer into an animal very different from its ancestors.

The horses that were taken to America by the Spaniards were partly of Arab stock, though the blood was mixed with that of coarser breeds. Thus it was that horses came back to the land of their beginnings, in small, crowded ships. Some wild horses in America today show the characteristics of the Arab steed, but most are poorer animals, often quite ugly in appearance.

The powerful dray-horse breeds are descended from the European horses, as we have seen. They were not originally meant to be work horses. Oxen did all the heavy work until quite recent times. These horses were bred to carry men wearing heavy suits of armor.

The knights developed out of the Roman cavalry. At first the armor was fairly light; any horse could carry the warrior. But as heavier and heavier armor suits were worn, the chargers that carried the knights in tourney or war had to be large, powerful animals. At last even the horses were given armor. Selection and breeding of horses for war chargers led to greatly increased size and strength, and so in each European country special large breeds of horses were developed. In time of peace, or on journeys, the knights rode on small horses, called palfreys; but when the hour of battle came they mounted their great horses. Charging at a gallop, the opposing knights met in a mighty clash. Many a man and horse went rolling on the field, never to rise again.



The United States Trotting Association

There are few more thrilling and graceful sights than a trotting race, and thousands of people attend them each year. The vehicle which the horse draws is called a sulky. It is very light.

When gunpowder and guns began to be used in warfare, the knights became of little importance. Faster, lighter horses were used for cavalry, and the heavy chargers were now set to pull the plow and draw heavy carts and wagons and coaches.

From the names of the various kinds of work horses we can tell pretty well where the different types developed. The Clydesdales came from Scotland, the Shire and Suffolk horses from England and the Belgian horse from Belgium, while the Percheron was developed in France. Similarly, Thoroughbreds are of English descent, as are Hackneys, which were developed by crossing Thoroughbreds and work horses for coach and carriage work. America, as we have said, has developed many breeds of her own, mostly from English and Arab and Barb (Barbary) stock. Standard Bred and American Thoroughbred are two of the best racing breeds. The Morgan breed was developed in New England for saddle and carriage use.

A horse is measured by "hands," a hand being four inches. The measure is taken from the ground to the highest point of the shoulder. Most horses are between fourteen and sixteen hands high; if an animal is less than fourteen and a half hands, it is often called a pony.

Shetland ponies are the smallest of the accepted breeds, only three feet or a little more. They are strong and enduring. They are sometimes said to have descended from a few horses from a ship wrecked on the Shetland Islands, but it is more probable that the Northmen who settled these islands a thousand years ago brought with them their medium-sized horses. The hard life on the islands gave small horses advantages, and their owners selected the breeding stock from among the smallest. The descendants of the wild horses, often called mustangs, broncos or cayuses, are really ponies, short but hardy. They have been good friends to Indians, cowboys and soldiers during much of America's history. Apart from the descendants of the wild horses, the horse that is the most distinctively American is the trotter. Although the ancestry of the trotter is much like that of the Thoroughbred, breeding has modified both its shape and its gait. Trotters never gallop, but they cover the ground with amazing speed, pulling a light racing sulky.



Thoroughbred Racing Associations of the U. S., Inc.
Man o' War, one of the most famous Thoroughbreds.

A newborn horse is called a foal; later it is called a colt. A young female horse is a filly; when full-grown it is a mare; when it has young it is a dam. A male horse



Thoroughbred Racing Associations of the U. S., Inc.
Exterminator, a famous American race horse, and his playmate, Peanuts III, a Shetland pony. Horses like companionship, and the pony keeps Exterminator from being lonely.

is a stallion. A male horse that is not used for breeding but for work is a gelding.

THE GAILY PATTERNED ZEBRAS AND QUAGGAS OF AFRICA

The zebras and quagga are the African branch of the horse family. They are the striped horses. Their manes form upright crests, and their tails are without long hairs on the upper half. The ears are long, and the hoofs narrow, like those of the asses.

The mountain zebra lives in dry, hilly parts. Once zebras were common in South Africa, but now there are only a few bands there; and there are some in South-West Africa and southern Angola (Portuguese West Africa). Mountain zebras are whitish with many uniform black stripes, set close together. On the croup the black stripe that runs down the back is connected with the flank stripes by a series of transverse (crosswise) bars. They are beautiful animals.



Photograph by John A. Stryker, Fort Worth, Texas
It requires skill and nerve to stick on a bucking broncho.

In 1840 the quagga lived in great herds on the plains of Cape Province, South Africa, but fifty years later it was completely exterminated. The quagga was only partly striped; its upper parts were pale brownish. The hind quarters and forelegs were without bars, but the head, neck and front part of the body had dark brown stripes which gradually became fainter toward the rear. A dark stripe ran down the back of the upper part of the tail. The forelegs and lower hind legs were almost white.

The common zebra, or Burchell's zebra, is found throughout the plains and savanna country of Africa. This animal is a close relative of the quagga; indeed in Africa it is often called "bontequagga," or common quagga. Often there are shadow stripes on the white interspaces on the flanks and thighs, and the lower parts of the legs may be completely striped to the hoofs or may have few stripes. There are many local races of this widespread species.

Grevy's zebra is the largest and most handsome of the whole group. Its head is long, and the stripes are finer and more numerous than in other zebras. It is found in East Africa. These animals often associate with the common zebra and various kinds of antelopes.

Zebras are the chief prey of lions which often work together in hunting them. Several lions may lie in wait while others drive the zebras toward the ambush. Or a lion may wait at a water hole for a zebra to come to drink. In spite of the hazards of life, zebras still manage to live in great numbers in regions heavily infested with lions. This is another illustration of the fact that the carnivores (the meat-eating animals) do not wipe out their prey. Men with their guns do much more damage to game.

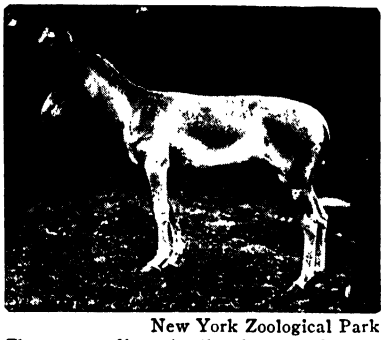
Scientists have found that some of the fossil horses of America had teeth like those of the zebras. This would make the zebras, like many other African mammals, living fossils—animals of an earlier day that have managed to survive.

ASSES AND MULES, BURDEN-BEARERS OF THE WORLD

The asses are the last of the horse group to consider. They are not striped like the zebras, but they often have a stripe down the back and sometimes have cross-markings on the legs. They are found in Asia or North Africa: we should mention the onager, or wild ass, of Syria, Persia, northern India and the Mongolian deserts; the kiang of the Tibetan highlands; and the true asses of Somaliland, Libya and, formerly, Tunis

and Algeria in Africa.

The kiang, the largest of this group, stands about fifty inches high at the shoulder. It is reddish brown in color, with pale underparts and limbs and with a narrow stripe down the back. Kiangs feed on the woody shrubs of the high plateau region. They swim well, often crossing the swift, icy rivers with little concern. They are extremely curious, approaching within a stone's throw of any strange thing they see. Hunters attempting to stalk wary sheep or goats in Tibet are often annoyed by this habit, which warns the game that an enemy is near.



New York Zoological Park

The onager lives in the deserts of Asia.

The onager lives in the desert and near-desert regions of central Asia and the Middle East. Its speed is great. Horsemen can overtake an onager only by chasing in relays, and even automobiles have difficulty catching the animals on the plains, where the ground is better for hoofs than for wheels. These beasts are rather horse-like, with short ears and rounded hoofs. They do not become tame in captivity, and it was not from them that the ancestors of domestic donkeys came.

Those ancestors were no doubt the North-African wild asses. Once these could be found in the dry lands from the Red Sea to Morocco; today only in the eastern part of this range are there any of the shy creatures. Their ears are much longer than those of their Asiatic relatives. The general color of the North-African asses is grayish, with a dark shoulder stripe in most individuals, in addition to the usual dark back stripe. The muzzle and underparts are white; the legs are often white, and stripes may or may not be present.

People who have never seen any donkeys except the domesticated ones, can have little idea how handsome the wild animals appear. There are many signs of breeding in their carriage. Their gait is high-stepping and sure-footed over the rocky desert. They feed on the dry, wiry grass found in these places, but in spite of this poor diet they keep in good condition and fat.

Long before horses were tamed and taught to carry and haul, the Egyptians and Babylonians had donkeys. We read in the Bible that Job had a thousand donkeys. Abraham had large numbers of them, and the sons of Jacob brought donkeys down to Egypt to carry back the grain that was to save them from famine. Probably the donkeys were first used to carry burdens on their backs, and then they were taught to carry old or weak people. Not long ago the prospectors in the desert regions of the American Southwest all had their donkeys, called burros, to pack (carry) food and tools. They require less water than horses and can live on the weeds and thorny shrubs they find. The prospectors called them "mountain canaries," because of their braying. Now ancient automobiles have largely replaced the burros, leaving a few wandering beasts around masterless.



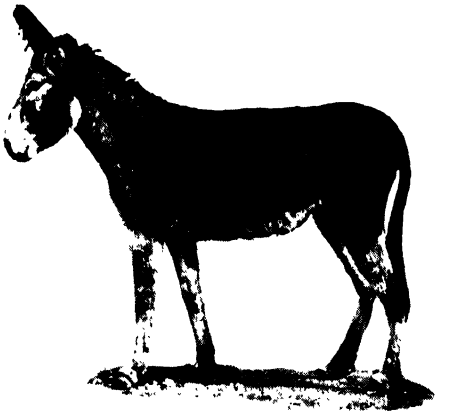
New York Zoological Park

A zebra mother and baby. The zebras' stripes blend with their background of tall grasses and help to hide them from their enemies.

Although asses have served man longer than horses, they have never received the care or affection that horses have gained. They have not generally inspired poetry or songs, nor do they share the shelter and

food of their masters, as Arab horses often do. Nor do donkeys ever seem to care much for their owners. A patient, hard-working animal may sometimes turn and attack the man who is driving it.

The donkey has long been a symbol of stupidity and dullness. This is a strange mistake, for the donkey is really not at all stupid. On the contrary, where donkeys and horses herd together a donkey is always the leader.



U. S. Department of Agriculture
The patient donkey has been a friend to man.

Donkeys are most common in the warm lands; they do not thrive in the cold North. Spain, Portugal, Italy, Syria, North Africa and Central-American countries are places where donkeys are much used. The largest and finest donkeys are bred in the Poitou region of France, where animals as high as fifteen hands (sixty inches) are known, almost twice as big as the ordinary kind.

The mule is the offspring of a jack, or male, ass and a mare, a female horse. The offspring of a female ass and a horse is known as a hinny. Mules can not reproduce their kind. These animals have been bred from Greek and Roman times to the present. In the United States millions of mules are in use, and breeding them for markets is an important industry in the states of Missouri, Tennessee and Kentucky. Practically all mules are used for hauling or for farm work. They are seldom used for riding or for drawing carriages or light passenger vehicles.

The mule has some qualities of both parents, and in others it is superior to either. In size it is more like the horse, but its ears, tail and shape are more like those of the ass. Like donkeys, mules are sure-footed, obstinate, intelligent and hardy. They can live on poor food on which a horse would starve. Mules are very important in wartime. Even in this mechanized age, it is difficult or impossible to get supplies through rough mountain country without mules.

By JOHN ERIC HILL.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 2139.



U. S. Department of Agriculture
Mules are used in many countries in war. In the United States they are now used mainly in mountain warfare.

The Story of Locks

THE lock was probably one of the earliest inventions of man after he became civilized. It took so long for him to make pots, pans, kettles, weapons and tools that he came to value them. Therefore he tried to find a way to guard his possessions when he had to be away from his home or when he was asleep at night. And so he invented the lock.

The oldest lock known to us was a wooden one that was found in an ancient Assyrian palace near the ruins of Nineveh. This lock was made by an Egyptian craftsman about 4,000 years ago. It consisted of a bolt that could be pushed through a staple—a wooden block set in the frame of a door. There were several tumblers, or pins, in the upper part of the staple. When the bolt was shot to its full length, the tumblers in the staple dropped into corresponding holes bored in the bolt; the bolt was then held fast.

The key was a straight piece of wood, with pegs on one end. If the key was inserted in a slot in the bolt, the pegs lay right under the tumblers. When the key was lifted, the tumblers were raised flush with the top of the bolt, and so it could now be drawn. The Egyptians made their early locks of wood; later they used brass or iron.

The ancient Greeks were satisfied at first with simple safeguards. A leather thong tied in curious knots around the handle of the door was the only lock; the knack of untying the knot was the only key. Later the Greeks used bars or bolts. These could be worked from the outside of the door by means of a huge key, of the size and shape of a reaper's sickle. The key was inserted through a hole in the door above the bolt; its tip caught the bolt and pushed it. The slaves or wardens who used such keys carried them over their shoulders.

The Romans had many different kinds of locks. Some of them were provided with tumblers of various shapes—round, triangular or square. One of their cleverest locks combined the features of the Egyptian tumbler lock and the Greek sickle lock. The key was inserted in a hole in the door; then pegs on the key pushed up tumblers and thus released the bolt.

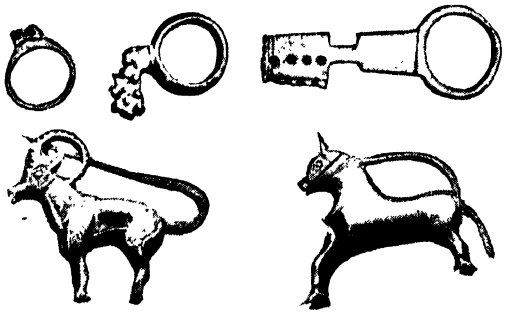
The Romans made wide use of the padlock, which was popular in many other ancient lands. It was used a good deal by Roman ladies to lock their vanity cases. The simple key that operated this lock was often designed to fit on the finger as a ring. The Romans, skilled in metal work, created padlocks in various designs; animal designs were particular favorites.

The Romans were also familiar with warded locks. (See the pictures on page 2023.) The key that opened a lock of this



Bettmann Archive

Coat-of-arms of a medieval locksmiths' guild.



All photos, Yale & Towne Mfg. Co.
Keys and padlocks used in ancient times.

kind turned in a keyhole. But before it could do so it had to pass several obstacles, or wards, set near the keyhole. Unless the key was cut so that it could pass the wards, it could not turn in the lock and so it could not push back the bolt.

The locksmiths of the Middle Ages made no important changes in the designs of locks. Instead, they depended on complicated devices to foil thieves. They sometimes made a number of locks and keyholes for a single door or chest. Certain chests had as many as twelve bolts, worked by several keys. One chest was really a clever trap. If a thief succeeded in opening it, he would have to lift an empty tray, pierced with several holes, before he could get at the contents of the chest. But when he thrust his fingers through the holes in order to lift the tray, a spring snapped shut on his fingers. Since the chest was bolted to the floor, the thief was held fast.

The locksmith of the Renaissance in France, Italy, Germany and England was an important figure. He was an artist in iron, bronze and copper. He had numerous apprentices, who were distinguished by a special costume. Locks and keys were handmade and were often models of fine workmanship. But, like the locks and keys of the Middle Ages, they marked no real advance over the designs which were already common in ancient times.

In the latter part of the eighteenth century, an Englishman, Robert Barron, invented a lock which was much harder to pick than any lock that had ever been made before. Two other English locksmiths, Joseph Bramah and Jeremiah Chubb, also made important contributions to lock-making in the years that followed.

The middle of the nineteenth century saw the development of the Yale cylinder lock. It was first patented by Linus Yale, Sr., a manufacturer of bank locks, in 1844. His son, Linus Yale, Jr., improved the lock and took out two other patents in 1861 and 1865. It has been further improved since that time but it still works on the same principle. It consists of a shell, or case, in which there is a rotating cylinder, called a plug; the key is inserted in the plug. On page 2026 we show you how the cylinder lock works.

The Yale lock brought about a revolution in the lock-making industry. Up to that time good locks had been made by hand and they were very expensive. The invention of the cylinder lock made it possible to use mass-production methods in making really fine locks. Nowadays such locks are available to rich and poor alike.

No matter how strong and well designed a lock may be, the keyhole always presents a weak point. Many devices to hide the keyhole, and even to take the place of a lock proper, have been tried, but the only one in general use is the combination lock. This is a lock in which the arranging of the internal parts in their proper positions is done from the outside by merely using numbers or letters in their right order. These numbers show on a disc which is usually marked from 1 to 100. In this case the only key is a secret—the right figures and the order in which they are to be used. Where letters are used the lock may be set to open only when a particular word is spelled.

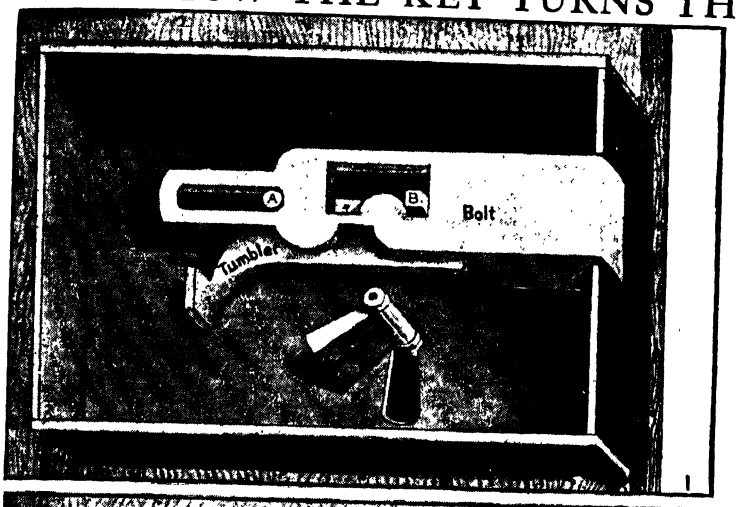
These improvements made the combination lock almost unpickable. There still remained a secret, which, if known, would open the lock, and burglars sometimes used torture to force the possessor of the secret to reveal it to them.

Then the inventors took another step and produced the time-lock, which can be opened only at certain hours selected in advance, just as we set our alarm clocks to ring the next day. Still the burglar found a way of introducing liquid explosives into the space surrounding the lock spindle (the bolt which

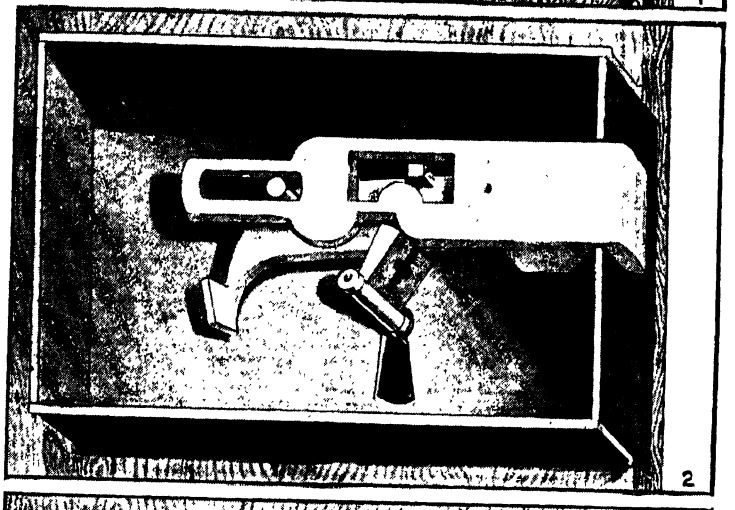


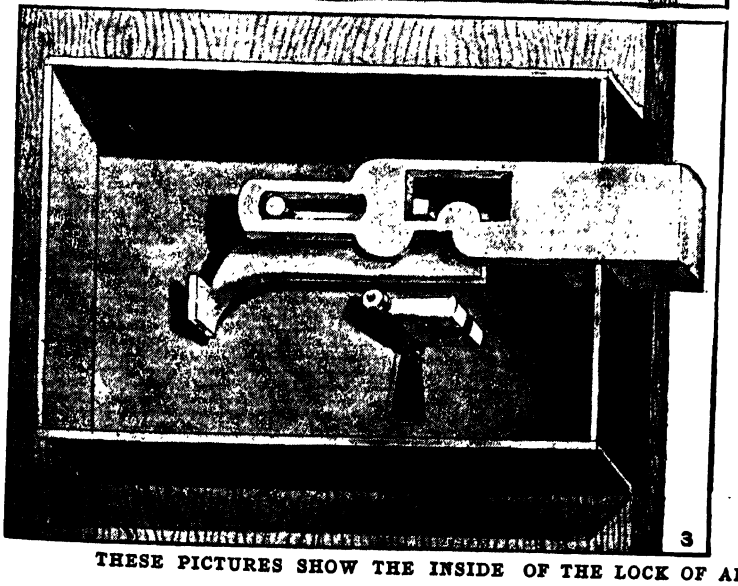
The open front plate of an elegant sixteenth-century iron chest lock, with a graceful leaf design.

HOW THE KEY TURNS THE LOCK

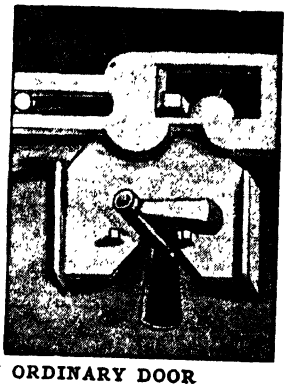




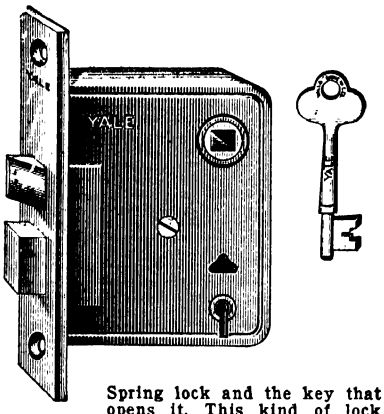




Locks are as old as civilization, and were first made of wood. It was in the reign of Alfred the Great that locks were first manufactured in England, but there was little improvement in their construction until the end of the eighteenth century. Since that time there have been marvelous developments, until we have the elaborate and costly locks shown on these pages. Here we see how the common tumbler lock works. This is the ordinary cheap lock found on cupboards and drawers. As shown in this picture, a metal "tumbler" works on a pivot A. A stud, B, projects from the tumbler and fits into a notch in the bolt, preventing the bolt from moving either way. But when the key is turned, as seen in picture 2, the "bit," or flat part of the key, lifts the tumbler and enables the bolt to be pushed along as seen in picture 3. As soon as the key is turned right around, the tumbler falls, its stud fitting into a second notch in the bolt and holding it firm. Picture 4 shows the wards, or projections, which prevent any key but one specially cut to fit the lock from turning around, and in picture 5 we see how the right key can be turned over the wards.



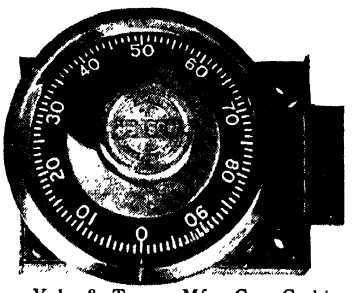
THESE PICTURES SHOW THE INSIDE OF THE LOCK OF AN ORDINARY DOOR



Spring lock and the key that opens it. This kind of lock is usually found on drawers and small cases.



Padlock.



Yale & Towne Mfg. Co.; Corbin Cabinet Lock; Mosler Safe Co.

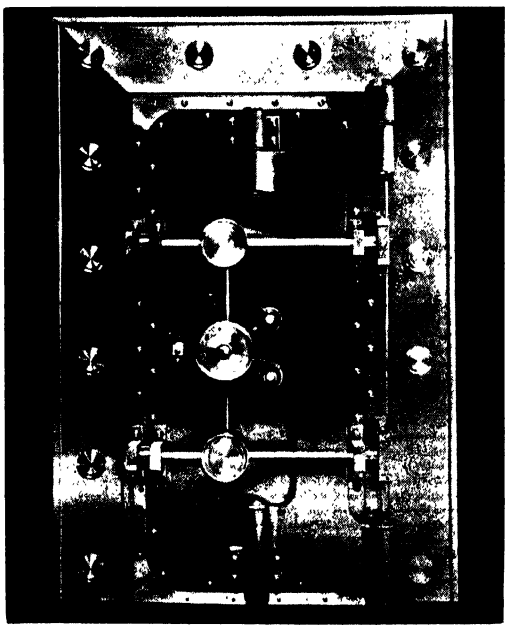
Combination lock, the kind used on ordinary safes. One needs to know the right combination of numbers, to which to turn the dial, in order to open it.

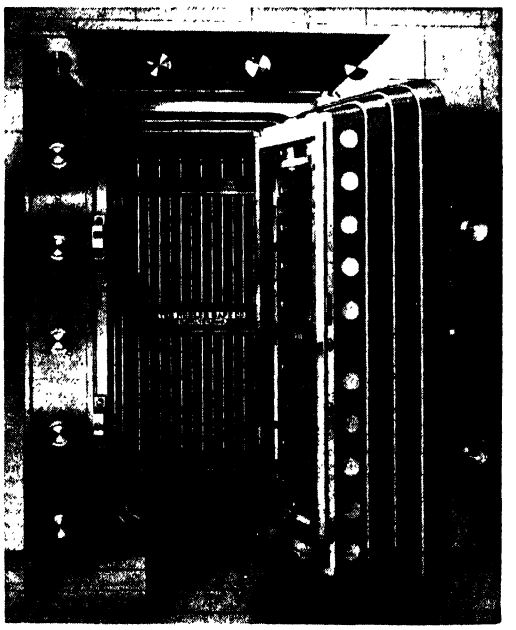
passes from the outside combination dial to the tumblers inside the door).

The problem was to make the introduction of these explosives impossible, and to do this the spindle-holes had to be done away with. This is done by a motor device working with a time-lock. The motor throws the bolts and draws them back according to the setting of the time-lock. The only way to overcome a modern vault door is to use force destroying the whole structure.

Locks are often master-keyed. Each lock in a master-keyed series has its own key which fits no other lock in the series, but there is as well a master key which fits all the locks in the series. This is a convenience in a building with many locks. Thus, in a large office building, each tenant can unlock only his own door; the porter for a given floor can with his master key unlock only the locks on his floor; and the building superintendent with his master key can unlock any of the locks on any of the floors, if necessary.

Today there are locks for doors, safes, safety-deposit boxes, cars, ignition switches and a great many other things. The manufacturers of locks are doing all in their power to safeguard our treasures; and they are succeeding as never before.





The lock on the massive door of this bank vault is controlled by means of an electric time mechanism.

A LOCK OPENED WITH NUMBERS

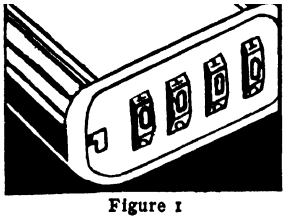


Figure 1

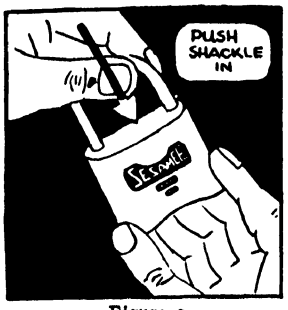


Figure 2



Figure 3

Here is a handy little lock, shaped like a padlock but opened with numbers instead of keys. The bottom of the lock, as shown in figure 1, has four series of numbers on wheels, each running from 0 to 9. These numbers may be set in any desired order, but familiar ones, such as birth dates, telephone and home numbers, are generally used so that the combination may not be forgotten. When the wheels are turned to the proper numbers the shackle is pushed in and the lock is opened (figures 2 and 3). In figure 4 a birth date has been used—the first two numbers, 1 and 2, are for the twelfth month, December, and the last two, 1 and 5, are for the day of the month. The lock is closed by turning one or all of the numbers so that they read any other number than the one which will open it (figure 5) and by pushing the shackle into the case.

The combination may easily be changed. The lock is opened as we have just described and, as in figure 6, the little block X is moved by a coin into the slot Y. The number wheels are then turned to the new combination and X is moved back to its original position (figure 7).

If the number wheels are turned backward as far as possible they will stop at 0. This is very useful in the dark when the dial can not be seen because it is a simple matter to count from 0 the numbers on each wheel by feeling the clicks. For example, if the combination is 1215, one click will indicate the first number, two clicks the second, one click the third and five clicks the fourth.



Figure 4

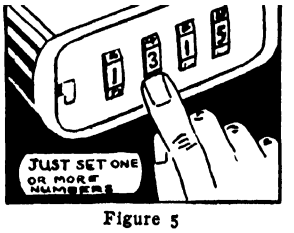


Figure 5

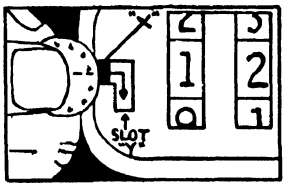


Figure 6

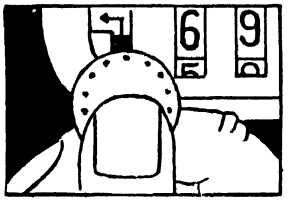
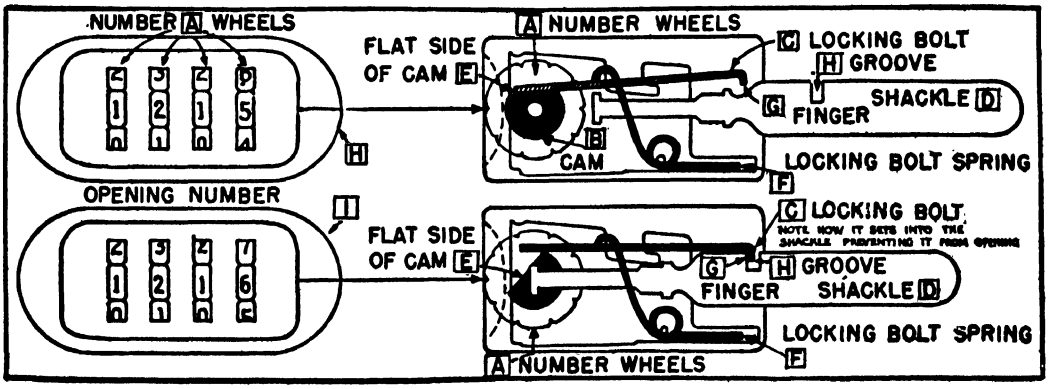


Figure 7



This is a diagram shewing the interior of the lock and how it works. Attached to each number wheel and revolving with it is a cam B with one flat side E. When the number wheels A are turned to the opening number, the flat side of the cam is touching the locking bolt C. The spring F pulls the locking bolt down upon this flat surface which in turn raises the other end of the locking bolt. This disconnects the finger G of the locking bolt from the groove H in the end of the shackle. The shackle is thus released and can be pulled out, opening the lock.

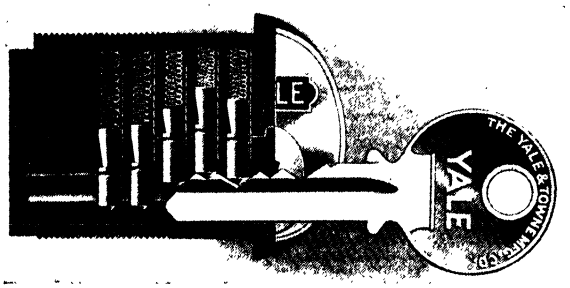
When any one of the number wheels is not in position for opening, as shown in the lower part of the diagram, the round side of its cam is holding the locking bolt up so that the finger is locked in the groove of the shackle and the lock is closed and can not be opened while the wheels are in this position.

Diagrams courtesy of The Sesamee Co.

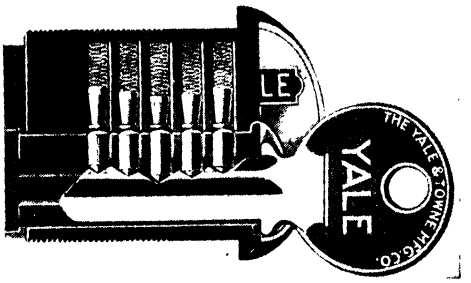
HOW A LOCK WORKS



Above, cross section of a Yale cylinder lock, showing one pin with its driver and spring. In the first picture, the pin is down, before the key has been inserted. Next, the key is inserted, lifting the pin until its point of contact is flush with the surface of the cylinder. In the last picture, the key is turned, turning the cylinder with it, and the lock opens.



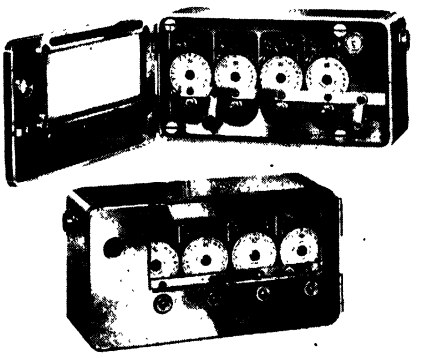
Above, lengthwise cross section of the cylinder of a lock, showing the five housings for pin-tumblers and springs. The key can not open the lock yet, because three of the pins are still engaged in both the cylinder and their housings. The picture to the right shows the key pushed home, with all the pins in perfect alignment where they contact the drivers. This permits the key to turn the cylinder, and the lock opens.





On the left is the door to an individual box in a bank's safety-deposit vault. One lock is opened by the bank's key (which the vault guard carries), and the other by the renter's key. Both keys must be used.

All photos, Yale & Towne Mfg. Co.



At right, the lock of a bank safe, fitted with a clockwork mechanism. The lock is shown open and closed. The dials of four clocks bear numbers showing the hours. One clock would be sufficient to operate the lock; but as it is extremely important that the lock open only at a certain time, it is safer not to trust to a single clock.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 2069.



The T. F. Henry Collection

Thomas Chatterton, the Bristol boy, is entranced by the old-style English on some fifteenth-century parchments.

POETRY GOES BACK TO THE COUNTRY

BRITISH VERSE OF THE EIGHTEENTH CENTURY

IN the later part of the seventeenth century and the early part of the eighteenth, as we have seen, English poetry almost completely deserted the country for the town.

Shakespeare and the other Elizabethans had been at heart countrymen and had kept country life as a background to nearly all their writings. So had Milton, less freely and in a more formal way. But in the poor drama that followed Shakespeare and in the elaborate courtliness of the later Stuart reigns which led up to the town-bred poetry of Dryden and Pope, nature almost faded out from English literature.

The only poet who showed a heart open to the country during that period was Robert Herrick. He also was a man of the town by choice, but he was obliged to live in the country; and being a true poet, he reflected his surroundings and wrote many a gay little song about his Devonshire flowers. Most of the poetry, however, was town-born.

Still, even while Alexander Pope was at the height of his fame, a less formal spirit in writing was beginning to show itself here and there. Poems with simple country backgrounds were occasionally produced, until, before the eighteenth century closed, Nature was the poets' main inspiration.

While there was growing up the feeling for nature as the background of human life, there grew with it a new sense of mankind as a whole. Writers felt that the everyday lives and thoughts of simple men were important. Also, along with the growth of delight in the beauty of the world, and of sympathy with the lives of all kinds of men and women, a real interest in animal life sprang up. Thus friendship with animals began to find expression in verse.

There was one more new feature of eighteenth-century poetry. Men's thoughts were turned back to the poetry of the past by Dr. Thomas Percy's RELIQUES OF ANCIENT POETRY. This collection of many old ballads awoke the slumbering sense of romance. In

tune with this movement was the sham poetry supposed to be written by an ancient bard, Ossian. It was really foisted on the public by a Scottish schoolmaster named James Macpherson (1738-1796).

Of the same kind were the forged antique poems of the boy genius of Bristol, Thomas Chatterton (1752-1770). While Thomas was



Culver Service

A portrait by Sir Joshua Reynolds of Dr. Thomas Percy who made a famous collection of old ballads.

still a young schoolboy, there came into his house by chance some old fifteenth-century parchments printed with unimportant records. They were not treasured but were used for lining chests and even cut up into paper dolls for the children; but Thomas was fascinated by the old-style English and pored over the parchments until he had absorbed something of the spirit of the old writing. He then managed to find a glossary (dictionary) of English country dialects, and soon was able to write very passable exercises in the olden style. Full of glee at the results of his play, he announced that his family had found some very valuable old manuscripts, with bits of local history and also poems by a man named Rowley. He seems to have been believed, and many of his exercises were published. Though he was only sixteen years old, he went to London, hoping for a career in literature; but he was not able to support himself, and died by poison before his eighteenth birthday. Chatterton's brief and tragic life is one of the sad bits in English history. He was undoubtedly a genius. His "Rowley" poems show imagination, poetic fire and skill.

From Percy, Macpherson, Chatterton and others arose the desire, afterward more fully expressed by Scott in prose romance, to look back curiously into the poetry and history of the past.

In 1725 Allan Ramsay, a Scottish bookseller who had been busy in discovering ancient Scottish ballads, published his pastoral, THE GENTLE SHEPHERD. (A pastoral is a simple poem or prose work with a country scene.) In 1727, John Dyer, a Welsh poet, gave to the world his GRONGAR HILL, a poem descriptive of the view from a height in South Wales. Both those poems were liked well enough to show that the world was ready to receive thankfully the poetry of woods and fields.

JAMES THOMSON, WHO BROUGHT A BREATH OF COUNTRY AIR TO LONDON

James Thomson (1700-1748), son of a Scottish minister, went straight to London in his twenty-fifth year and gave to the great city a breath of country air in his poem WINTER. He sold three editions of it in a year and secured orders for describing the other seasons in a similar way. Later he wrote with only moderate success for the stage but received comfortable official appointments so that he was able to live in the spirit of his final poem, THE CASTLE OF INDOLENCE. This charmed his readers when it was published in the year of his death.

Thomson's SEASONS was written in blank verse—a daring form to use in those days. His CASTLE OF INDOLENCE was in the same metre as Spenser's FAERIE QUEENE and was plainly an imitation. The poet rewrote and expanded much of THE SEASONS, so that its length grew from 3,902 to 5,403 lines, from the first to the last editions. There can be no doubt that the poet was a sincere lover of nature. Sometimes he painted his landscapes in words too general, but he could describe a scene with his eye on the object all the while. Here, for instance, is his description of birds building their nests:

Now 'tis naught
But restless hurry through the busy air,
Beat by unnumbered wings. The swallow sweeps
The slimy pool, to build his hanging house
Intent. And often, from the careless back
Of herds and flocks a thousand tugging bills
Pluck hair and wool; and oft, when unobserved
Steal from the barn a straw; till soft and warm,
Clean and complete, their habitation grows.

That Thomson turned men's eyes and thoughts back to nature, no one can doubt. Though he does not compare in exquisiteness with some later poets who have interpreted the beauty of the world, we should read him with respect, for his influence as a writer was both wholesome and sincere.

Two other poets of the era published first poems in the year 1747. They were Thomas Gray (1716-1771) and William Collins (1721-1759). Both these men were choice and scholarly; both of them liked to write in the ode form so heartily detested by Doctor Johnson. Both left verse which will always live because of its charm and perfection, though it does not reach the topmost summit of literary greatness.



Culver Service

William Cowper, who wrote the merry JOHN GILPIN; and Thomas Gray, author of ELEGY WRITTEN IN A COUNTRY CHURCHYARD.

Thomas Gray was born in London, fifth of a family of twelve children, and the only one to survive infancy. After an unhappy childhood (his father was a very cruel man) Thomas was sent to school at Eton, where Horace Walpole became one of his close friends. Both friends attended Cambridge and later went together on a "grand tour of the Continent," where they quarreled bitterly and separated. After a time in London, Gray returned to Cambridge to study law; and he secured his degree there in 1743. From that time Cambridge became his home. He never married but passed his years in studying teaching and turning out a slender quota of prose and poetry. He is best known for his ELEGY WRITTEN IN A COUNTRY CHURCHYARD, which you will find on page 3741. The churchyard of the poem is at Stoke Poges, where his mother and he are now buried.

Gray had really great and lasting influence on English literature. He had it because of his intense love of beautiful scenery, expressed rather in his letters than in his poems. Gray did not believe in writing descriptions of nature in verse. His idea was that description should be used only here and there as literary ornament, and should not be the main subject. "The ploughman homeward plods his weary way," is just an incidental touch to a scene telling of nightfall.

The breezy call of incense-breathing morn,
The swallow twittering from its straw-built shed,
The cock's shrill clarion, or the echoing horn

are not described for description's sake, but as a contrast to the stillness of the village dead in the line:

No more shall rouse them from their lowly bed.

THE ELEGY is the most perfect quietly thoughtful poem in English.

Both Gray and Collins wrote a number of odes, in which abstract ideas, such as Misfortune, Quiet, Envy and Age are treated as persons and spelled with a capital letter. They follow poetical rules, but such an artificial fashion soon tires us and we look for simple things. We are glad to have some odes in the Gray and Collins style, but the craftsmen who made them so well live most surely in our memories and hearts by simpler poems—Gray by his ELEGY, which returns again and again to our minds with all its original beauty, and Collins by his unsurpassed lament for those fallen in battle.

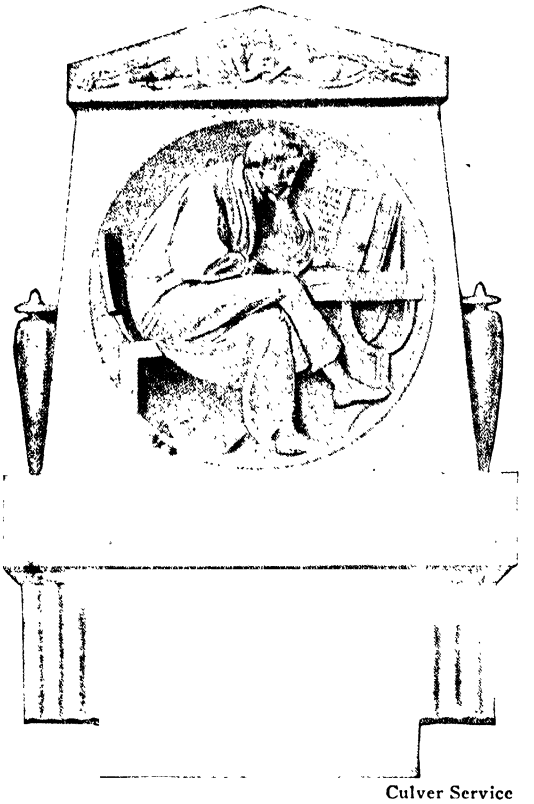
How sleep the brave who sink to rest
By all their country's wishes blest!
When Spring, with dewy fingers cold,
Returns to deck their hallowed mould,
She there shall dress a sweeter sod
Than Fancy's feet have ever trod.
By fairy hands their knell is rung,
By forms unseen their dirge is sung;
There Honor comes, a pilgrim gray,
To bless the turf that wraps their clay,
And Freedom shall a while repair,
To dwell, a weeping hermit, there!

Collins was born at Chichester in December 1721, and he died on June 12, 1759, after six years of insanity, partly caused, perhaps, by the feeling that his poetry was not appreciated.

The poet who best shows the later eight-

eenth-century escape from the witty bookish verse made according to neat rules was William Cowper (1731-1800). He regained freedom in style and wide choice of subject. His flow of feeling was as natural as his flow of verse. No topic was too homely for his pen. Cowper had an unerring rightness of feeling, whether his sympathic eye rested on mankind as a whole, or men as individuals, or the friendly world of animals, or the changeful beauty of the outdoor world. But there was a tragic side to his nature.

His gentle spirit was invariably kindly, except, alas, in one respect, for he was haunted by doubts about the welfare of his own tender soul. It is a strange thing that the kindest of all poets could not be sure that God would be as kind to him as he himself was kind to all living things! And so his life was tormented by fears for the fate of his soul. He suffered fits of insanity, during which he believed he was doomed for his wickedness to eternal punishment.



Culver Service

Monument to William Collins, Chichester Cathedral.

This awful view spoiled the life of a good man and skillful poet. In fact, Cowper's goodness, and his poetry, and his fear of the future were the three things that make up his whole life. A well-educated, scholarly young man, with influential friends, Cowper had the offer of an appointment as Clerk of the Journals of the House of Lords, but distrust of himself drove him out of his mind, and he was sent into a home to be cared for. When he recovered, he retired from active life and lived with friends in the country.

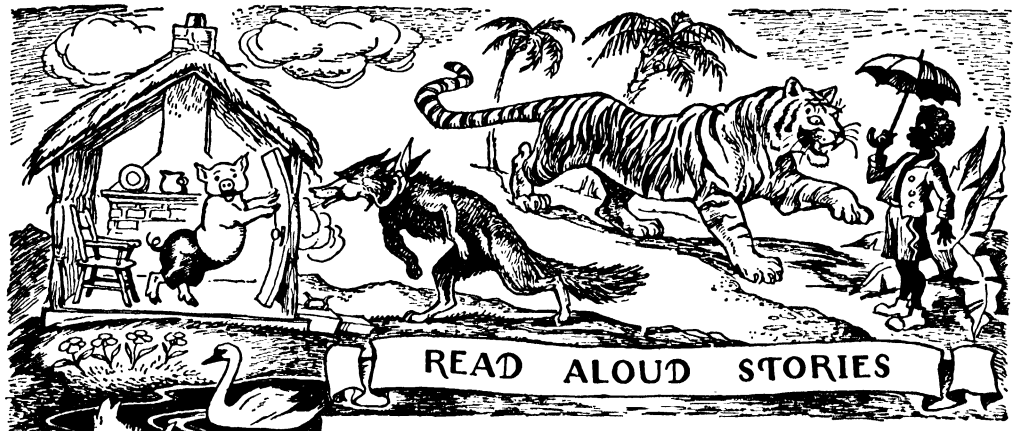
His friends were very religious, and with them hymn-writing was a favorite duty. At Olney in Buckinghamshire, where he lived more than a quarter of a century, Cowper and his friend, the clergyman John Newton, wrote a whole book of hymns, in which Cowper's contribution numbered sixty-seven.

It was found that versifying was a pleasant and calming recreation, and so Cowper's friends gave him subjects on which to practice. When he was fifty-one years of age his first volume of rimed verse was issued, and three years later (1785) his principal work, THE TASK, written in blank verse, was published. Before the poet's death, fifteen years later, eleven editions of this had been printed, with other poems added.

It seems a dull life, writing in a quiet country place to ward off depression, but when the cloud of religious helplessness was not resting on him the poet was mildly happy. His nature was tender, his sympathies were active. He was a loyal friend with loyal friends about him, and his natural temperament, when unstrained, was rippling with a quiet sense of humor. These qualities appear equally in his poems and his charming letters.

The ease of Cowper's writing should not blind us to the fact that his interests were varied and widespread. He was a great lover of the outdoor world, the coziest of friends indoors, a genuine understander of animals, whom he warmly championed. He loved a frolic, as we can see by JOHN GILPIN (page 605). He was an ardent patriot, a thoughtful politician and a tender humanitarian afire with the love of freedom. Indeed, William Cowper brought poetry down into the homely ways of men. In doing so he, with Robert Burns, completed the transformation of poetry from a scholar's exercise, as it had been under Pope, to a picture of the hearts of men. These two blazed a trail which greater poets, in the nineteenth century, gladly followed.

THE NEXT STORY OF LITERATURE IS ON PAGE 2135.



FINN and the FAIRY SHOEMAKER

AN IRISH FOLK TALE

Version by Margaret Lima Norgaard

FINN O'SHEA'S grandmother knew more about fairies than anyone else in the village. One afternoon when the sun was shining on the tops of the Nine Hills where the fairies lived, Finn and his grandmother were coming home from a walk, and the old woman picked up the tiniest bit of gray feather.

"What is it, Granny?" asked Finn.

"An owl's feather, lad. It fell out of one of the wee red caps of the fairies when they danced here last night."

"I wish I could see them dancing," said Finn.

"Ah, my lad, no one can see them so long as they keep their wee red caps on," said grandmother. "Sometimes they toss their caps aside, and then you could see them if you were close by, but the frogs are always on the lookout to warn the fairies if anyone approaches."

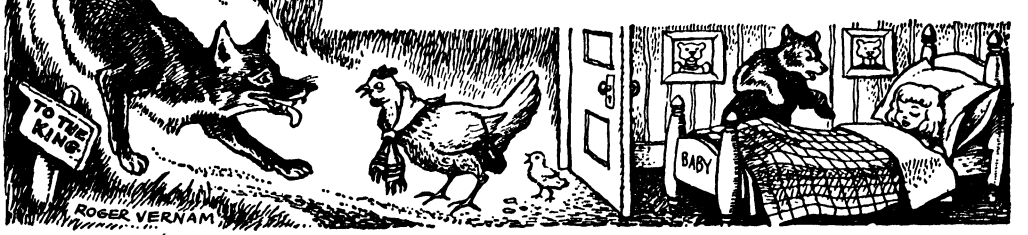
"Do they dance every night, Grandmother?" asked Finn.

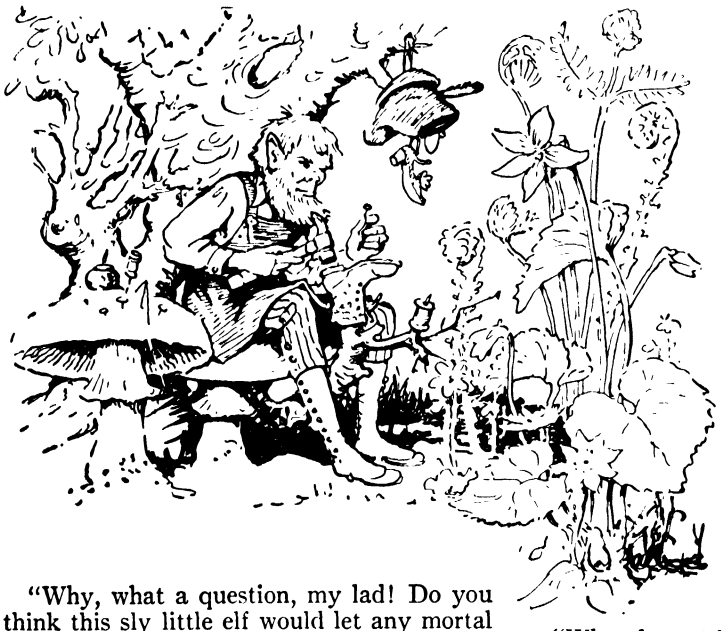
"Every night, my lad, especially if the moon is bright."

"They must wear out many pairs of shoes," said Finn.

"That they do," said grandmother, "but Little Leprechaun, the fairy shoemaker, makes them new ones. The fairy shoemaker is very rich, Finn, from making satin slippers with silver laces and diamond buckles, and, oh, all sorts of little shoes. He's a wonderful wee old man, is the fairy shoemaker."

"Where does he keep his money, Granny?"





"Why, what a question, my lad! Do you think this sly little elf would let any mortal know that secret? Not he! And if anyone should catch him without his wee red cap on, small good it would do, for the very instant a person took his eyes off the little man, away he would vanish."

Well, all the way home and all the time he was eating his supper and long after he went to bed, Finn thought and thought about the fairy shoemaker and how he would like to catch him and get one of his pots of money so he could buy things for Granny to make her more comfortable.

In the morning when Finn drove the cow to pasture, he peeped among the low willows that bordered the brook. He looked all around the big stones in the meadow. Several times he stopped and listened. Once he was sure he heard the clicking sound of an elfin hammer. It seemed to come from the direction of a tall weed, but when Finn drew near, the sound stopped and he could see nothing.

After that, day after day all summer long, Finn searched for the fairy shoemaker, Little Leprechaun, but not a sign of him could he find.

Now one afternoon Finn stopped by a brook near the Nine Hills, for he was very thirsty. He was stooping down to drink when — what do you suppose — there beneath a toadstool, as still as a mouse, was the fairy shoemaker! He wore a little leather apron and in his hand he held a tiny hammer; and the reason Finn could see him was that he had laid his wee red cap aside and hadn't been able to reach for it soon enough.

Quick as a flash, Finn snatched up the cap. But before he could speak, the shoemaker pulled out a tiny gold box filled with black powder and offered it to Finn. "Have a pinch, sir," said he with a smile.

"Why, how friendly he seems," thought Finn, bending over to see what was in the box.

"Pouf-f!" The fairy shoemaker blew all the powder right into Finn's face, and then he found out what it was. It was pepper!

"Ka-choo! Ka-choo-o-o!" sneezed Finn, shutting his eyes. In a twinkling, the wee man had snatched his red cap and was gone!

Finn went home very sad. "Why didn't I remember what Granny told me about his tricks?" he said to himself. "I'll try again, and he shall not catch me a second time."



One afternoon a few weeks later, Finn walked as far as the Nine Hills. He was very tired, so he sat down on a grassy hillside to rest. How quiet it was there! Suddenly he heard a sound:

Tip-a-tap-tip
And tick-a-tack-too,
Rip-rap-rip
Tick-tack-too.

After a while a shrill voice sang:

A wedding feast to-night
And dancing on the green!
In moonbeams' silver light

Gay fairies will be seen.
Tiny satin sandals
To grace the dainty bride;
Stitch away, Leprechaun,
They must be your pride.

It was the voice of Little Leprechaun! Finn crept up the slope, and there, in the shadow of some low bushes sat the tiny elf. He was putting a high heel on the daintiest white sandal you ever saw, and beside him lay his wee red cap.

Tip-tap-rip-rap
Tick-a-tack-too.

The elfin hammer was working busily.

Finn slipped up as quiet as a mouse and snatched up the red cap, and all at the same time laid hold of the wee man's shoulder. Up jumped the elf and looked around quickly for his cap.

"Good-day, sir," said Finn.

Leprechaun made a deep bow.

"You are busy, I see."

"Always busy, sir," answered the wee man. "Always busy. I like to work. Come now, do you?"

Finn felt a little ashamed at this last question, but he answered:

"Tell me where you keep your treasure crocks and I will let you go. I want only a little money—just enough to buy a few things for Granny; she has never had pretty things in all her life."

"I will show you where I keep *one* of my crocks," answered Leprechaun.

"All right," said Finn. "If you will lead me to the spot where one crock of money is buried, I'll not bother you again."

"Come then," said the elf.

Down the hill and over the fields hurried the fairy shoemaker. It was wonderful to see him skip over the ditches and hedges and hop over the stones and rough places in the meadow. Finn was becoming very tired. "How much farther is it?" he asked.

"Come along, come along," laugh·d Little Leprechaun.

Finally they came to a field full of weeds. The fairy shoemaker stopped and pointed his tiny finger. "If you dig deep under the roots of this weed," he said, "you'll find one of my treasure crocks filled to the brim with money."

"But I can't dig without a spade," said Finn.

"Then go home and get your spade and come back," said Leprechaun.

"I'll do that!" said Finn. "But I'd better mark the weed so I'll know which one it is."

"That would be a good plan," said the shoemaker. "Here I have a bit of bright red string in my pocket. Let us tie it around the stem near the top."

How quickly the elfin fingers tied the mark!



"Thank you very kindly," said Finn. "Now will you promise not to touch the string?"

"I promise not to touch it," the shoemaker said, nodding his head and laughing. "And what's more, I'll see that no one else touches it!"

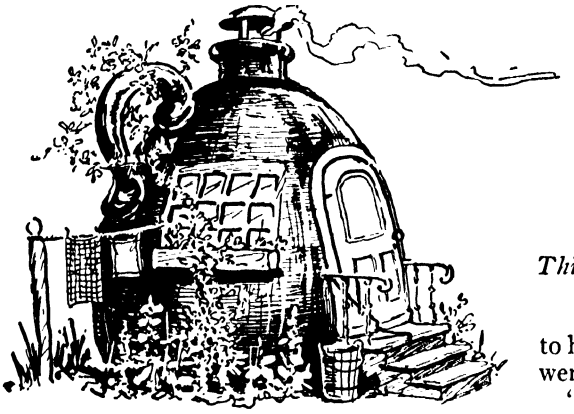
So Finn gave the fairy shoemaker back his cap, and the little man scampered off, chuckling to himself.

You may be sure Finn hurried fast to fetch that spade. He thought of how surprised Granny would be to hear that he had caught the fairy shoemaker. He would not tell her until he carried home the money. In breathless haste he got his spade and hurried back to the field of weeds. Then Finn stood still and looked! A bit of bright red string was tied around every weed in the field! The fairy shoemaker had tricked him again! He thought he heard a laugh, and he listened carefully.

From among the weeds he heard a faint voice singing:

How does the little Leprechaun
Fill treasure crocks with gold?
The live-long day he works away
From far-off times of old.

Adapted by permission from Finn and the Fairy Shoemaker in Merry Tales, by E. L. and A. M. Skinner; American Book Company, New York, publishers.



THE STORY of MR. VINEGAR

This Version is by Margaret Lima Norgaard

MR. AND MRS. VINEGAR lived in a vinegar bottle. Now, one day when Mr. Vinegar was from home and Mrs. Vinegar, who was a very good housewife, was busily sweeping her house, an unlucky thump of the broom brought the whole house clitter-clatter about her ears. In great grief she rushed forth to meet her husband and exclaimed,

"Oh, Mr. Vinegar, Mr. Vinegar, we are ruined, we are ruined! I have knocked the house down, and it is all to pieces!"

Mr. Vinegar then said: "My dear, let us see what can be done. Here is the door; I will take it on my back, and we will go forth to seek our fortune."

They walked all that day and at nightfall entered a thick forest. They were both very tired, and Mr. Vinegar said: "My love, I will climb up into a tree, drag up the door, and you shall follow."

He did so, and they both stretched their weary limbs on the door and fell fast asleep.

In the middle of the night Mr. Vinegar was disturbed by the sound of voices beneath, and to his great fear he saw that a party of thieves were met to divide their booty.

"Here, Jack," said one, "here's five for you. Here, Bill, here's ten for you. Here, Bob, here's three for you."

Mr. Vinegar could listen no longer; he was so frightened that he trembled all over and shook down the door on their heads. Away scampered the thieves while Mr. and Mrs. Vinegar clung to the branches till broad daylight. Mr. Vinegar then scrambled out of the tree and went to lift up the door. What did he see but a number of gold coins!

"Come down, Mrs. Vinegar," he cried. "Come down, I say. Our fortune is made! Come down, I say."

Mrs. Vinegar got down as fast as she could and saw the money with equal delight.

"Now, my dear," said she, "I'll tell you what you shall do. There is a fair at the neighboring town; you shall take these forty gold pieces and buy a cow. I can make butter and cheese, which you shall sell at market, and we shall then be able to live very comfortably."

Mr. Vinegar agreed, took the money, and went off to the fair.

When he arrived, he walked up and down,

and at length saw a beautiful red cow. It was an excellent milker and perfect in every respect.

"Oh," thought Mr. Vinegar, "if I had but that cow, I should be the happiest man alive." So he offered the forty pieces of gold for the cow, and the owner declaring that, as he was a friend, he'd oblige him, the bargain was made.

Proud of his purchase, he drove the cow backwards and forwards to show it. By and by, he saw a man playing the bagpipes: *tweedle-dum, tweedle-dee.* The children followed him about, and he appeared to be pocketing money on all sides.

"Well," thought Mr. Vinegar, "if I had but that beautiful instrument, I should be the happiest man alive. My fortune would be made."

So he went up to the man. "Friend," says he, "what a beautiful instrument that is, and what a deal of money you must make."

"Why yes," said the man, "I make a great deal of money, to be sure, and it is a wonderful instrument."

"Oh, cried Mr. Vinegar, "how I should like to own it."

"Well," said the man, "as you are a friend, I don't mind parting with it; you shall have it for that red cow."

"Done!" said the delighted Mr. Vinegar. So the beautiful red cow was given for the bagpipes. He walked up and down with his purchase; but in vain he attempted to play a tune; and instead of pocketing pennies, he was followed by a troop of boys who hooted and laughed at him.

Poor Mr. Vinegar! His fingers grew very cold, and he was so ashamed that he was starting to leave town when he met a man with a fine thick pair of gloves.

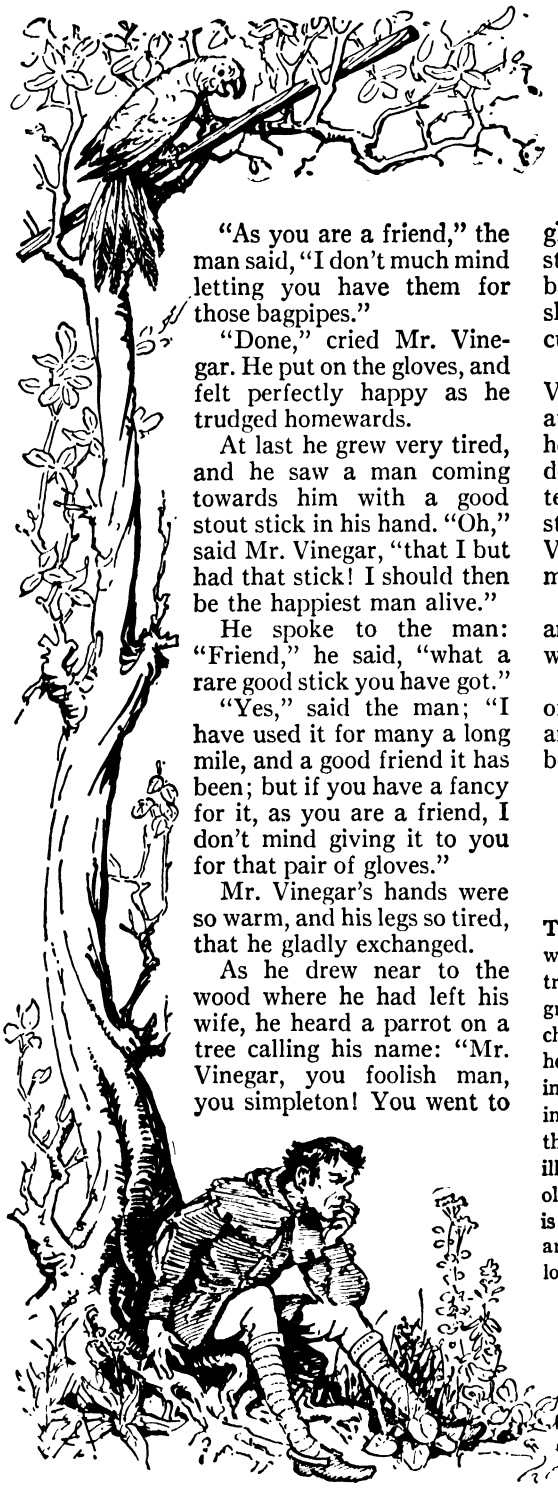
"Oh, my fingers are so very cold," said Mr. Vinegar to himself. "If I had but those beautiful gloves I should be the happiest man alive."

He went up to the man and said to him: "Friend, you seem to have a capital pair of gloves there."

"Yes, truly," cried the man; "and my hands are as warm as possible this cold November day."

"Well," said Mr. Vinegar, "I should like to have them."





"As you are a friend," the man said, "I don't much mind letting you have them for those bagpipes."

"Done," cried Mr. Vinegar. He put on the gloves, and felt perfectly happy as he trudged homewards.

At last he grew very tired, and he saw a man coming towards him with a good stout stick in his hand. "Oh," said Mr. Vinegar, "that I but had that stick! I should then be the happiest man alive."

He spoke to the man: "Friend," he said, "what a rare good stick you have got."

"Yes," said the man; "I have used it for many a long mile, and a good friend it has been; but if you have a fancy for it, as you are a friend, I don't mind giving it to you for that pair of gloves."

Mr. Vinegar's hands were so warm, and his legs so tired, that he gladly exchanged.

As he drew near to the wood where he had left his wife, he heard a parrot on a tree calling his name: "Mr. Vinegar, you foolish man, you simpleton! You went to the fair and spent all your money on a cow. Not content with that, you changed it for bagpipes on which you could not play and which were not worth one-tenth the money. You had no sooner got the bagpipes than you changed them for the gloves which were not worth one-quarter the money. And when you had got the gloves, you changed them for a poor miserable stick. Now for your forty pieces of gold, cow, bagpipes and gloves, you have nothing to show but that stick which you might have cut in any hedge."

On this the bird laughed loudly, and Mr. Vinegar, falling into a rage, threw the stick at its head. The stick lodged in the tree and he could not loosen it. Then Mr. Vinegar sat down under the tree and began to weep bitterly that money, cow, bagpipes, gloves and stick, all were gone. But at this moment Mrs. Vinegar came running through the woods to meet him.

"Oh, Mr. Vinegar," she cried. "I have found another bottle and set up housekeeping there with the door that we saved from the old."

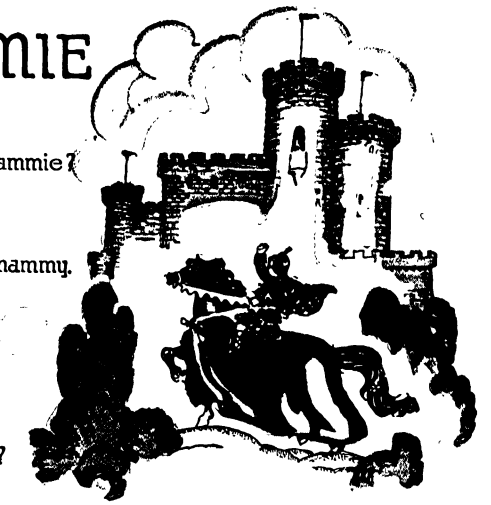
So arm in arm Mr. and Mrs. Vinegar set off for their new home, completely happy, and no poorer than before the adventure began.

THE NEXT READ ALOUD STORIES ARE ON PAGE 2637.

Note on Mr. Vinegar

This story of Mr. Vinegar is a good example of the way in which fairy tales, or stories of magic, have traveled over the world. The theme of most of the great fairy tales appears again and again in the childhood lore of many countries. Cinderella goes to her ball in a French gown, in gay Italian grandeur, in the silks and jewels of oriental splendor, depending on where the story is told. So with Mr. Vinegar, the well-meaning man who was followed by comical ill fortune. We find a primitive "Mr. Vinegar" in the old, old native folklore of Africa; there the story is called One Cannot Help an Unlucky Man. The article beginning on page 2264 tells about the folklore and fairy tales of many lands.

My Boy Tammie



Where have you been all the day, my boy Tammie?
I've been all the day
Courting of a lady gay;
But, oh, she's too young to be taken from her mammy.

Can she bake and can she brew,
my
boy
Tammie?



She can brew and she can bake
And she can make our wedding cake:
But, oh, she's too young to be taken from her mammy.

Can she bake a cherry pie.
my
boy
Tammie?





She can bake a cherry pie
Quicker than a cat can wink its eye·
But, oh, she's too young to be taken from her mammy.





What age may she be, my boy Tammie?
Twice two, twice seven, twice ten,
twice eleven;









But, oh, she's too young to be taken from her mammy.

THE WALRUS AND THE CARPENTER

BY LEWIS CARROLL



THE sun was shining on the sea,
Shining with all his might;
He did his very best to make
The billows smooth and bright—
And this was odd, because it was
The middle of the night.

The moon was shining sulkily,
Because she thought the sun
Had got no business to be there
After the day was done—
"It's very rude of him," she said,
"To come and spoil the fun!"

The sea was wet as wet could be,
The sands were dry as dry.
You could not see a cloud because
No cloud was in the sky;
No birds were flying overhead—
There were no birds to fly.

The Walrus and the Carpenter
Were walking close at hand;
They wept like anything to see
Such quantities of sand:
"If this were only cleared away,"
They said, "it *would* be grand!"

"If seven maids with seven mops
Swept it for half a year,
Do you suppose," the Walrus said,
"That they could get it clear?"
"I doubt it," said the Carpenter,
And shed a bitter tear.

"O, Oysters, come and walk with us!"
The Walrus did beseech.
"A pleasant walk, a pleasant talk,
Along the briny beach:
We cannot do with more than four,
To give a hand to each."

The eldest Oyster looked at him,
But never a word he said:
The eldest Oyster winked his eye,
And shook his heavy head—
Meaning to say he did not choose
To leave his oyster-bed.

But four young Oysters hurried up,
All eager for the treat:
Their coats were brushed, their faces washed,
Their shoes were clean and neat—
And this was odd, because, you know,
They hadn't any feet.

Four other Oysters followed them,
And yet another four;
And thick and fast they came at last,
And more, and more, and more—
All hopping through the frothy waves,
And scrambling to the shore.



The Walrus and the Carpenter
Walked on a mile or so,
And then they rested on a rock
Conveniently low:
And all the little Oysters stood
And waited in a row.

"The time has come," the Walrus said,
"To talk of many things:
Of shoes—and ships—and sealing-wax—
Of cabbages—and kings—
And why the sea is boiling hot—
And whether pigs have wings."

"But wait a bit," the Oysters cried,
"Before we have our chat;
For some of us are out of breath,
And all of us are fat!"
"No hurry!" said the Carpenter.
They thanked him much for that.

"A loaf of bread," the Walrus said,
"Is what we chiefly need:
Pepper and vinegar besides
Are very good indeed.
Now, if you're ready, Oysters dear,
We can begin to feed."

"But not on us!" the Oysters cried,
Turning a little blue;
"After such kindness, that would be
A dismal thing to do!"
"The night is fine," the Walrus said,
"Do you admire the view?

"It was so kind of you to come!
And you are very nice!"
The Carpenter said nothing but
"Cut me another slice.
I wish you were not quite so deaf—
I've had to ask you twice!"

"It seems a shame," the Walrus said,
"To play them such a trick,
After we've brought them out so far,
And made them trot so quick!"
The Carpenter said nothing but
"The butter's spread too thick!"

"I weep for you," the Walrus said;
"I deeply sympathise,"
With sobs and tears he sorted out
Those of the largest size,
Holding his pocket-handkerchief
Before his streaming eyes.

"O, Oysters," said the Carpenter,
"You've had a pleasant run!
Shall we be trotting home again?"
But answer came there none—
And this was scarcely odd, because
They'd eaten every one.

There Was an Old Woman



There was an old woman, as I've heard tell,
She went to the market her eggs to sell;
She went to the market all on a market day,
And she fell asleep on the king's highway.



There came by
a peddler, whose name was Stout,
He cut her petticoats all round about:
He cut her petticoats up to the knees,
Which made the old woman to
shiver and freeze.



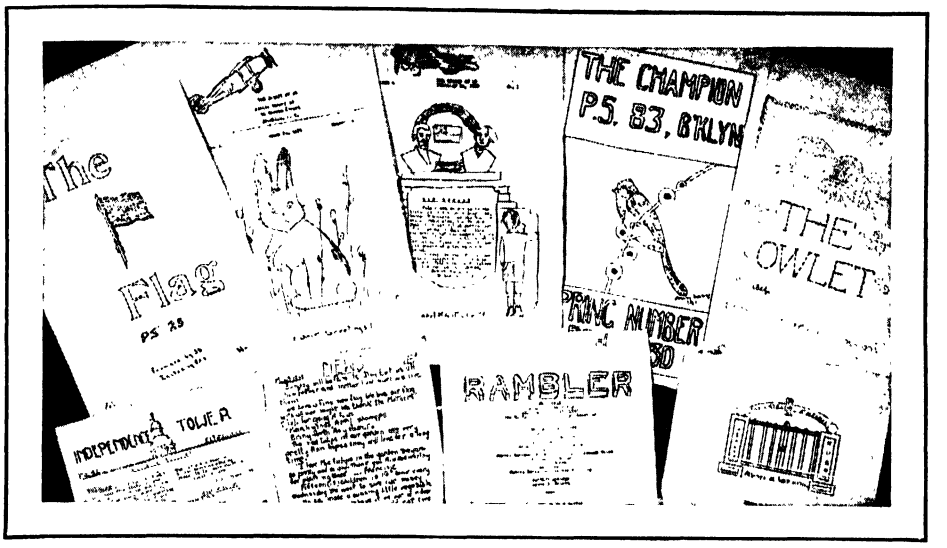
When the little woman first did wake,
She began to shiver and she began to shake,
She began to wonder and she began to cry:
"Oh, deary, deary me, this is none of I!"



"But if it be I, as I do hope it be,
I've a little dog at home and he'll know me:
If it be I, he'll wag his little tail,
And if it be not I, he'll loudly bark and wail."

Home went the little woman all in the dark,
Up got the little dog, and he began to bark;
He began to bark, so she began to cry:
"Oh, deary, deary me, this is none of I!"





Photographs in this article from "All the Children"

STARTING A SCHOOL PAPER

A SCHOOL paper cannot well be undertaken by one person alone. There are so many different things to be done, and so many of them call for special aptitude, that the work is best accomplished by a division of labor.

Whoever is going to run a school paper must take care to select helpers in such a way as to insure all branches of the work being really well done.

The work can roughly be divided into four main parts, which may be called the writing, the drawing, the printing and the selling. A school paper may be founded by four friends, each of whom will undertake the charge of one of the above departments.

Much of the success of the venture depends upon the firmness of the friendship which exists between the founders. Nothing demands more unity of action than the production of a school paper.

Let us consider these four friends and see what qualities fit them for the posts they will occupy. The editor is of necessity the chief; he must be a good student—so good that none of his schoolboy critics will be able to pull him to pieces. He must also be on fairly good terms not only with his schoolmates but also with his teachers. These latter will be of the greatest assistance to him, not only in furnishing occasional articles, but also in influencing the circulation. One of the teachers of a literary turn of mind might be persuaded to look over the manuscript articles submitted, and correct the grammatical blunders which might otherwise be passed over by the youthful editor and so get into print.

The second position, that of art editor, is nowadays an easy post to fill. Most schools of any size possess a fair share of pupils who can draw well, and from among their number a suitable editor can be chosen.

The third position will be that of foreman printer, and whoever fills this post will generally have the whole of his business to learn. Much of the hard work will fall to his share, so that great care must be taken to choose as printer one who possesses a full share of diligence and who is really fond of working with his hands.

The fourth editor will be head of the circulation department and must, above all things, be a genial fellow—one who is on good terms with everyone. He will have to help with the printing, so that he must also be willing to work when needed.

The first question that the founders of the school paper will have to decide will be the method of printing. Printing with type may be impossible because of the expense. If so, some form of duplicator must be bought or

IN THE COMPOSING DEPARTMENT



From "All the Children"

Setting up type for a school paper. This boy, who is composing type for printing on a press, stands before a type case. Here are metal types of the letters of the alphabet, punctuation marks and numbers, all arranged in little compartments so that they can be selected quickly. With copy before him, he picks out the letters one by one and slides them on the composing "stick" which has previously been adjusted to the length of the line he wishes to make. The full "stick" is placed on a tray, or galley, and he goes on until the page is completed. Then the lines are locked and placed in the hand press, which we show in the next picture.



The lines having been placed in the hand press, the boys here feed blank paper and remove the printed page.

borrowed. Should there be such a thing as a school mimeograph, the principal may be prevailed upon to allow its use. Failing this, a hectograph will be found a cheap and easy means of reproduction, and will, if rapidly manipulated, give eighty to one hundred clear copies from one original writing or drawing. The hectograph composition can be bought in cans, and when melted may be poured into any shallow tray.

The question of printing being thus settled, arrangements must be made for the paper. The size, of course, must be governed by the size of your hectograph or mimeograph. Legal size paper, 8½ inches by 13 inches, has been used satisfactorily for the school papers at the top of page 2041. These papers also give you an idea of the art work as well as the titles and arrangement of some that have been published. These were printed with a mimeograph.

The subject-matter will vary with the taste and capabilities of the staff, but certain regular features will probably be common to many school papers. Allusion has been made to the desirability of co-operating with the principal, and this can best be accomplished by offering a page or two of space for school notes. Few principals will refuse such an opportunity of awakening outside interest in school doings.

After school notes the most important feature will probably be school sports. These can be supplied by the various captains or secretaries, and in schools where directors take charge of sports a timely article on training, fielding, diving and so on, will be found of general interest.

Here will be ample opportunity for the art editor to introduce a few sketches. Tiny illustrations in the margins take but little time, and help to make the pages look bright. Nature notes of the month and local history are sure to be subjects which are not only full of interest, but are easily written up, either by enthusiasts or by the editor with the help of a few books from the nearest library. Playground gossip will give opportunity for some harmless fun, but the editor must be careful that the fun does not degenerate into unkindness. He must remember that while we should all be able to stand a joke, it is cruel to hold anyone up to ridicule.

Now for a word as to printing. At first it will be as well to write the matter in the form of a book, so that the difficulty of arranging pages is approached gradually. After a time the editor and printer will get

to know just what the page will hold, and no difficulty will be experienced. Sketches will be more effective if printed in ink of another color, and, fortunately, hectograph ink is made in several colors.

The future of the paper will depend entirely upon its circulation. The price should be fixed so as to be easily within the spending powers of every member of the school, and the circulation manager must endeavor to secure every boy and girl in the school as a subscriber.

Should the circulation outgrow the duplicating powers of a hectograph, the profits will easily purchase a second-hand mimeograph. The price for such a machine will not be great, and there is no limit to its duplicating power if it is skillfully handled.

Additional helpers may, as need arises, be drafted into the scheme, but the editors must take care to enlist only enthusiasts. The business side of a school paper includes such officials as the advertising manager, clerks and so on.

Such an organization is, of course, a matter of time, and we may be sure that our paper, if started in the right way and with the necessary enthusiasm, will grow into quite a prosperous and up-to-date journal.

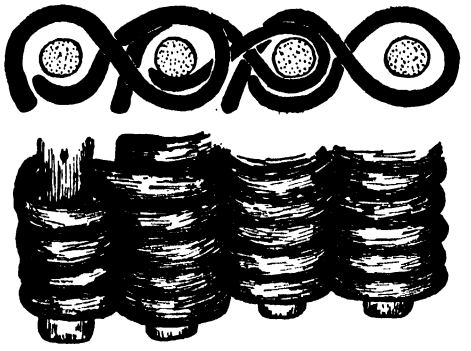
You will find that running a school newspaper will provide good experience for all connected with it. It will give the editors the opportunity to note the interesting features of the life about them and to write of this material as entertainingly as possible. It will also give them training in doing good work even when pressed for time. A good newspaper man cannot be too leisurely in turning out his copy; it must be ready in time if the printing of the newspaper is not to be delayed. If you turn to journalism not merely as a school-time undertaking but as a life-time profession, you will find that there is no greater asset than the ability to present your thoughts clearly and interestingly when you have only a limited amount of time at your disposal.

Finally, not only the editors of the paper but all concerned with the problems of distribution will receive an elementary business training that will undoubtedly prove to be valuable to them in later life.

A RAFFIA-COVERED RATTAN BASKET

THE basket that we are going to tell you about is quite easy to make and may be used in a great variety of ways. Perhaps you may want to use this basket for your sewing things. Or again, it will look very attractive indeed when filled with fruit and set on your dining table.

After deciding upon the use which you will make of this basket, an outline pattern is made of the size and shape decided upon by folding and cutting a piece of heavy paper as planned. This is then transferred to drawing paper and, if desired, a suitable design may be colored either with crayons or with water-colors. It is well to choose a simple but rich pattern.



Method of making over-and-under, or figure-eight, stitch.

In making a basket from reed or rattan and raffia it is possible to use any one of several stitches. However, one which makes a very firm basket is the figure-eight stitch, so called because the raffia makes this figure as it passes in and out in the process of sewing. This basket is formed by coiling a piece of rattan, covering it with raffia and at the same time sewing it to itself as the process of coiling develops. After the rattan has been thoroughly soaked, one end is first bent to the form of a hook, after which plain raffia is wrapped about it and the coiled-sewing begins as shown. A large blunt-pointed needle (fine tapestry) is best suited for sewing with the raffia. The raffia is split, in order that the sewing may be aided, and is always used when dry. The figure-eight is merely an over-and-under stitch, as shown in the drawings. The needle goes between



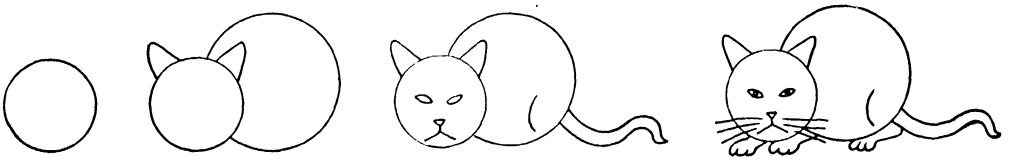
Hook-formed end wrapped with raffia for coiled-sewing.

reeds and into the basket, then around outside reed and into the basket, and finally around inside reed and out of the basket. As this is repeated again and again the coils gradually form the bottom of the basket and are then turned up to shape the sides as planned. In case it is decided to use a border design, the colored raffia can be inserted at intervals as it is needed to give the desired effect. If more than one color of raffia is used, it will be found convenient to have a separate needle for each color.

Raffia baskets made in the manner described above are very decorative and serve many useful purposes. They make excellent gifts for a friend's birthday or at Christmas.

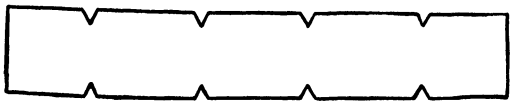
A CAT DRAWN WITH THE AID OF TWO COINS

THE four little pictures shown here prove to us how simple it is to make amusing drawings. We need a five-cent and a fifty-cent piece, a pencil and a piece of paper. We first put our five-cent piece on the paper and draw around it; then we put our fifty-cent piece to the right, overlapping slightly, and run our pencil around its edge, being careful not to cut into the first circle. The ears, eyes, nose, mouth and tail are then inserted. A few more strokes, which we show in the picture, complete our pussy.



MAKING A FLOWER-BOX FOR THE WINDOW

IN these days, when great numbers of people live in cities and towns, a good many are not fortunate enough to have gardens in which to grow flowers. But after all we do not need a garden for this purpose. A window sill will serve very well, indeed, provided that it is long enough and wide enough to hold a flower-box. In this article we are going to show you how to make a flower-box for a window sill. This is one of the easiest things for a young carpenter to make. It is inexpensive, too, since it requires little material.



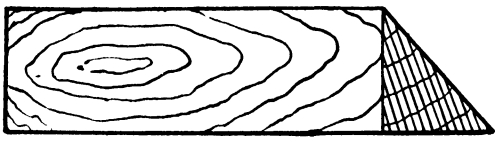
1.



2.

As windows differ in size, we can not give measurements here that would fit every window. Simply remember that the box is to be as long and as wide as the window space will permit. Let us suppose that our window

has space enough for a box 36 inches long and 8 inches wide. A board 36 inches long, 6 inches wide and an inch thick will serve as the bottom part of the box. We make a



3.

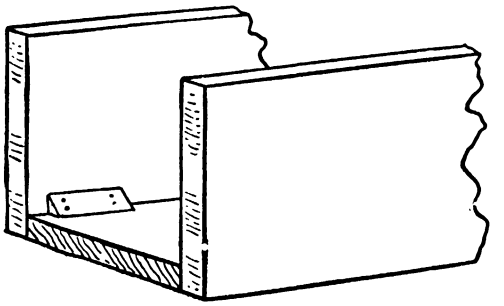
series of wedge-shaped notches along the edges of the board, as shown in Figure 1. Thus, when the box is finally put together, it will have a number of holes in the bottom. The purpose of these holes is to permit proper drainage of water.

You see, you are later to fill the box with soil, and of course this will have to be well watered from time to time. If the water were not allowed to drain off from the box, it would turn the soil sour and this would prevent the flowers from thriving. If you have a brace and bit in your carpenter's kit, you may also make satisfactory drainage holes by drilling at intervals along the bottom of the box.

Next we must prepare two pieces of wood 36 inches long, 8 inches wide and an inch thick; these are to serve as the front and back pieces of the window-box. We shall also need two end pieces, 7 inches long, 6 inches wide and an inch thick. We nail all these pieces together as is shown in Figure 2. You will note that the front and back come down in front of the bottom piece; the end pieces go on top of the bottom piece and between the front and back pieces.

We can make the box more solid by adding strengthening pieces like that shown in Figure 3. They should be attached at the corners; they are to be nailed to both the pieces against which they are placed, as indicated in Figure 4. When our nailing is done, we complete our task by giving the box two or more coats of paint.

After we have placed the box in position on the window sill, we line the bottom of the box, to a depth of about two inches, with broken pieces of crockery. (Like the holes in the bottom piece, they are for drainage purposes.) Then we put in soil up to within



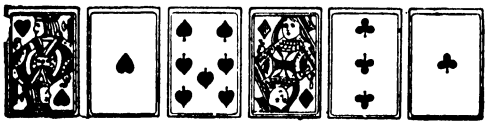
4.

half an inch of the top of the box. We are now ready to put seeds, plants or cuttings into our flower-box. It would be well to choose flowers which have large blossoms and brilliant colors.

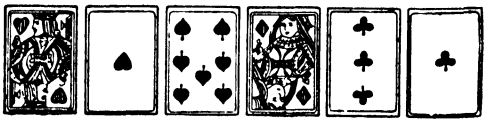
THOUGHT-READING BY CARDS

THIS is a trick that needs the assistance of an accomplice. Some cards—six, or nine, or twelve, or as many as you like—are spread out, face upward, on a table. The thought-reader goes out of the room, and the accomplice, or stage manager, as we shall call him, says: "Will anyone please pick up a card, any card, and hand it to me?"

Someone does so, and the stage manager puts it down again in the same place. The thought-reader comes into the room, and by merely looking at the cards he knows which card had been lifted and replaced. But he need not say so right away. He can go up to anybody in the audience and he can pretend to be studying that person's face intently, as if to examine carefully the workings of his or her mind. Then, after saying:



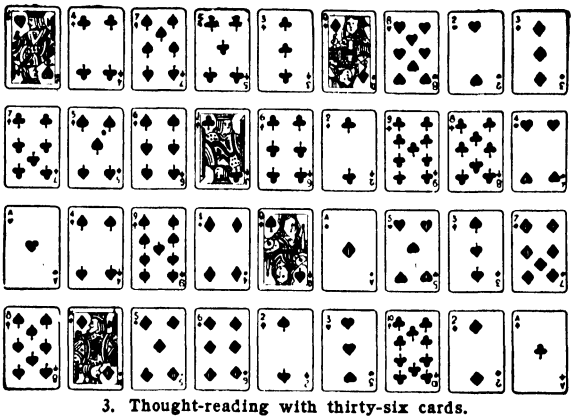
1. A row of cards before touching.



2. The same row of cards after being touched.

"Think of the name of the card that has been touched," he holds his or her hands or head and then says what card it was.

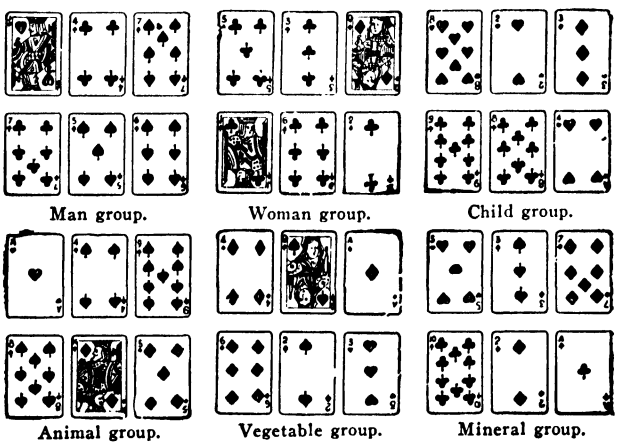
How does he know? Easily enough. The cards must be of the kind that have a line round each, outside the spots or picture. Many cards are of this variety. They are always cut so as to leave a wider margin at one end than at the other. As the cards are spread out on the table in the first instance, all the broad margins are put facing one way. When the accomplice replaces the card, he puts it back with the narrow margin at the end where the broad margin was before, and the conjurer sees by merely looking at them which card has been taken and put back. Picture 1 shows a number of cards as they would be before being touched, and picture 2 shows the same cards after the conjurer comes into the room. It is plain that the three of clubs is the selected card. This trick is impressive because the accomplice says not a word and makes not a sign. Indeed, he may be sent out of the room or behind a screen before the conjurer comes into the room.



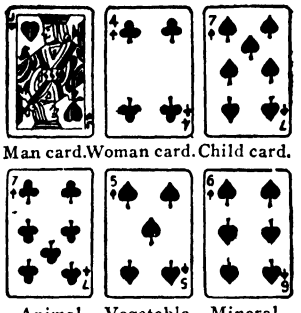
3. Thought-reading with thirty-six cards.

Another thought-reading card trick is very clever and very puzzling. Thirty-six cards are used, and again there is both a conjurer and an accomplice. The cards are spread out in four rows, with nine cards in each row, as seen in picture 3. The conjurer goes out of the room and someone touches a card. Then when he comes back the accomplice says something like this: "Uncle William likes green peas," or "Little Mary Smith lost her needle." These words indicate what card has been touched. This is a trick that may be repeated as often as you like; the more often it is done the more puzzling it becomes, and it is practically impossible to find the key for it.

What is the key or secret code used by the performers? They must suppose that the cards are divided into six groups of six cards, as indicated in picture 4. Then the names of the groups take the following order—man, woman, child, animal, vegetable, mineral. Picture 4 indicates the order of the groups. Then it is supposed that each group is divided in the same way, so that in each group there is a man card, a woman card, a child card, an animal card, a vegetable card and a mineral card. Picture 5 indicates the name of the cards in each group. The sentence spoken by the accomplice must contain two nouns, the first noun indicating the group and the second noun indicating the card in the group. Thus "Uncle William likes green peas" means man group, vegetable card, so that the card touched will be the second from the left hand in the second row from the back. "Little Mary Smith lost her needle" is the explanatory sentence and it means child group and mineral card, so that in this case the card touched was the card at the extreme right of the second row from the back. "Our donkey loves baby" means animal group and child card, so that the card this time is the one third from the left of the second row from the front. Very little practice will give skill in this trick, which is one of the best for evening par-



4. Division of the cards into groups.



5. Division of a group.

ties, as people ask for it to be repeated again and again, hoping that they may at last be so clever as to find out the secret. But this they rarely do unless the trick is clumsily done. Of course, if you continue to use the same nouns for the six groups of the trick, some bright person in the audience may put two and two together and suddenly discover the secret of the performance. To avoid this mishap, you should never use the same noun twice in performing the trick. Naturally you should have no difficulty in finding enough nouns for your purpose.

If your audience fails to guess the secret of the trick, you may be asked to disclose it. It is a good plan to keep your magic secrets to yourself. These are your stock in trade as a magician, and you should surround them with as much mystery as possible.

THE DISAPPEARING PENNY

A LITTLE practice enables a boy to mystify others with the trick of the disappearing penny. The conjurer offers someone a penny, and as the other opens his hand to receive it he also opens his hand (apparently), and the penny has fled. The conjurer must see that the sleeve of his coat hangs with as much space as possible below the wrist, and it is good also if the shirt sleeve or cuff come as far down as possible. Then he takes the penny between his thumb and middle finger, as shown in the picture, at the same time raising his arm a little above the horizontal. As his friend opens his hand for the coin he snaps the two fingers, and the coin will disappear up his sleeve. He opens his hand and it is empty. Then as he lowers his arm by his side the penny falls down his sleeve into his hand again. When the young conjurer attempts this trick for the first time he will probably fail, but a half-hour's practice will give him skill, and eventually, if he is careful, he will be able to do it every time he tries. This mystifying little trick should be in the repertoire of every amateur magician.


"Sleeving" a penny.

HOW FAST DO YOU WALK?

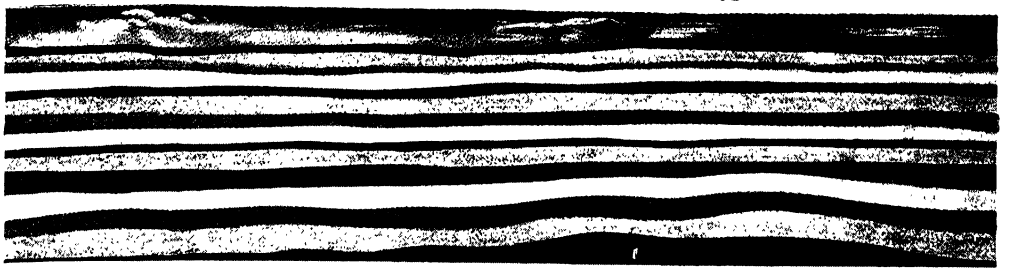
THERE is a very simple way of telling at what speed one walks. Take a piece of thin string, say, 80 or 100 yards long. To one end tie a weight—a piece of lead or other metal, or even a stone. At a point 44 feet from the weight put a knot or a loop. Then put a second knot or loop 44 feet from the first, and so on along the entire length of the string.

Take in one hand a watch with a second hand. Now drop the weight upon the ground, and walk along at an ordinary pace, letting the weight remain where it fell and allowing the knots or loops to slip through one hand. The number of knots or loops that pass through the hand in half a minute are the same as the number of miles walked in an hour. Of course you must keep an accurate count of the knots or loops.

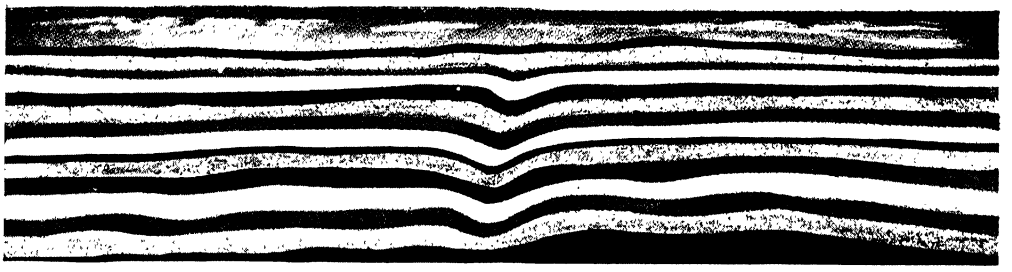
It is always well to know the reason for what we do. It is not enough to know that the number of times we walk 44 feet in half a minute is the same as the number of miles we walk in an hour. We ought to know *why* it is so. The reason is that 44 feet is the 120th part of a mile, because a mile contains 5,280 feet, or 1,760 yards, and a half-minute is the 120th part of an hour. Therefore we are able to walk 120th of a mile just as many times in 120th of an hour as we can walk a mile in an hour.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 2163.

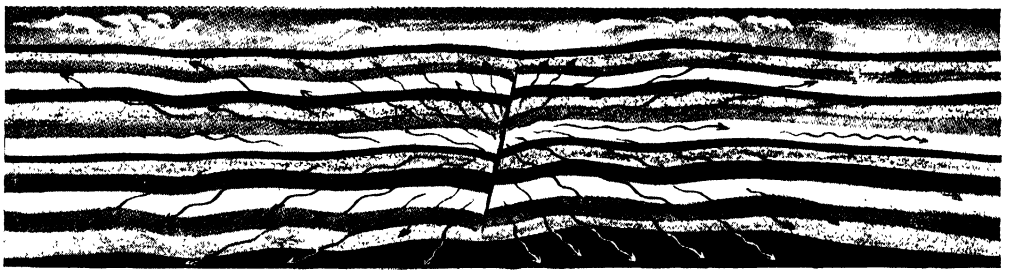
WHAT MAKES THE EARTH QUAKE?



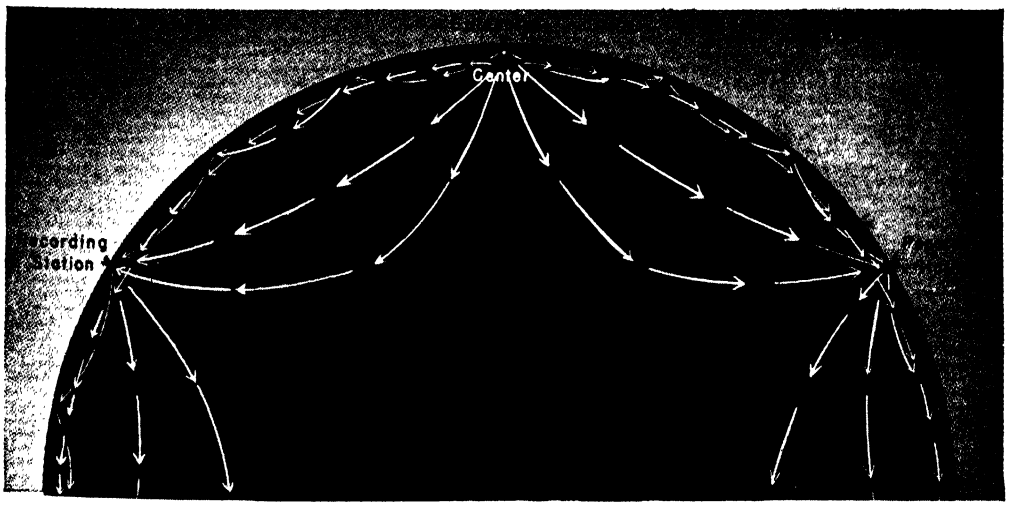
The earth's crust is in layers of different rocks. Sometimes the layers are very uneven, or not well balanced.



Unequal pressures of layers may in time cause the crust to fold downward at a weak spot.

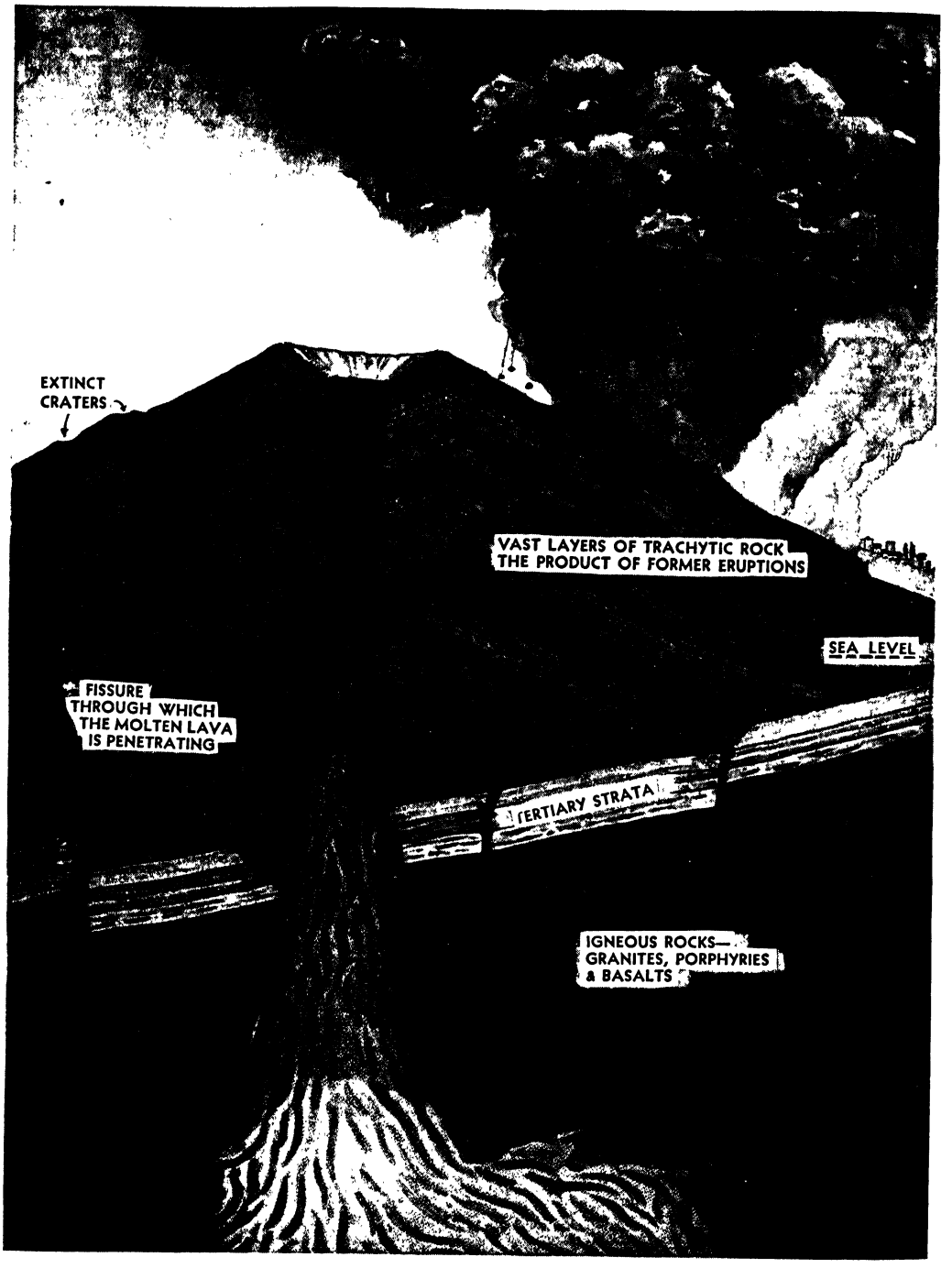


After a long time the continual folding at the weak spot (fault) causes an actual break in the crust.



When a break occurs, the crust quakes, or trembles; and the trembling travels in waves from the quake (epicenter) around the earth; other waves go to the core and bounce back; others go through the layers beneath the crust. By measuring the various waves at recording stations, men can learn where the quake happened and how intense it was.

AN IMAGINARY SECTION THROUGH A VOLCANO



The artist, J. P. Wilson, shows in this picture how a volcano in action might look. Molten rock (lava) and gas are being forced up through several cracks, or fissures. At the top of the central fissure is a great hole, or crater. From this, and from smaller craters, the lava flows down the mountain, sweeping everything before it. It rapidly hardens into a fine-grained, dark rock, and you can see in the picture how the mountain has been built up by layer upon layer of lava that welled up inside the mountain, flowed over the rim and hardened.



Press Association, Inc.

The eruption of Mount Vesuvius in 1944, photographed from an airplane.

EARTHQUAKES AND VOLCANOES

MAN is seldom conscious of the geology all around him. He does not say to himself every time he looks at a landscape, "This is the result of geological processes." Yet when he plants a garden or picks a flower he is gaining some benefit from those processes; and when he kicks aside a stone he is moving one of the fundamental objects of the earth and life itself.

However, when he reads in his morning paper that an earthquake has occurred in some distant place and destroyed a city and taken hundreds of lives, he suddenly becomes conscious of the great earth forces that are just beneath his feet but beyond his control. Geology becomes then associated with overwhelming things, terrifying things.

Earthquakes do represent the most deadly of all of nature's forces. An earthquake is caused by a break (called a fault) in the earth's crust. The weak place around the break may be jarred slightly, or a portion of the earth's crust may slip along the crack, until it finds a new position. We say the portion of earth is displaced. The actual displacement of crust may be only a few feet one way or the other, or up and down. This movement in itself can do little harm, and often deep-seated earthquakes do not displace the top of the crust at all. The damage is caused by vibrating waves radiating from the point of the quake. They give a sudden sharp push to the rocks at the surface, and to buildings and other objects on the surface. You can reproduce what happens by suddenly knocking out the supporting block from the bottom of a pile. Earthquake-proof houses can be constructed by fastening the building together so that there are no loose sections; a house which could be picked up and turned over without anything falling off would go through the severest earthquakes without damage.

There are several types of waves issuing from an earthquake, though the near-by observer would consider them all alike. Dis-

tant observers make records of the earthquakes with an instrument called a seismograph, which writes the story of the quake on special paper (sensitized paper, we call it). The observers can distinguish the different waves arriving at different times, one after the other, each making a different type of record on the sensitized paper. Some of the waves come directly through the earth to the seismograph, some come around the surface, and others reach the recorder by a series of bounces, like a billiard ball going from one side of the table to the other. They are given different names, and a seismologist (that is, a geologist whose specialty is earthquakes) learns much from the study of his records. By noting the difference in arrival time between fast-moving and slow-moving waves he can tell how far away the earthquake is. He can also tell the approximate direction. Later study and comparison with records from other stations will tell him how deep was the focal point (the place of the quake) and exactly where it was. He can also tell something about the rock layers through which the waves passed. The seismologist gives us much of our information about the shelly nature of the interior of the earth, its density and its composition. We read about these things in the chapter on the stuff of the earth, beginning on page 279.

Earthquakes are far more numerous than most people realize. Only a few are strong enough to be felt where people live; most are too weak and many are under the sea floor. But the seismograph detects these weak and distant quakes, and we learn about them from our seismograph records. Most earthquakes occur along certain belts, or zones, in the earth's crust.

There is another disturbance of the earth's crust that seems even more strange and marvelous than an earthquake. It is a volcanic eruption. Volcanoes are really less destructive than earthquakes, but they are such weird spectacles that men hold them in awe and fear. Volcanoes do comparatively little damage; though once in a while we do have outbursts which wipe out almost instantly thousands of people. One of the greatest eruptions occurred in 79 A.D., when Vesuvius exploded, and sent forth an immense column of hot dust and rock, with fumes of many uprushing gases. The cindery cloud gushed upward, then fell like rain on



Wide World Photos

This garden in Pompeii was buried under volcanic dust in 79 A.D., and was dug out many centuries later.

the surrounding fields, and on two rich and beautiful Roman cities, Pompeii and Herculaneum. Amid thunder and lightning, under blackened skies, for three days and three nights, the cindery rain fell—until the two cities were buried deep. Most of the people had time to escape. About 2,000 perished. The Roman writer, Pliny, was one of those who lost his life at Pompeii. About two hundred years ago, treasure seekers and students of ancient history began to dig beneath the blanket of ashes; they have found the cities in a fair state of preservation. The cinders and ashes fell so fast and sealed the towns off from the air so thoroughly that the ordinary process of decay had small chance to get in its work.

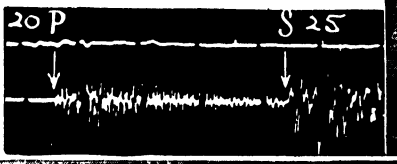
Some other important volcanoes are mentioned on page 2055. Volcanoes are often associated with earthquakes. In fact, we rarely find a great volcanic eruption without an accompanying ground movement. Volcanoes occur in definite zones in the earth's crust, and those zones are identical with the zones

American Museum of Natural History

A seismograph, or earthquake writer. The quake writes its own record with such an instrument.



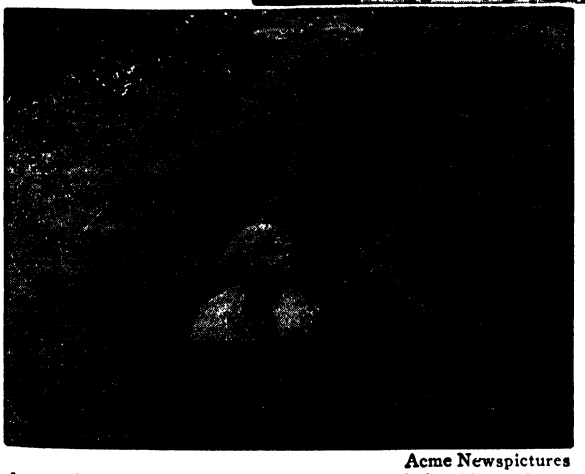
Below, part of the record written by an earthquake in wavy lines on sensitized paper.





International News

A quake stripped the walls off this hotel, leaving some of the rooms almost undisturbed.



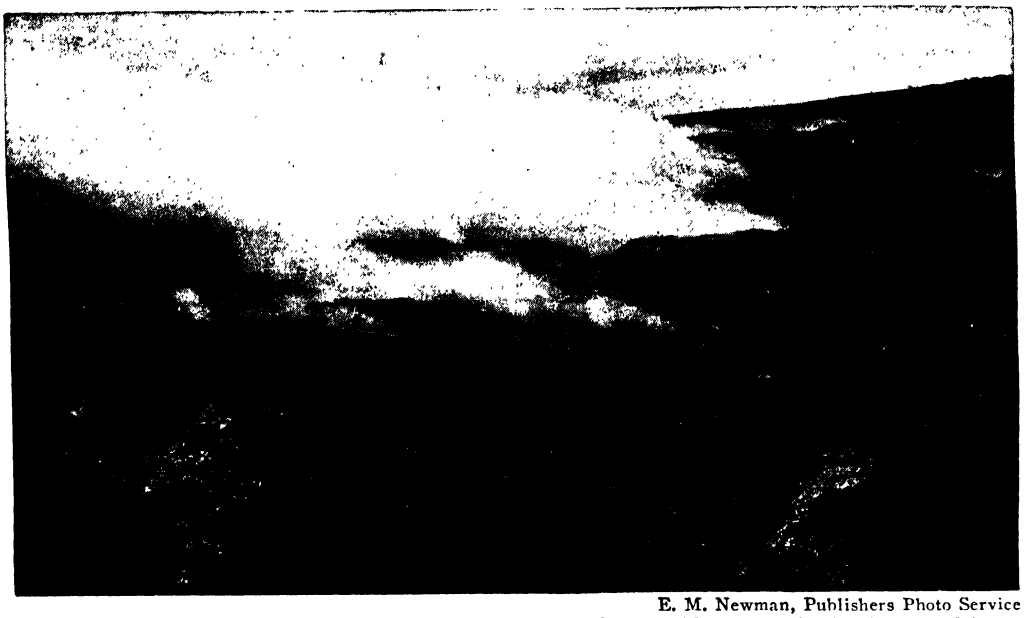
Acme Newspictures

An earthquake in Hawaii made a deep crack in this roadway.

of the greater number of earthquakes. Hence, we can safely assume that there is some sort of connection between the two, even though we can not precisely explain it at present.

No one knows what causes a volcano. For some reason, the rock in a pocket or along a crack in the earth's crust becomes hot enough to turn liquid and works to the surface. Probably blocks of solid rock are broken off and sink down into the molten magma as it eats its way up.

Upon reaching the surface, through a crevice, the volcano may give forth a gentle lava flow which will



E. M. Newman, Publishers Photo Service

Steam pouring from "the Kitchen" in the crater of Kilauea, a volcano on Mauna Loa, in the Hawaiian Islands.

spread out over the land. Such simple lava flows formed the Columbia River plateau in Oregon, and the gently sloping mountains of the Hawaiian Islands. Or, if there is considerable gas contained in the lava (the magma), it may burst forth with explosive force and start throwing rock fragments in the air as the gas bubbles burst. The effect is the same as that which you see when you take the cap off a bottle of soda, with all the bubbles of gas racing to the top. In the volcano we have water vapor and carbon dioxide and other gases trying to escape rapidly, and throwing up rock fragments. These rocks cool in the air and fall back, some of them building up a mound around the vent, or mouth, of the volcano.

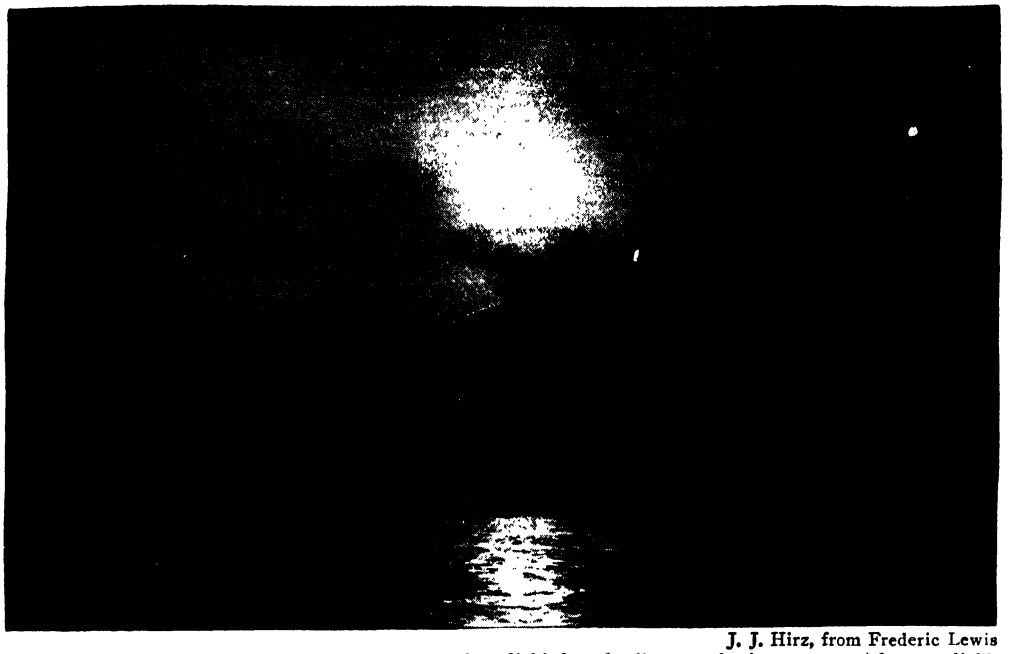
Such a volcano forms a cone with a steep slope of about thirty-five degrees, making a very different sort of mountain from that built by gentle, fluid lava flows. Combinations of explosive eruptions and gentle flows are generally the rule, and they often build high and solid conical peaks, like Vesuvius, or our American mountains of the West Coast, Mount Hood, Mount Shasta and Mount Rainier.

Popular accounts of volcanic eruptions always speak of the smoke and flame observed; and the geologist has a busy time explaining that in most eruptions there is neither smoke nor flame to be seen. The so-called smoke is really a column of rock dust—fragments varying all the way from the finest dust up to chunks several inches across. Often, when an eruption is really violent, we also observe large blocks of rock being thrown out, sometimes solid, sometimes fluid. These may whirl over and over and round themselves in the air, and on falling are known as volcanic bombs. At night all of these hot rock fragments are seen as glow-



U. S. Army photo

Halemaumau (House of Everlasting Fire), a boiling lake in Kilauea.



J. J. Hirz, from Frederic Lewis

Stromboli volcano, on a small island near Sicily, is here lighted up by its own glowing gases, not by moonlight.

ing pieces and the ordinary observer refers to them as flaming.

There is not always a lava flow when a volcano blows its head off. Sometimes there is an upgush of solid particles. These are named, from their size, dust, ash and lapilli (little stones); and they may cover the countryside and smother the plant life. Lava flows are usually more limited in size than the solid matter. The lava may be very fluid; then it runs rapidly at first, but as it cools it thickens and runs more slowly. At even a short distance from the vent the speed of the lava flow will be a few feet an hour. Lava may spill over the top of a cone formed in a previous eruption; but often it escapes from the side of the cone or from another vent along the same fissure and hence does not seem to be coming from the same mouth in the earth's crust. The diagram facing page 2049 shows how this can occur.

Not all volcanoes occur upon the land. In 1883 the volcanic island of Krakatoa, near Java, blew up, with a great loss of life and property. More than half the island was blown away. A huge tidal wave started, nearly 100 feet high; it traveled for miles and wiped out low-lying settlements on Java and Sumatra, drowning 36,000 inhabitants. Since then, there have been other eruptions from that vent under the sea; these have been so powerful that from time to time a small island has formed there.

Volcanoes generally have only brief periods of activity. When the stored-up gas pressure has been relieved by an eruption, they lapse once more into dormancy (a drowsy state). Sometimes years pass before another eruption takes place. Mount Pelée, on the island of Martinique, was thought to be extinct when it erupted in 1902, killing in a short time 32,000 inhabitants of the city of St. Pierre. Vesuvius is periodically active and ever threatening, but the villagers always return to grow their crops on its slopes, for the new ashes make wonderfully rich soil. Perhaps, some day, vulcanologists (students of volcanoes) will learn enough to be able to warn people of the danger in ample time before the eruptions. Even today, we usually know some hours before that an eruption is coming, in well-studied volcanoes like Vesuvius in Italy and Kilauea in the Hawaiian Islands.

By FREDERICK POUGH.

SOME WORDS WE USE IN SPEAKING OF EARTHQUAKES

Tremors, or temblors. The quakings of the earth. Vibrations.

Fracture. Crack in the earth's crust.

Fault. A place where the rocky layers are



Photo, American Museum of Natural History

Paricutin, the volcano that appeared suddenly in 1943, in a field in Mexico. Geologists watched the cone forming.

broken through by a fracture; and the rocks on one side of the fracture are lower than on the other. Corresponding masses do not meet.

Seismology. The study of earthquakes.

Seismograph. Instrument for recording earthquakes.

Earthquake center. The spot where an earthquake starts.

Earthquake epicenter. The spot on the surface of the earth just above the center or focal point.

SOME EARTHQUAKES OF THE TWENTIETH CENTURY

1902. Guatemala. The city of Quezaltenango was destroyed; and the city of Totonicapam was half destroyed.

1906. Formosa. There were two violent quakes in this year. The first, which was the most severe, took place on March 17. The second came on April 14, the day following the end of a violent eruption of Vesuvius. This is an instance in which disturbances in the earth's crust took form at widely separated spots.

1906. San Francisco. Four days after the April quake in Formosa. The earthquake caused a fire which destroyed almost one-third of the city. Damages amounted to $200,000,000. About 700 people perished. Four months later, on the same day, there was a quake in Alaska and one in Valparaiso, Chile.

1908. Italy, the toe of the boot and the part of Sicily nearest to it. Nearly 100,000 people were killed. The city of Messina was almost wiped out.

1915. Central Italy around Avezzano. About 30,000 people were killed; and 372 towns suffered, many of them severely.

1917. Antigua, Guatemala. The city was torn to pieces; 100,000 people were made homeless.

1917. San Salvador, Costa Rica. Millions of dollars in property were destroyed.

1920. Orizaba, Mexico. About 3,000 people were killed. Many towns were damaged.

1920. Kansu Province, China. One of the most violent series of quakes in our century. About 200,000 people perished.

1923. Yokohama and Tokyo, Japan. 160,000 people were killed. Billions of dollars in property were destroyed.

1929. Persia and Turkestan. Quakes over a wide area. About 2,000 persons were killed.

1934. India. 7,000 were killed.

1935. India. Several cities and towns were destroyed. 30,000 persons lost their lives. Quantities of water poured from the cracks in the earth. (Water mixed with bluish sand often trickles from the cracks made by earthquakes, but in this case there

were floods pouring from the earth.)

1935. Helena, Montana. A series of quakes. Two men were killed and damage amounted to nearly $3,000,000.

1939. Turkey. A wide region suffered quakes on several days. Land was laid waste; 45,000 were killed. Terrible blizzards followed the quakes.

1939. Chile. Quakes over a wide area devastated cities and towns and killed 25,000 people.

1940. Imperial Valley, California. This was the fifth most severe quake in the history of the United States.

SOME WORDS WE USE IN SPEAKING OF VOLCANOES

Volcano. An opening in the earth through which hot lava, rocks and gas are pushed out by pressure from beneath. The word comes from Vulcan, the Roman god of fire, blacksmith to the gods.

Vent. The volcano's hole. Sometimes a volcano has a number of vents.

Cone. Heaped-up rock and lava around the outside of the volcano. This is usually cone-shaped, at first; but it loses its perfect shape as wind and weather work upon it.

Crater. A depression in the top of the cone. Small cones sometimes form inside the crater.

Extinct. Dead. Permanently quiet.

Dormant. Sleeping. Quiescent. Quiet for a time.

Fumarole. A small hole from which volcanic gases escape.

Magma. Molten rocks (lava) mixed with gas.

Lava. Hot rocks, solid or fluid, that are ejected from a volcano, or that leak from a crack in the earth's crust.

Ash. Fine powdery particles of lava. Also called volcanic dust.

Lapilli. Pebbles of ejected volcanic matter.

Cinders. Small bits of lava.

Leakage. The streaming out of lava from fissures in the earth's crust.

Vapor. Gases which escape through the vent. The commonest volcanic gases are steam, chlorine, sulphur, carbon dioxide.

Eruption. The explosion of a volcano. An eruption may last for days or even for a number of weeks.

Volcanic mud. Volcanic ashes mixed with water. The hot ashes are often hurled far into the air, which, of course, is cooler than the volcano. The water in the air condenses against the particles of ash and rain falls. As it mingles with the ashes on the ground it forms thick mud.

SOME FAMOUS VOLCANOES

IN NORTH AMERICA

Orizaba, Mexico, 18,200 feet. Highest peak in Mexico. Erupted in 1545 and 1566. Now almost dormant.

St. Elias, Alaska, 18,100 feet. Extinct. Snow-covered, with glaciers on its slopes.

Popocatepetl, Mexico, 17,875 feet. The Aztec name means Smoking Mountain. Snow-capped. Only small eruptions in 400 years, but constantly sends out smoke and cinders. Sulphur lines the crater.

Rainier, Washington, 14,526 feet. Dormant. Crowned with a snowy glacier.

Shasta, California, 14,350 feet. Extinct or dormant.

Adams, Washington, 12,470 feet. Extinct.

Hood, Oregon, 11,253 feet. Extinct.

Irazú, Costa Rica, 11,200 feet. Active.

Baker, Washington, 10,827 feet. Dormant or extinct. Said to have been active in 1843.

Lassen Peak, California, 10,577 feet. The most recently active volcano in the United States.

Pelée, Martinique, 4,430 feet. Eruptions in 1762 and 1851, then the volcano was thought to be extinct, until 1902, when there were two outbursts in which 32,000 people perished. The top of the mountain was blown off.

Coseguina, Nicaragua, 4,000 feet. Dormant. During the last great eruption in 1835, the sky for 100 miles around was darkened.

Paricutin, Mexico, 1,200 feet. Born in 1943 in a cornfield.

IN SOUTH AMERICA

Aconcagua, Chile, 23,080 feet. Extinct.

Chimborazo, Ecuador, about 20,000 feet. Snow-capped. Extinct.

Cotopaxi, Ecuador, 19,488 feet. Snow-capped, except for the tip of the cone. Eruptions in 1698, 1738, 1742, 1744, 1766, 1803, 1877, 1885. Many of these were violent. This is a particularly noisy volcano. Smoke and steam are almost constantly issuing forth.

IN EUROPE

Teneriffe, Canary Islands, 12,200 feet. Dormant.

Etna, Sicily, 10,760 feet. The largest active volcano in Europe. Highest mountain in Italy. There are many cones. More than 80 eruptions have been recorded. In 1169

the town of Catania was burned, with 15,000 persons. In 1669 more than 10,000 lives were lost; and in 1693 more than 60,000 people perished from an eruption and earthquake. In 1928 a new crater appeared.

Hekla, Iceland, 5,100 feet. Three snow-clad peaks. Since the tenth century there have been 43 eruptions recorded.

Puy-de-Dôme, France, 4,806 feet. Extinct.

Vesuvius, Italy, 4,300 feet. This volcano is noted for its great number of explosions, which seem to occur in groups, followed by quiet periods, sometimes of many years. In the quiet periods towns flourish around the mountain. Many terrible outbursts have buried towns and killed thousands of people. In the year 79 A.D. there was an explosion that buried the fair Roman cities of Pompeii and Herculaneum. Other severe eruptions came in 1681, 1767, 1779, 1794, 1861, 1872, 1906, and 1944.

Stromboli, volcanic isle in the Mediterranean, 3,022 feet. In constant activity. The ancient Greeks and Romans believed that Vulcan, the god of fire, dwelt there.

IN ASIA, AUSTRALIA AND PACIFIC ISLES

Demaverd, Iran, 17,930 feet. Extinct. The crater is now filled with snow. There are hot springs around the base. Sulphur vapors still are being emitted.

Ararat, Turkey, 17,000 feet. There are two peaks. On one of these the Bible says Noah's ark touched land, after the Deluge, or Great Flood. The volcano is extinct.

Mauna Loa, Hawaii, 13,675 feet. The crater is about five miles in circumference. On the eastern slope is another crater, Kilauea, nine miles in circumference. These appear to be quite separate volcanoes.

Fujiyama, Japan, 12,395 feet. Dormant. Snow-capped. Held sacred by the Japanese. Pilgrims visit the shrines and temples on its slopes.

Haleakala, Hawaii, 10,000 feet. The largest extinct crater in the world, covering 19 square miles, and in places several thousand feet deep.

Mayon, Philippine Islands, 7,915 feet. Occasionally active. Usually crowned by vapor which glows with a reddish light at night.

Krakatoa, volcanic island in Sunda Strait between Java and Sumatra. Most important cone is 2,623 feet. Terrific explosion in 1883 and another in 1928; October 13, 1936, a new eruption and light explosions up to 300 meters in height; August 7, 1937, commenced a second new eruption.

IN AFRICA

Kilimanjaro, Tanganyika. There are two peaks, 19,710 feet and 17,570 feet, both snow-clad.

Kenya, British East Africa, 17,040 feet.

THE NEXT STORY OF THE EARTH IS ON PAGE 2414.



Photo, J. J. Hirz, from Frederic Lewis

The island volcano of Krakatoa, near Java. In 1883 a terrific eruption blew away about half the island.

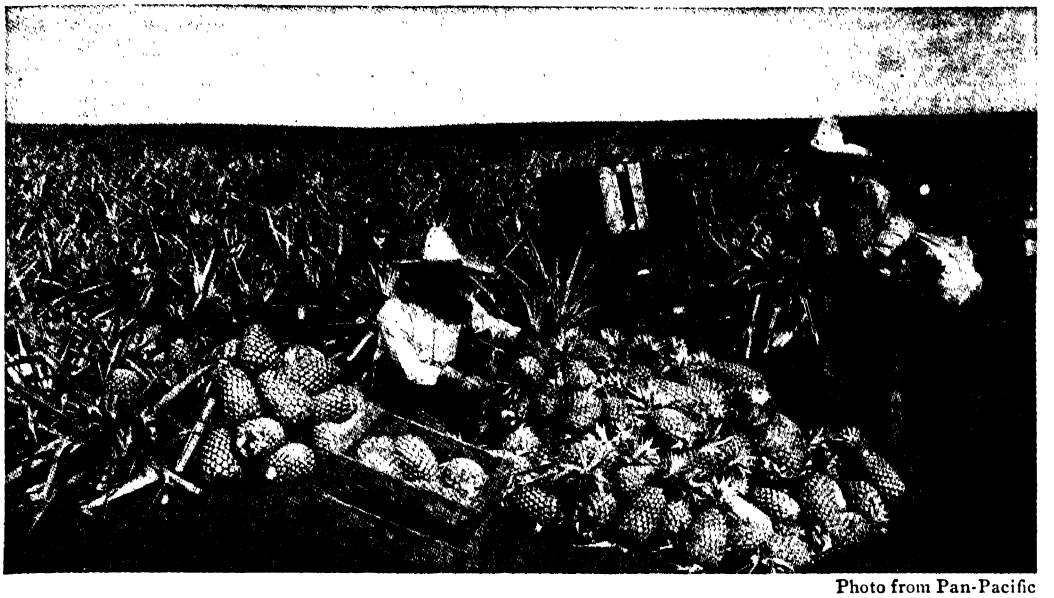


Photo from Pan-Pacific

Picking Hawaiian pineapples. The crowns of sword-like leaves are being cut off before the fruit is crated.

THE MOST IMPORTANT FRUITS

NORTH AMERICA is fortunate above all other continents so far as fruit is concerned. The earliest settlers found many delicious fruits already here and brought others with them. Except for some tropical varieties, almost every kind of fruit can be grown in Canada or the United States. As a result, in North America more varieties are plentiful and cheap than anywhere else in the world. Nowhere in Europe do we find fruit in abundance except on the shores of the Mediterranean, and there we miss some favorites.

Considering the world as a whole perhaps the most prized fruits of all are the members of that great family of semitropical fruits known as the citrus fruits, which includes the orange, lemon, lime, citron, grapefruit and others less familiar to us. Of these the orange, the lemon and the grapefruit are the most important.

The sweet orange is believed to be a native of southern China, from which country it has now spread to all the semitropical lands in every continent. Probably it was introduced into Europe by the Moors, for the Greeks and Romans do not seem to have cultivated the orange. The bitter orange, called the Seville orange, is similar to the sweet orange, except for the flavor. Both appear to be varieties of the same species of plant, and though bitter-orange seeds are said never to produce sweet oranges, sweet-orange seeds sometimes produce bitter oranges. This would suggest that the bitter orange was the original stock.

If you go shopping for oranges, you will probably buy one of the two chief varieties grown in the United States—the navel and the Valencia. You will know the navel orange by its bright golden color, which is entirely natural, and by the curious formation at the end opposite the stem, which makes it different from all other oranges. The Valencia orange is lighter in color and is very sweet and juicy. When the Valencia is fully ripe it sometimes turns slightly greenish in color, but its flavor is delicious.



U. S. Department of Agriculture

Starbright strawberries.

More than half of the oranges we eat are grown in California, but Florida is also



When frost threatens the orange groves, heaters are put between the rows of trees.

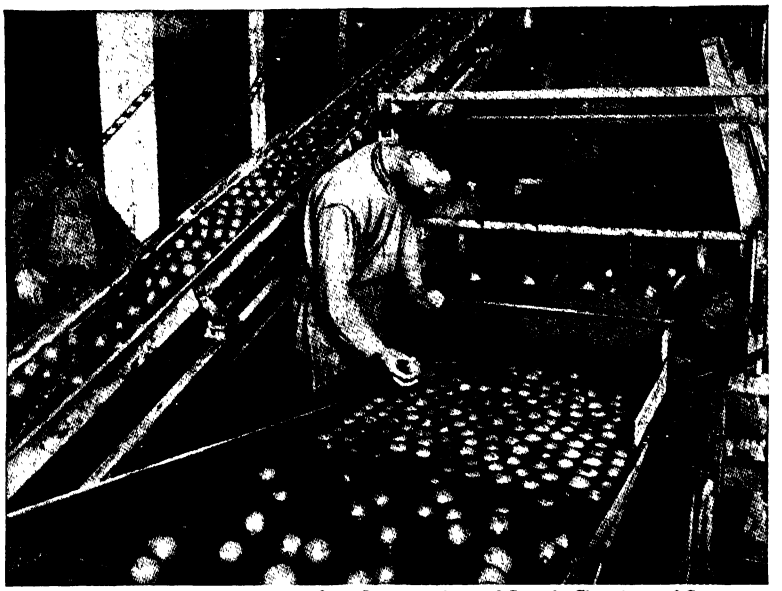
a very important orange-growing state.

Whole trainloads from these states are sent out at one time and distributed all over the continent. We also get quantities of oranges from Cuba, Puerto Rico, Jamaica and other West-Indian islands. Europe gets most of its oranges from the Mediterranean lands —especially from Spain and Italy.

Oranges are picked when fully ripe. At that time, their skin is very tender. Care is taken not to scratch or bruise the skin, for the slightest injury is enough to cause the orange to decay. Millions of dollars worth of this fruit were lost before this fact was understood. Nowadays, pickers wear gloves so that their fingernails can not scratch the orange, and they wear canvas picking sacks in which to put the oranges as they carefully clip them from the tree. The bit of stem that is still attached to the fruit must not be too long, for it might puncture the other oranges. When the sack is full, it is set gently in the picking box. Then the flap at the bottom of the sack is unbuttoned and the sack is pulled away from the fruit, which must never be allowed to fall.

Equal care is taken in the packing house, where the oranges are handled in the most sanitary way. There they are gently washed with soft brushes in a warm water bath, and are dried before being sorted into various grades and sizes. Oranges of the highest quality are usually wrapped in tissue paper before being placed in the familiar orange crate which will carry them to market.

The tree grows to a height of twenty feet, though some reach nearly twice that height, and where climate and soil are suitable one tree, occupying a space about twelve feet in diameter, will yield from three to four thousand oranges a year. It lives and bears for about a hundred years, and the older trees produce better fruits than the young ones.



Pictures from Los Angeles and Seattle Chambers of Commerce

Oranges are handled very gently to avoid bruising the skins. When the fruit comes from the groves it is washed, then the inferior oranges are picked out and removed.

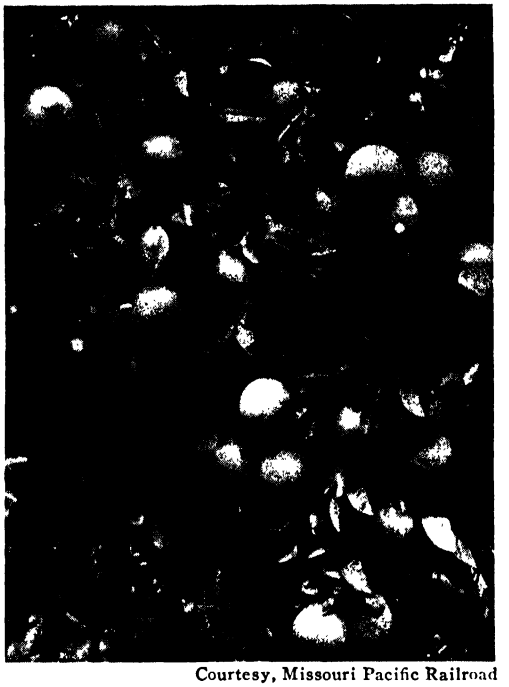
The story of the seedless orange is interesting. In 1870 the Department of Agriculture in Washington received from Bahia, in Brazil, twelve small navel-orange trees, which had long been cultivated there. Cuttings were taken from them and grafted on native stock. In 1873 two small trees were sent to the Tibbetts family, pioneer settlers of Riverside, California. The trees flourished, and many cuttings were made from them. In fact the industry in California really developed from these two small trees. This orange

is now called the Washington Navel. Other navel varieties have been introduced, and the plant-breeders are always striving to produce better varieties.

In California today, although there are many thousands of acres of navel-orange groves, an even larger area is planted with the juicy Valencia variety. Other varieties occupy only a few thousand acres.

There are many varieties of orange. Tangerines and mandarins are small and of delicate flavor, with skins that are loose when ripe, and sections that are easily parted. Kumquats are tiny olive-shaped oranges an inch long. They are grown in Japan and Florida. They are eaten skin and all, although the skin is thick in proportion to the amount of pulp. The blood orange is a sweet orange, which has its pulp mottled with crimson. Bitter oranges make a delicious marmalade, but in the United States they are grown chiefly as a root stock on which sweet oranges and other citrus fruits are budded.

After the orange, the most important citrus fruit is the lemon, which originated in China or India, and is now known all over the world. Though lemons are extensively grown in California and the West Indies, some of our supply is brought from Sicily and southern Italy. Palestine also furnishes some oranges and lemons.



Courtesy, Missouri Pacific Railroad
These grapefruit grow in the Rio Grande Valley.

LEMONS ARE PICKED ACCORDING TO SIZE WHETHER THEY ARE GREEN OR YELLOW

The best lemons are the ones that are green when they are picked, but lemons are picked according to size whether they are green or yellow. The picker carries a ring to test the size of the lemon, and if it will pass through the ring it is too small to be picked. Green lemons are sorted from the yellow ones at the packing house, and are cured in a cool storage room where their green skins slowly turn to a beautiful waxy yellow.

Lemons, like oranges, are clipped from the tree and are handled with great care. Lemon growers say they "must be handled as carefully as eggs." They keep much better than oranges, and fruit picked in December is good in July if air has been allowed to circulate freely about it.

Like the orange, the lemon seems to have been unknown to the Greeks and Romans. It was introduced into Spain from the East about the twelfth or thirteenth century.

The citron, which grows wild in northern India, is cultivated in Europe, America and China for its thick rind, which is candied as a preserve. Your mother puts it in fruitcakes, perhaps. The fruit itself is not eatable when fresh. In the United States the name is sometimes incorrectly given to a relative of the watermelon.

Another delicious fruit which Florida, California, Arizona and Texas furnish to us is the grapefruit, which is grown in large quantities in these states. It also grows in the West Indies and in Mexico, but its original home is in the islands of the Pacific. It is known also as the pomelo, and two varieties—one of which has crimson flesh—are called the shaddock. These are more often grown in Jamaica. They are said to have been introduced into the West Indies by a Captain Shaddock. The grapefruit belongs to the same family as the orange and is cultivated in the same way. Its large yellow balls often grow in grape-like clusters, and it is from this fact that it gets its name.

The lime is like a small greenish lemon with very sour juice. It grows on a dwarf plant often set in hedges. In the days of sailing ships, when voyages were very long and vessels were unable to carry supplies of fresh meat and vegetables, lime juice was one of the most valuable of all of a ship's stores, for it helped the sailors who had to



Picking Thompson seedless grapes in California.

live on dried and salted foods to resist scurvy, which often carried off half a ship's crew.

Scurvy is a disease that comes from bad diet, chiefly from lack of Vitamin C. Though he did not know anything about vitamins, of course, Captain James Cook, the famous British explorer, discovered that lime juice prevented scurvy on long voyages when the food was mostly salted meat and bread and cheese. So from his time on, English ships carried supplies of limes; and even today (though the crews have fresh foods) "limey" is a slang term for an English sailor.

All the citrous trees are evergreen, with shiny leaves and waxy white flowers; the fragrance of the orange blossom is famous. The skins of the fruits contain in their rind a number of tiny glands filled with a valuable and fragrant oil which is very refreshing and is used for a variety of purposes. The skins of many of these fruits, like the orange, lemon and citron, are candied and used in confectionery for flavoring cakes and puddings.

Among other fruits used in large quantities in normal times, the banana takes one of the foremost places. This is a very wonderful plant, and its uses are legion. It is very prolific, an amazement to all who know and study it. Four thousand pounds of bananas will grow within the same space of ground that is required to raise ninety-nine pounds of potatoes or thirty-three pounds of wheat, and while the potato and the wheat require constant attention, the banana asks for no care beyond the removal of the stalks as they wither.

The fruit is nourishing, whether eaten fresh or dried in the sun. When ground up, the dried fruit makes an excellent flour, and a beverage is also made from the banana. The leaves are used for thatching houses, and the fiber of the stalk is woven into a canvas used for cloth-



Seedless raisins drying in the sun between the rows of vines.

ing and sacking and rope. These are only a few of the hundreds of uses to which the banana plant is put. No wonder it has been called the "maid of all work in the vegetable world."

The banana needs a warm temperature with a good supply of moisture, and the plant will then grow to a height of thirty feet, with leaves ten feet long; but in plantations it is not allowed to reach such a height, owing to the difficulty of harvesting the bunches. All the cultivation it needs is to

THE LUSCIOUS FRUITS OF THE EARTH



Apricots.



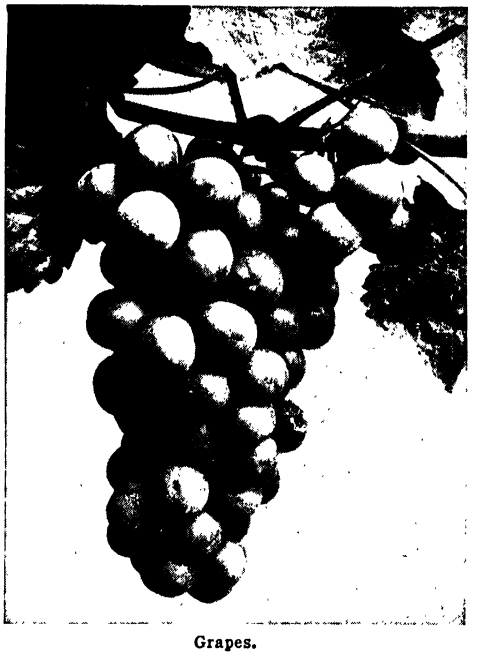
Loganberries.



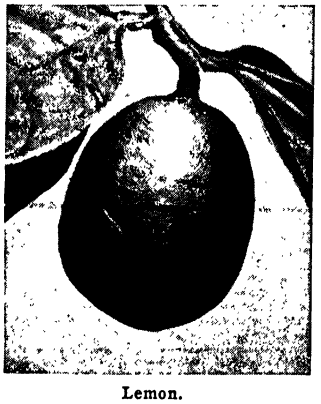
Plums.



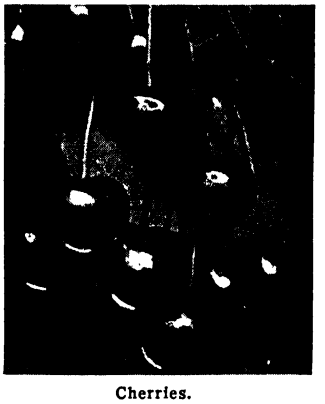
Red Currants.



Grapes.



Lemon.



Cherries.



Orange.

Fruits are improved by selection and cultivation. By choosing the best and breeding only from them, fine specimens are obtained. The loganberry is a cross between the blackberry and the raspberry.

reap the fruit and cut down and clear away the stalk so that a new shoot may have room to grow up from the rootstock which lives on. The stalk dies immediately after fruiting.

One of the fruits California can not grow is the banana. Bananas come to us by the shipload from Cuba and the other West Indies; but mainly from Central America, especially southern Mexico (Yucatan), Guatemala, Nicaragua and Costa Rica. Not only do the people of those countries produce them in large quantities, but many farmers from the United States and Canada have settled in those places and planted great fields of bananas of various kinds, as well as orange and lemon groves, coffee groves and plantations of pineapples, for sale to us. Jamaica has very extensive plantations, but most of its product goes to England and other countries of Europe. Bananas are gathered while still green and gradually ripen on the cut stalk.

THE STRANGE PLANT FROM WHICH OUR BANANAS COME

The banana plant, though looking so much like a tree, is really only an herb, and the stems that look so substantial are formed merely of the sheathing bases of the leaf stalks and are quite destitute of woody matter. When full grown, the stem is surmounted by a crown of leaves and has a palm-like appearance. A single huge bud springs from the center of the crown of leaves and then turns down and blossoms. This develops into the bunch of bananas which may weigh from fifty to a hundred pounds or more.

The plantain, a large variety of banana, has less flavor and is cooked in the tropics as a vegetable. Some kinds of plantain in East Africa grow to the size of a man's arm. Millions of people in the tropics practically live on the banana, which is one of the most wonderful of natural foods. There are two members of the banana family that yield no edible fruit, but from the leaves of one of these we obtain the valuable fiber known as Manila hemp.

THE GRAPE IS THE OLDEST OF ALL CULTIVATED FRUITS

The oldest of all cultivated fruits is probably the grape. In the world's oldest writings we read of men tending the vine and gathering the fruit of it, and for at least six thousand years grapes have been grown for food and drink. The seeds of the grape have been found among the lake-dwellings of the Bronze Age. The vine grows wild in western Asia, Southern Europe, North Africa and North America, but man has constantly improved the grape, until now there are over a thousand varieties, some of them exceedingly large and luscious. Some of our varieties have been developed from native grapes, some have come from Europe, and others are the result of crossing.

RAISINS AND ZANTE CURRANTS, WHICH ARE REALLY DRIED GRAPES

We have no need to import table grapes. Yet there is one sort, the large, greenish white, fleshy grape, called the Malaga after a city in Spain, which we bring in great quantities in the autumn from the Mediterranean countries. Even this importation has lessened, however, because large vineyards of these are being grown in California. California also grows an immense amount of raisin grapes, which are made into excellent raisins. Greece and the countries of the Near East still send us, however, "Zante currants" which are not really currants but small dried grapes. Europe gets its raisins from Spain, Greece, Turkey and Australia.

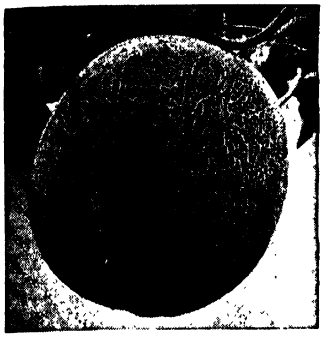
The vine has many foes. Its greatest enemy is an insect pest known as the phylloxera, a native of the country east of the Rocky Mountains. This had always lived in the wild vines of America, but it attracted no particular attention until it was imported into France about 1860. It spread rapidly through the chief vine districts of southern Europe, causing immense losses, and for a time the vineyards were swept away and the wine industry was ruined. All the damage was caused by insignificant creatures less than a sixteenth of an inch long. In France alone the phylloxera in a few years cost more than the Franco-Prussian War.

THE MELONS, MEMBERS OF THE GOURD FAMILY

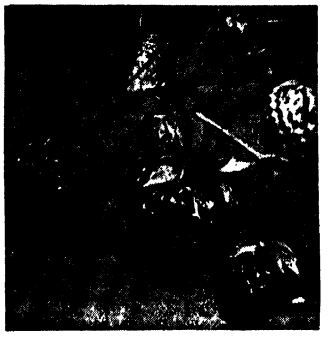
There are many kinds of melons, but the most important and popular are watermelons, muskmelons and the honeydew. The first home of the melon was in Africa and southern Asia, and most varieties still grow best in warm climates. Melon plants are vines with trailing or climbing stems. They belong to the gourd family and are annual herbs resembling the pumpkin, squash and cucumber, to which they are related.

To grow well, melons need a fertile, sandy loam and plenty of sunshine. Nothing is more discouraging to them than a cold, damp summer, and they are easily killed by frost. Plant-breeders have done wonders in devel-

HOW MAN HAS IMPROVED THE WILD FRUITS



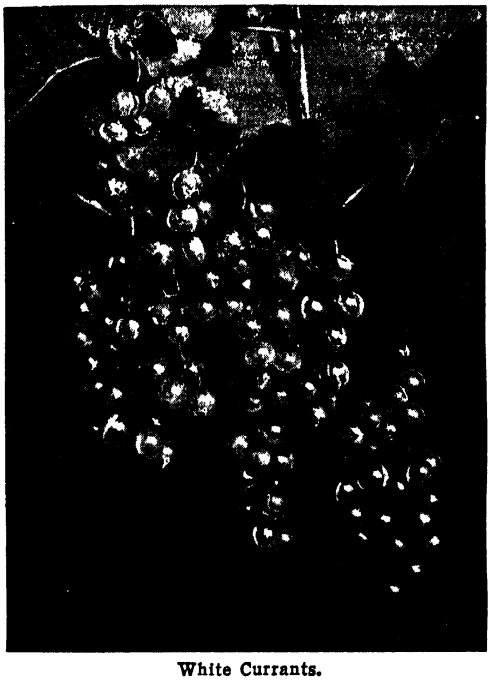
Muskmelon.



Strawberries.



Pears.



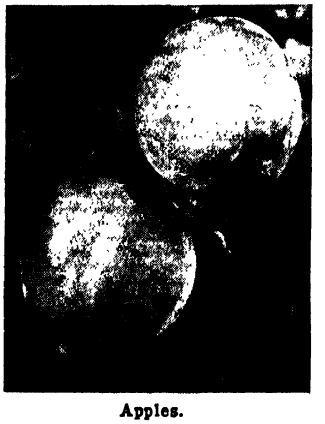
White Currants.



Gooseberries.



Raspberries.



Apples.



Medlars.

These beautiful fruits have all been produced by man from the small fruits that grow wild in different parts of the world. In every respect they far surpass their wild ancestors.

oping varieties that can withstand the cool climates of most of the northern states and the warmer parts of the Canadian provinces. The muskmelon has proved most adaptable for this purpose, especially the netted or nutmeg melon. Watermelons are grown principally in Georgia and Colorado, but they are common throughout the southern states. Some short-season varieties may be grown as far north as Michigan and Ontario. Where summers are short, melon vines must be started under glass so that they will be well grown by the time the weather is warm enough to set them out in the field. Melons are always eaten raw and are never made into jams or jellies, but a delicious pickle or preserve is often made of a part of the rind.



U. S. Department of Agriculture

Pomegranates. Note the dark, glossy seeds.

The pineapple is a table fruit quite different botanically from all the fruits that have been mentioned above. It is not a seed-case, but a collection of many flowers consolidated into one succulent mass. The pineapple plant grows on the ground. A number of long, sharp-pointed, rigid leaves with saw-like edges spring from the root, and in the middle of these a short flower stem is thrown up bearing a single spike of flowers which later on becomes the pineapple. At the summit of the fruit there is a little tuft of small leaves, and this is capable of becoming a new plant. It is by means of these crowns and by suckers that the plant is propagated, and not by seeds.

The natives who gather pineapples for the market generally cover their legs up to the knees with thick cloth. Then they put on gloves made of thick canvas, and with short hooked knives cut the pineapples and put them in sacks slung from their shoulders. Grasping the tuft of leaves at the top, the harvester cuts off the stem at its base. The best pineapples come from Hawaii, but they are grown in many places, including parts of the United States, Mexico, the West



Ewing Galloway

Harvesting the crop in a New Jersey peach orchard. Note the size of the fruit, and how heavily laden the tree is.

Indies, the Philippines and South Africa.

Many of the fruits we grow are members of the rose family. This is the case with the cherry, plum, damson, greengage, apple, pear, medlar, strawberry, raspberry and blackberry—they are all cousins and near relatives of our roses. (The exceptions are the currants and the gooseberry, which are members of the saxifrage family.) All the beautiful and delicious varieties of these fruits have been produced by means of careful selection and cultivation from the smallest wild varieties, generally hard and unattractive, that grow freely in the countryside today. Nowhere has man triumphed more than in the production of choice fruits from small wild plants. Our strawberries and raspberries now grow almost everywhere.

Long before man cultivated fruits he ate the wild varieties, and we find the remains of apples and pears among the lake-dwellings of Switzerland and Italy. Some of the fruits referred to have been carried to America and Australia and other temperate climates, where they sometimes flourish more than in their native homes. This is particularly the case with the apple, which grows nowhere better than in Nova Scotia in the north and in Tasmania in the south.

Apples are among the most important fruits grown in North America, and there are many reasons why this is true. It is enough to make our mouths water just to look at the shining red apples we see in the markets. They taste just as good as they look, too, and are one of the most healthful of all fruits, especially if we eat the skin where the important minerals lie. In addition to all this, they are easily grown and many varieties keep for a long time. These may be shipped to distant points without harming them in the least.

Most apples are delicious to eat raw, but beware of eating them before they are ripe. They will almost certainly give you a stomach ache. Cooked apples furnish some of America's favorite dishes, such as apple pie, baked apples, applesauce and apple butter. Rosy red crab apples are not eaten raw, but they make a delicious jelly. Apples are very versatile. They are an important food when they are dried, or the juice may be pressed out to provide us with apple juice and cider.

The apple tree is one of the best-known trees in North America, especially to boys and girls, who like to climb in its low, crooked branches. Apple trees seldom grow higher than thirty feet. Dwarf varieties are often planted to save space where a garden is small, or because their beautiful blossoms and gay fruit are a delight to see. Apples are among the oldest fruits known. They appear in the ancient annals of China, Babylon and Egypt; earlier still, they were known to the prehistoric lake-dwellers of Europe.

Red, golden, russet or green, the color of a ripe apple depends on the variety of the tree. In the great apple orchards of the United States and Canada, so many varieties are grown that it is impossible to list them all. Some ripe apples are hard, with a fine, sharp tang, such as the Northern Spy; others, such as the Delicious, are softer and more mellow. In the midst of the newer varieties, there are many old favorites, including Snow apples, Winesaps, Pippins, Russets, Greenings, Baldwins, Rome Beauties and McIntosh Reds. There are great associations of apple-growers that market this fruit in every section of the country.



Cranberry Canners, Inc., Hanson, Mass.
Cranberries on their way to our Thanksgiving dinner table.

Pears belong to the same family as the apple. They are believed to be natives of western Asia and the parts of Europe that lie near by. Pears grow best in a cool

climate and today they are grown chiefly in the United States and France. They will adapt themselves to almost any kind of soil, but are at their finest in a well-drained, heavy loam. Pears are gathered before they are fully ripe. Then they are stored for a time to gain a fine flavor and good color. Juicy Bartlett pears are most widely grown in the United States, but some people value the little Seckel pear as finest of all varieties of pear in flavor.

The peach, regarded by many as the choicest of all stone fruits, was originally a native of China, where it has been cultivated from a remote period. It was carried into Europe at least three centuries before Jesus was born, and the early colonists brought it to America, where it thrives amazingly well.

Peaches in season are common and cheap in this country. The largest supply for the East comes from Georgia in the South, and from Michigan and Ontario in the North; but they are grown almost everywhere, and most of the fine canned peaches that we buy in the stores come from California.

Nectarines are peaches with smooth skins; they are not so popular as peaches that have furry skins. They are grown chiefly in California and though they may be eaten raw, most nectarines are either dried or canned.

The color and downy skin of the apricot makes it look much like a peach, but its flavor is generally stronger and it is less juicy. Apricots are natives of China. The trees are very beautiful, with dark green leaves and a cloud of white blossoms. It is not easy to grow this fruit. One difficulty is that the blossoms appear so very early in the spring that they are likely to be killed by late spring frosts. However, quantities of apricots are grown in southern California for canning and drying.

THE CHERRY IS A COUSIN OF THE PLUM

The cherry is a small stone fruit which belongs to the same family as the plum. When we think of cherries, perhaps the first color that comes to mind is the beautiful bright "cherry red," but some cherries are a very dark red while others are a pale yellow. Sweet cherries are delicious to eat as fresh fruit, but sour or "pie" cherries must first be cooked, usually with plenty of sugar.

Some cherries are natives of North America, but the kinds that are most widely grown have come to us from two European varieties which have been cultivated in the Old World for centuries. In Quebec and in northern Ontario a native species, the chokecherry, is grown for making jams and jellies. Sweet cherry trees reach a great size and will not stand very cold winters. Sweet cherries thrive in the Hudson Valley and the Great Lakes region, and along the West Coast, especially in Oregon and California. Sour-cherry trees are more moderate in size, and are good trees to plant in a small garden. Sour cherries do not ship well; so even in season, they are sometimes hard to find in the market.

SPANISH MISSIONARIES BROUGHT US THE OLIVE

Olives have been grown in California since the Franciscan Fathers first planted them in the garden of the San Diego Mission. There are many olive groves now in that state, and it sends us stuffed and pickled olives in attractive-looking glass bottles, ripe black olives and some of our best olive oil.

We know little of fresh dates, though some are grown in California, Arizona, Texas, Florida and New Mexico. We import dried dates from Asia and Africa. On page 2155 we tell you of them, and also the story of the fig.

Few of us, as we eat some plump, juicy prunes for breakfast, or a delicious prune whip for dessert, are aware that the state of California alone produces more prunes than any other country. They are also grown in British Columbia and in Washington, Oregon and Idaho. As we know, prunes are dried plums, but all plums will not make prunes. Three varieties, commonly called the petite, the Italian and the silver prunes, have been found best for this purpose, and hundreds of acres of these plums are grown. The fruit is allowed to become very ripe, and is then picked, dipped for a minute into boiling lye to soften the skin, carefully washed and dried in the sun or in an evaporator.

Among our native small fruits we have several varieties of blueberries and huckleberries. Some of them grow in low swampy ground, some on dry hard soil, and others, again, on the rocky ground of the mountain side. These delicious fruits grow wild in such large quantities and in so many places that very little effort was made to cultivate them until about twenty years ago. In New Brunswick and in New Jersey the "wild" blueberry fields have been carefully looked after. Canneries have been built close to

HOW THE BUNCHES OF BANANAS GROW



Courtesy, United Fruit Co.

Bananas grow in bunches like this one, the fruits (fingers) turning upward as they develop. The bunches are always cut while the fruits are still green. If they were allowed to ripen on the tree, the skin would break open and insects would crawl in upon the fruit, spoiling it for us. There are many varieties of bananas.

these fields, large quantities of the fruit are preserved on the spot, and a flourishing industry has grown up in what might otherwise be waste places.

The Department of Agriculture has made experiments and has found that improved varieties can be made to grow on ground which is fit for little else. Most of the blueberries are large and juicy, with a lovely blue bloom, and no more delicious fruit can be found. The huckleberry fruit is of a jet-black color, and one variety has gritty little three-cornered seeds which make it less agreeable for eating. Blueberries and huckleberries both belong to the heath family.

A close relative of these fruits is the cranberry, the rich red berry dear to our hearts at Thanksgiving and Christmas time. For this berry we are indebted to several provinces of Canada, the New England states, New Jersey, Michigan and Wisconsin. The cranberry that we know in this country grows only in North America, so we may truly call it a national fruit. Its cultivation was first begun on Cape Cod, and the marshes of that region are largely given over to its growth. It grows best on low peaty ground. The plants are flooded during the winter season, but the bogs are drained in April. The fruit is picked in September and October and packed in boxes or barrels, and will keep for a long time. Large quantities are now exported, especially to France and the British Isles.

Nowadays it is our good fortune to be able to buy fruits which were the rarest sort of luxuries a generation or so ago. Among these are persimmons, pomegranates and avocados. The fruit of the Japanese persimmon is a familiar sight in many northern markets today. It looks like a tomato and its flavor may remind you of apricots. The Japanese persimmon is a native of China, Korea and Japan, and was successfully grown in the southern states in the latter part of the nineteenth century. It is now raised for market in California and the South. The American persimmon, with its yellow skin and pink cheek, is much smaller and does not ship well. Some varieties of our native persimmon are delicious and others are inedible. They grow wild in woods and fields from Connecticut to Indiana and throughout the Gulf States.

Pomegranates are still grown on a rather small scale in the United States, although many are grown in tropical America. The fruits are round, very juicy and full of seeds. Some varieties of pomegranates with brilliant red flowers and glossy leaves are grown for their beauty as well as for their fine fruits, and are popular in gardens of the South and of other warm areas in the United States. The pomegranate is a native of Asia and one of the most ancient fruits known in the Old World.

Avocados have become very well known in recent years. Their popular name is alligator pear. The yellowish-green pulp of the avocado is rich in oil and makes a fine salad. Not so well known is the fact that avocados make a delicious ice cream with a very delicate flavor. Avocado trees are handsome evergreens, and if allowed to grow to their full height may reach fifty feet. In southern Florida and California, where they are grown commercially, the tree is kept to a height of thirty feet, with many spreading branches. Avocados are natives of tropical and subtropical America.

We have now named most of the important fruits, but we could write much more about them. A whole volume of our book could easily be given to the fruits. We have spoken principally of the taste, but this is not the only reason why we should eat fruit every day in the year. Fresh fruit gives us an abundance of the vitamins and minerals we need to keep ourselves strong and fit. Because it helps to protect our health, fruit is called a protective food. The habit of eating fruit each day is one of the best that you can develop as well as one of the most pleasant.



Courtesy, Peter Henderson
A round, juicy watermelon of the variety known as Coles Early.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 2155.



Bettmann Collection

An eighteenth-century bookseller's display at the famous Leipzig Fair.

THE STORY OF FAIRS

NOWADAYS the necessities of life, and the luxuries as well, are at the other end of your telephone. Before the days of steam and electricity, people often had to wait long and travel far to buy what they wanted or to sell what they had. The result was that whenever they gathered in large groups, at a religious festival or an important political meeting, they took the opportunity to do business with one another. The fairs that gradually developed in connection with these gatherings were once a very important means for doing business, and today fairs are still useful and popular.

The ancient Greeks held fairs at Delphi, place of the famous oracle, and at Thermopylæ, where one of the great battles of history took place. They did this, not for convenience alone, but also because the fairs were closely connected with religious meetings, which helped to keep the fairs peaceful and honest. After two thousand years the problem of peaceful trading still exists at fairs in the South Sea Islands, for example, where a sacred drum announces the opening and closing of a truce period, and on the Congo, where the carrying of arms is strictly forbidden as long as a fair is in progress.

But religion, lawmaking and trade were not enough to occupy the fair-goers of the past. In addition to everything else they expected amusement, and they seem to have had it from the very beginning. There were games to watch; there were magicians, clowns, stilt-walkers, jugglers, animal trainers, actors, puppets and acrobats. There were also freaks, such as five-legged calves and six-clawed lobsters. Cruel sports, such as bear-baiting and bull-baiting, were a part of some fairs, although as early as 1604 they were given up at the Sturbridge fair in England because the officers of near-by Cambridge University objected to their effect on the students. We know from an old poem that at Sturbridge fair in 1683 there were two fire tricks on display, the sight of flames licking a child's hair without doing any harm and the spectacle of a horse apparently on fire.

Daniel Defoe, who wrote ROBINSON CRUSOE, visited Sturbridge fair in 1723, and he later wrote an account of his visit. He says that the shops were placed in rows like streets and that a great many things were offered for sale in them, including silver, china, pewter, glass, and all kinds of food and clothing. He also mentions that there was a toy shop. The place where clothes were for sale was called the Duddery, suggesting our word duds, which still means clothes. He tells us that he was surprised to find that little ferry boats, rowed with oars, were brought down on wagons from London

to carry people up and down the river Cam, which flowed along near the fair grounds. What would he have thought of the big motor barges, fast and silent, which glided over the great lagoon at the Chicago World's Fair of 1933-34?

He does not say very much about the amusements at Sturbridge fair, although he does mention puppet shows, tightrope walkers and horse races. At the end of his description he writes: "The Fair is like a well Fortified City, and there is the least Disorder and Confusion (I believe) that can be seen anywhere, with so great a Concourse of People."

Very much like the Sturbridge fair in its prime was the great Russian fair, which existed for centuries. It was held annually at a place named Nijni-Novgorod, meaning Lower New Town. It is actually an old town located at the meeting point of two rivers, the tremendous Volga and the smaller Oka. These two rivers, with the help of their tributaries, reach far out in all directions, so that goods from far distant countries, both of Europe and Asia, flowed into Nijni-Novgorod in midsummer of each year.

The site of the fair was a big plain outside the city. Much of it was originally a marsh and had to be reclaimed like the land prepared for the New York World's Fair of 1939. About a century ago the Russian government put up permanent buildings at Nijni-Novgorod. They were chiefly of stone, were two stories high, and had roofed porches, where goods could be displayed free from damage by rain or by the hot summer sun. The buildings were divided by streets into sixty-four groups, forming in all about 4,000 separate shops. A canal, built largely as a protection against fire, surrounded the shops on three sides. Sewers were laid under the streets, through which lake water was pumped several times a day. A wide avenue planted with shade trees cut through the center of this miniature city. Outside its limits, temporary encampments, including perhaps 4,000 more shops, stretched for miles in every direction.

The business carried on at the fair was largely wholesale, and great quantities of such things as tea (very important in Russia), sugar, iron, cotton, linen, silks, dried fruits, furs and lumber were bought and sold. Some of these products came from so far away and were moved along so slowly over winding trails and slow-moving streams that it took many months for them to reach the fair. Iron ore, furs and lumber were fairly close at hand in Russia, but tea was brought overland across Asia from China, and rugs began their journey to the fair from Persia (modern Iran) and Turkestan. For the merchants from these far-away places, it was



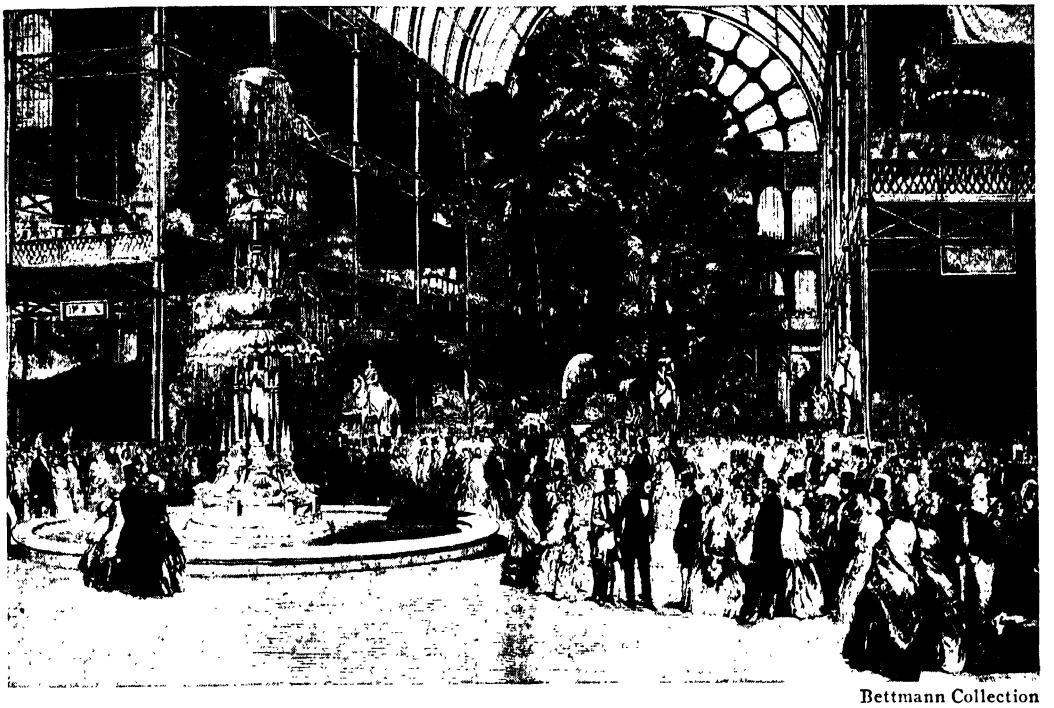
From Lens and Letters

A fair in medieval times. This was an important event for all the country round—lords, townsfolk and farmers.

as much of an adventure to get to Nijni-Novgorod and back as it was to attend the fair itself.

More attention was paid to business than to anything else, with the result that amusements did not develop to any great extent. The chief form of entertainment was a theater that featured an excellent ballet, a form of dancing in which the Russians excel.

The Nijni-Novgorod fair, with total sales as high as $200,000,000 in some years, held its own after many of those in other parts of the world had ceased to exist. It held out until 1930, then closed its doors. The city, renamed Gorki, is now one of the chief manufacturing centers of Russia and has one of the largest automobile factories in the Soviet Union.



Bettmann Collection

This view of the Crystal Palace, which housed the London Exhibition of 1851, shows the mighty roof and walls of glass and some of the tall trees growing inside the building. The palace was destroyed by fire in 1936.

More than four hundred years ago a small commercial fair took root at Leipzig, Germany. In the course of time, it became world-famous for its sales of furs and books. Leipzig was a closely built medieval city, so that it had to stretch itself to accommodate all its visitors at fair time. Visiting retail merchants were housed in several thousand neat wooden booths set up in streets and open places. Each booth was numbered, and its parts were also numbered. The booths were owned by the city and were put up by an army of carpenters at great speed and with a tremendous racket during the night before the fair opened. These little shops were strong and safe, since they were fitted with bolts, bars and shutters.

Wholesalers at the fair did not use the booths, but many a one had a whole store or at least a suite of rooms to himself. The regular owners gave up their property at fair time and took refuge in cellars and garrets as best they could. Sometimes space was so valuable that even windows were removed in order that goods could be packed high on the sills. There was a saying in Leipzig that after the fair was over the citizen was free to "come down out of his blanket." This referred to a famous cartoon in which the head of the family was shown asleep with his wife and five children in a blanket hung from the ceiling like a hammock, the only place possible while the rest of the house was full of traders.

Leipzig fair was noted for its books. All the publishers of Germany were represented there each year. Their exhibits were shown in a special building belonging to them exclusively, where, as late as 1856, business was done in cash on the spot, the only money



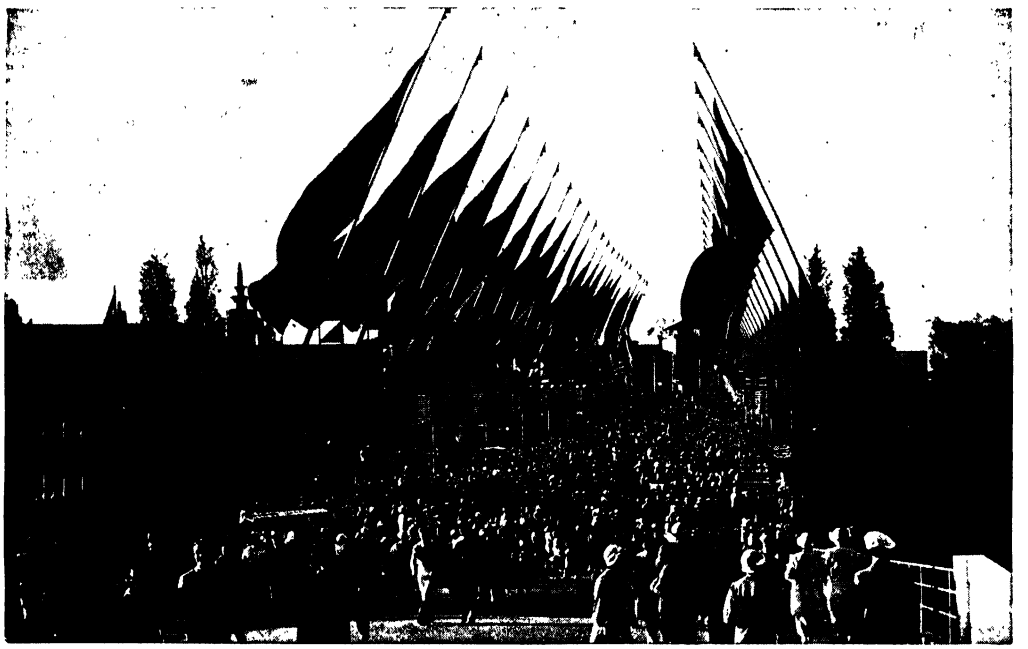
Courtesy, Canadian National Exhibition

The eastern entrance to the grounds of the Canadian National Exhibition, which is held every year at Toronto. The grounds cover over 350 acres.

allowed being gold coin. Accounts were settled in one big room, about a hundred feet long, with galleries at each end. It became widely known for its impressiveness and artistic decoration. The books, many of them exquisitely bound, were displayed in special rooms. There were as many as five thousand titles on view at one time, together with fine prints and photographs of art works.

As for the fur trade, it was for many years considered the greatest in the world. Choice furs were brought from North America, central Europe, Russia and Asia, representing the stock of 2,500 dealers from all parts of the world. The traders used to appear in native dress, creating a vivid and noisy scene when Americans, English, French, Italians, Russians, Swiss, Swedes, Dutch, Tartars, Greeks, Turks, Albanians, Poles and Wallachians all bargained together earnestly in more than ten different languages. The traders needed to be good linguists.

State and county fairs, devoted largely to farmers and their interests, have become a well-known feature of American life. The first county fair was organized by Elknah Watson and was held at Pittsfield, Massachusetts, in 1811. It was called the Berkshire County Fair. Its numberless successors



Kaufmann-Fabry photo

The Avenue of Flags at the Chicago Century of Progress fair. This famous exposition was held in 1933 and 1934.

have been much alike, but they do not resemble the old fairs of Europe except in name. They are really exhibitions of farm products and products related to farms. Most of them are held late in the summer, usually for a week. They are held on permanent grounds, with pavilions, booths and, quite often, a track and grandstand for horse racing. State fairs are frequently supported in part by grants from the legislatures, while county fairs may be privately incorporated and run by farmers and merchants, who make a small amount of money out of them.

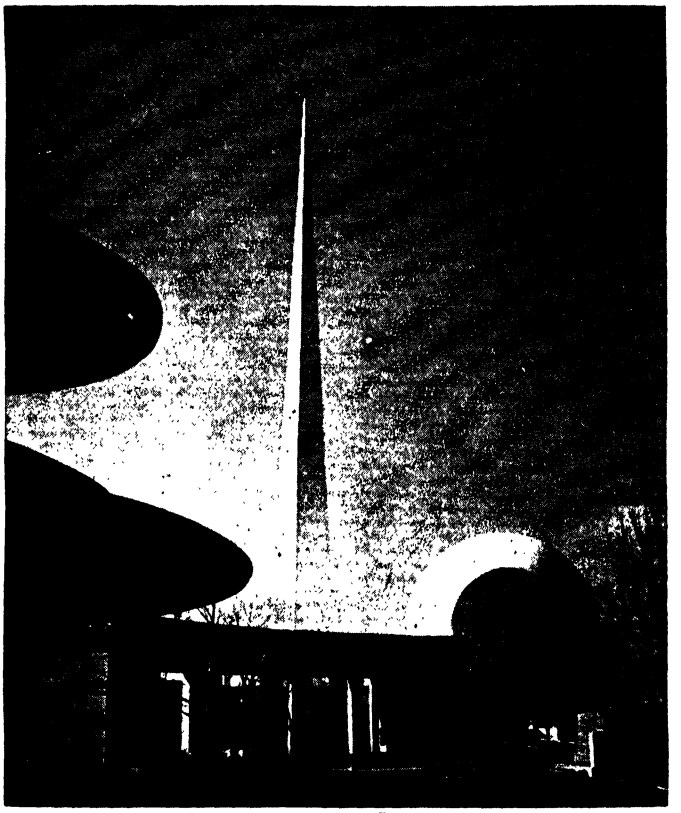
Much space at these fairs is occupied by individual exhibitors. Farmers show their fine cattle, hogs and other livestock, competing for prizes against all comers. Housewives enter home-made pies and cakes, preserves, fancy needlework and quiltings. Their work is carefully judged by experts. Sometimes there are corn-shucking and hog-calling contests, and, at large fairs, exhibits of farm tools and machinery.

Cities also have their fairs, usually called shows. They are held in a big, centrally located building and are confined to some one product. Automobile shows have become popular and are now so numerous and widespread that their combined effect upon the automobile industry is important. Makers exhibit all their latest models, if possible kept secret until show time, and they attract attention to the new features of their own makes by special diagrams, working models and demonstrations.

Radio shows, printing shows and motorboat shows are run along the same lines. Exhibitions of business machinery are rather new, and they are much more interesting than they may sound because they feature very delicate and very clever machines, which will add, subtract, divide and figure in other ways with tremendous speed and no mistakes. Some of them seem almost able to think. Shows of antique furniture and small articles and flower shows are popular.

Now we come to still another sort of fair. The older fairs were more like big markets than anything else until the London Exposition of 1851 gave the world a fresh idea. There had been other so-called expositions, but they were too small to compel universal attention. In 1845, however, Prince Albert, Queen Victoria's husband, suggested to a few influential men that a public exhibition of British and foreign-made products would be a good thing for trade and for international relations as a whole. His suggestion was not popular at first, and it took three attempts on a small scale, made in 1847, 1848 and 1849, to prove to the English public and the English manufacturer that the scheme was worth while. Finally, they were convinced, and under the direction of a Royal Commission an exposition for the first time on an international scale was planned for the year 1851.

Its purpose was to promote and increase the free exchange of raw materials and manufactured goods between all the countries of



Courtesy, New York World's Fair

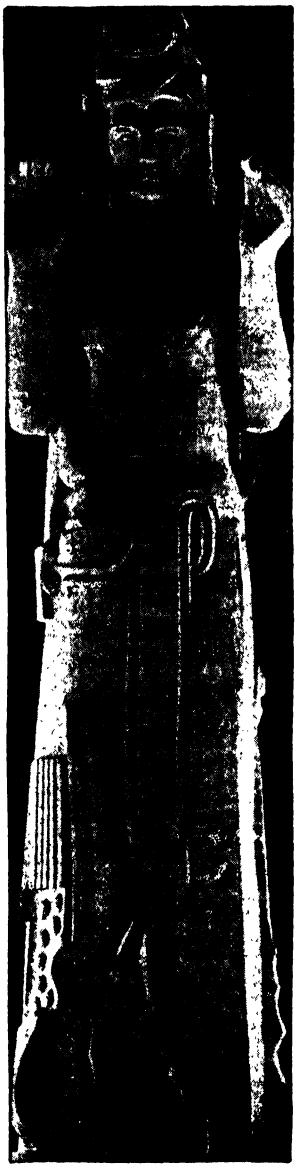
Perisphere (right) and Trylon at the New York World's Fair of 1939-40.

the earth. It was understood that there was to be no business done at the exposition itself. It was really to be a great sampling and advertisement of goods for the British Empire and for the other countries invited to exhibit. In this it differed from the great fairs of the world where trade was the main object. Prince Albert also insisted upon including the fine arts in the exposition, thus adding an educational feature new to fairs on a large scale.

One of the triumphs of the exposition was the huge building in which it was held. It was built in Hyde Park and was named the Crystal Palace. This was an immense structure of iron and glass, 1,848 feet long and with a maximum width of 408 feet. The main portion was 64 feet high. The interior, so large that full-size trees grew under the roof, was laid out in aisles and galleries well suited to exposition purposes. The glass in the main portion weighed 400 tons. In 1854, the Crystal Palace was moved to the outskirts of London, where it stood until it was destroyed by fire in 1936.

The exposition was opened May 1, 1851, by Queen Victoria and Prince Albert, before a great crowd of more than 25,000 people. It was a success from the beginning, daily attendance running as high as 74,000. It lasted 144 days, and in that time was visited by 6,170,000 people. There were 15,000 exhibitors. The United States sent such items as coaches, wagons, buggies; chandeliers and lamps; grains and other raw foods; paintings and photographs; pianos, rifles, and what proved a great curiosity in those days, an improved bell-signal system for hotels.

The international-exposition idea caught on. Expositions, variously called exhibitions, expositions and world's fairs, have been held often since 1851, particularly in France, England and the United States. Most of them have left some permanent building by which they are remembered and have contributed in one way or another to scientific or artistic progress. There was a world's fair at Paris in 1855, which drew 24,000 exhibitors. A second took place in 1867. No less than 25,000,000 people visited the fourth French International Exposition at Paris in 1889, where one of the chief features was the famous Eiffel Tower, 984 feet high, for a long time the tallest man-made structure in the world.



Golden Gate Internat. Expos.
"Pacifica," the eighty-foot theme figure of the 1939 Golden Gate International Exposition.

President Grant opened the first great exposition in the United States at Fairmount Park, Philadelphia, to celebrate the centennial of the Declaration of Independence, 1776-1876. It occupied 60 acres and had nearly 10,000,000 visitors.

The four hundredth anniversary of Columbus's discovery of America was celebrated a year late by the World's Columbian Exposition at Chicago in 1893. It was the biggest and most elaborate fair ever held up to that time. Many countries had exhibits and even buildings of their own to show their goods. One of the special features of the exposition was an amusement center called a Midway, repeated with success at the Chicago Century of Progress fair held in 1933 and 1934. The Columbian Exposition attracted a total attendance of 27,539,521, and a maximum daily attendance of 716,881. The income from paid admissions alone was more than $10,000,000. The buildings of this fair, famous for their beauty at the time, had a great influence upon American architecture.

Other noted American expositions include the following: the Pan-American Exposition at Buffalo in 1901; the St. Louis Exposition of 1904, celebrating the Louisiana Purchase, which reached a total attendance of 19,694,855 and



Golden Gate International Exposition
Sculpture and towers in a lovely green setting on Treasure Island.

cost $15,000,000; the Lewis and Clark Exposition at Portland, Oregon, in 1905; the Panama-Pacific Exposition, held at San Francisco from February to December, 1915, to mark the opening of the Panama Canal; and the Philadelphia Sesqui-Centennial of 1926.

The British Empire Exhibition held at Wembley Park, near London, in 1924 and again in 1925, was something new in expositions on a large scale. It was limited to the interests of the British Empire and was built to represent the Empire in miniature, including native types of architecture. Among its thousands of exhibitions were a model coal mine, a cotton mill working on a small scale, an accurate reproduction of Tutankhamen's tomb and a wonderful toy house, called the Queen's Doll House, which had genuine oil paintings three inches square by well-known artists on the walls and tiny bottles of real champagne in the wine cellar.

Canada has a large and unusual exhibition every summer at Toronto. It is unusual because it is large enough to be considered an exposition, yet, unlike most expositions, it takes place annually. The grounds are in the heart of the city of Toronto and are reached from the eastern side by a beautiful boulevard. There are many permanent buildings, spread out over 350 acres of ground. This fair, known as the Canadian National Exhibition, began as a small exhibition of Upper Canadian products held at Toronto in 1846. It has grown until now it is the largest annual exposition in the world.

A world's fair was held in Paris from May to November, 1937. Its theme was international progress in ar , craft and science. The influence of this fair can be seen in the great fairs held in the year 1939 in New York and in San Francisco. There were resemblances particularly in layout, which sought to avoid congestion, and in lighting methods, which employed every new device to realize beauty and variety.

The New York World's Fair of 1939-40, Building the World of Tomorrow, adopted the modern Perisphere and Trylon as its theme center. Looking to the future for inspiration, buildings were constructed in the modern style of architecture with much use of glass.

The fair, which commemorated the 150th anniversary of George Washington's inauguration as first president of the United States, was held in Flushing Meadow Park, Queens. This 1,200-acre plot, near the geographic center of New York City, was transformed from an ugly dump heap into a beautiful park especially for the fair.

While plans were going forward for the New York World's Fair, Pacific coast cities were making ready for a celebration—the Golden Gate International Exposition—to mark the completion of the two great bridges which span San Francisco Bay.

The fair was held on a man-made island, called Treasure Island, placed in the bay midway between San Francisco and Oakland. It took for its plan an ancient walled city in which Oriental decoration predominated. The most prominent building was the Tower of the Sun representing the worship of pan-Pacific peoples long before history was written.

Like other big fairs of recent years, both these fairs had exhibits from all over the world, large amusement sections and special areas for children. There was a definite emphasis on art and education.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 2169.

A PORTRAIT BY J. L. DAVID



Photo, courtesy Metropolitan Museum of Art.

MLLE. CHARLOTTE DU VAL D'OGNES, IN THE METROPOLITAN MUSEUM, NEW YORK



Horace Vernet's picture of the Battle of Bouvines.

FRENCH ART AFTER THE REVOLUTION

TOWARD the end of the eighteenth century the eyes of Europe were turned toward France, where Revolution seemed to mean an actual turning about for everything. Government, literature, art, religion—all life appeared to be taking a new direction.

A strong wave of interest in everything classic swept along, lifting men and women upon a crest of enthusiasm for imitating the Greeks and Romans. Even their clothes had to be modeled after the ancient styles. There are several things that help to explain this revival of attention to the life and art of the past.

About the middle of the century the buried cities of Pompeii and Herculaneum had begun to come to light under the spades of excavators; and at the same time two men had by their books and drawings been spreading a knowledge of the beauty in Greek and Roman art and architecture, even when in ruins. One was a German archæologist—Winckelmann—who studied and wrote about the treasures of classical antiquity. The other was Piranesi, an Italian architectural artist and engraver, whose hundreds of fine engravings of buildings, monuments and decorations carried a knowledge of their dignity and splendor into many lands. The Colosseum, Trajan's Column, the Arch of Titus, Hadrian's Mausoleum, the Pantheon and many other glories of an older day in Europe were brought before the eyes of modern men near and far by means of this engraver's tools.

The natural tendency in France is to follow an appeal to the mind and to appreciate anything that has fineness of construction. It is easy to understand, then, that the door opened quickly and swung wide to admit the classic idea. Indeed, it was not a new idea in French art. You remember that Poussin's pictures are the very embodiment of classic feeling and are examples of a truly classic style. Even Greuze was masquerading rather than really living as a romantic painter. His genre looks academic and studied when placed beside the Dutch and Flemish genre. Of the French painters only Chardin could be as "natural as a Dutchman." He was an exception, standing alone.

Before the Revolution began, the undercurrent of sympathy with the classic spirit had been coming nearer the surface of life and thought. The softness and sentimentalism of the work of Boucher and others—unworthy followers of Watteau—grew wearisome. A return to sterner expression was welcome.

Boucher himself had a pupil named David, who was to become the strongest force in bringing about the triumph

of the classic revival in French art. But Boucher, recognizing that this pupil's genius was of a sort that could never be at home with his own style, had the good sense to refer him to another instructor, J. M. Vien, a pioneer in the return to classicism. Correctness in drawing, perfection in form, and balance in composition were the aims of this school. With Vien young David went to Rome to study the treasures of the old galleries.

Jacques Louis David (1748–1825) was one of those leaders of men who are sure to make a place in a nation's story. He was an extremist; he drove a wedge through other people's opinions. He had no patience with criticism, and loathed compromise. Most of the art world of France in his time was like wax in his hands. He was a strong politician, and brought about the break-up of the Academy founded by Mazarin and Colbert. But it seemed as if there must be some kind of national institution. During Napoleon's consulate the academy appeared again, but with changed name and lesser powers.

David played the part in French art of a second Charles le Brun. But Le Brun had served a king; David gave his services to the Republic after the fall of Louis XVI. He illustrated the tale of the glory of Napoleon. Where the artists of Louis XIV had tried to make classic and Italian art French, David aimed to put classic art in the place of French art.

He did not feel the value of native style. Such skill as the French had learned he would throw away; all those characteristics which stamp the genius of a people with their own individuality he would wipe out. There must be for him nothing but timeless, flawless Greek beauty, something set apart, unique in the world's history. It was as true, he thought, in the days of Bonaparte as in the days of Praxiteles.



DAVID'S FAMOUS PORTRAIT OF MADAME RÉCAMIER, IN THE LOUVRE

This, of course, was an impossible position. One cannot set back the clock for two thousand years and pretend that nothing of any merit has happened since.

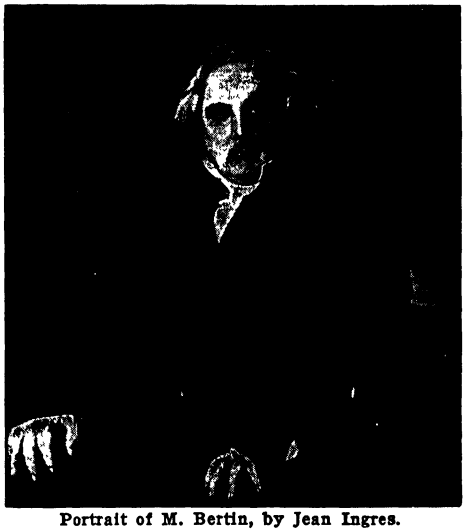
A curious, cold shadow of David's ideal clings to his work in portraits such as those of Madame Récamier and M. and Mme. Sériziat, in the Louvre. He could be magnificent at times, as in The Coronation (of Josephine), which is one of the finest compositions of the French school.

His French soldiers, his Bonaparte, were made of the stuff of Greek and Roman warriors. He stamped the pictures of the Napoleon era with something of the spiritual grandeur of his ideal. Later on came men who painted pictures

PICTURES BY VERNET, DAVID AND INGRES



The Taking of the Smala, by Horace Vernet.



Portrait of M. Bertin, by Jean Ingres.



An Eastern Trader, by Horace Vernet.



The Coronation of Josephine by Napoleon, painted by David.

of Bonaparte's armies from the point of view of the obscure soldier, the pathos of weary men stumbling blindly on, suffering from cold and from lack of food. But David was thrilling with a fine and abstract heroism. The compositions he most loved were those of Greek and Roman story, such as The Oath of the Horatii, and Leonidas at the Pass.

This remarkable man so controlled the period that other artists are classed as followers of David or those who refused to follow his leadership. His influence reached beyond the realm of painting. For instance, we read that at his suggestion a famous actor playing the part of Brutus adopted the toga and sandals of the Romans for that rôle, instead of appearing, as had been the custom, in the clothes of his own day, even to the red-heeled shoes and curled wig.

DAVID'S PUPIL WHO BECAME ONE OF THE WORLD'S GREATEST DRAFTSMEN

In David's pupil Ingres, the same passion for Greek art burned bright. Ingres (1780–1867) was one of the greatest draftsmen the world has known, but he distrusted and disliked color. If a picture were perfectly drawn, he thought, no painting was necessary. He saw the world as a huge "line" drawing. As he expressed it, "in nature all is form."

While his work was without warmth or fervor and he had no power to invent, Ingres could draw with a mastery that was pure genius. He would spend hours, days, drawing draperies, hands, heads, the long sweeping line from a woman's neck to her finger-tips. It would seem, in looking at reproductions of his pencil work, that no one before or since has come within hail of his perfection. His pencil portrait group of the Stamati family, in the Bonnat Collection, Bayonne; his drawing of Madame Delorme, in the Louvre, show to what heights this neglected and beautiful art of fine point drawing may attain. To him, more than to anyone else, France owes the finished draftsmanship for which French art is noted.

Ingres was naturally a maker of portraits. In those that he painted his color was not very happy; one has to forgive this for the sake of the draftsmanship that shines through the pigment. The best of these portraits are: M. Bertin, in the Louvre; Madame de Senonnes, in the Nantes Museum; and Madame Devauçay, in the Condé Museum, Chantilly.

Ingres made himself a little ridiculous by his too-great enthusiasm for the ancient Greeks. To him there was only one poet in the world—Homer. Shakespeare and Goethe he set aside as of no importance because their style of writing was not Homer's. His finest epic painting—a decoration on a ceiling in the Louvre—is called the Apotheosis of Homer. It shows writers and artists grouped about the ancient poet in awe and adoration. In color it is dull and uninteresting.

PRUDHON MINGLES WARMTH AND LIGHT WITH CLASSIC STRENGTH

One of David's most famous contemporaries was Prudhon (1758–1823), who is to be remembered for many attractive qualities. The art of portraiture, which had been since the reign of Louis XIV one of the increasing glories of the French school, was strengthened by Prudhon. He had a great love for classical subjects, but to this he added a warmth and wealth of color which the Greeks did not know. He had a worshipful feeling for Leonardo da Vinci—the man who had learned the secret of the play of light and shade on flesh tints. In Prudhon's portraits and other pictures we can perceive both his own genius and these great influences. His works are counted as treasures of France; among the finest are the portraits of the Empress Josephine and Madame Copia, in the Louvre.

Prudhon could paint better than he could draw, perhaps because he was so absorbed in the beauty of light effects and other problems of the colorist. There are several pictures in the Louvre which show how much he had learned of these subtle problems. He was still of the classic group, but his art was forward-looking, leaning toward what was to come.

CLASSICAL ART PASSES AND A NEW VIGOR IS BORN IN PAINTING

The classic wave, rising, had swept the taste of the people away from the sentimentalism of the gallant age. Now its place was to be taken by a new wave which came rolling in—a wave of romanticism.

Young artists of the days when David was an old man found classic art too lifeless and rigid, and began to turn away from it. But though we may agree with them that the art of an age-long past could not be revived to become a living, moving part of modern time, we must

remember that classicism had served a purpose. It had stifled much weak, unnecessary work.

In David's time a young artist called Gros (1771–1835), one of the strong men of the period, unconsciously prepared the way for the new school. Although he was severely taken to task by David, and told to "turn over the pages of Plutarch" if he wanted inspiration, he persisted in choosing subjects of a more human and less distant kind than those which inspired David and his followers. He was capable of handling large canvases without losing the interest and fire of his original purpose.

There is something very living in a picture like his Embarkation of the Duchesse d'Angoulême, which is in the Bordeaux Museum. His people really seem alive; whereas in many of David's paintings you feel that if you undressed the figures they would be cold statuary underneath their garments. But Gros's fame is the result of the fine work he put into his pictures of Napoleon and the army—Bonaparte at Arcola, Bonaparte at Jaffa and Bonaparte at Eylau.

A PAINTER WHO MARCHED WITH NAPOLEON, THEN MADE BATTLE PICTURES

Gros had been a soldier himself, and he added to his genius as a military painter his personal knowledge of life on the field. His picture of Napoleon at Eylau is the first really good military picture of France. David and his followers painted pictures of Napoleon's army, but they were the pictures a man who had never been in a battle or on a march, would paint, and they all "smelled" of a studio. Those of Gros were intensely real. And apart from the place which he had won as a military painter, Gros had moved his art into a more human field some distance from David's camp.

Géricault, who lived from 1791 to 1824, was another painter who in his short life did some excellent work and went farther on in the new direction. There is a study of "flying" horsemen in the Bayonne Museum that is a miracle of energy and strength. In the Louvre is his best-known picture, The Raft of the Medusa, a terrible shipwreck scene—a harrowing theme presented in a dramatic and romantic composition.

A young friend of Géricault carried on the spirit of his work and that of Gros. This was Delacroix, who lived from 1799 to 1863 and was destined to be the leading spirit in the new romantic school.

THE YOUNG FRENCHMEN WHO MADE PICTURES TELL STORIES

This body of artists got their name, romanticists, from the kind of pictures they chose to paint, in opposition to the theories of classicism. They took subjects from Dante, Shakespeare, Byron, or from European history. Their work expressed freely the individuality of the painter, and in this way was a striking contrast to the work of David, who thought that all pictures should look as if they had been painted by Greek artists.

Instead of trying to paint an ideal, cold and impersonal, these younger men gave room to their own personal feelings. What the artist thought, and especially what he felt, was the thing he would put into his picture for the rest of the world to read. Because of their individuality of expression we can hardly call these painters a school.

With them began a style of painting on a large scale, with breadth and a sense of history—the picture which tells a story. There was a danger, of course, that the story would become more important than the art. We can understand why Ingres, fearing that art would lose its stern grandeur, hated the new school. But before his death the new kind of painting had come to the front in France. Delacroix set the fashion, then, and youth asked nothing but to follow it.

There were some lively scenes in Paris in the days of the young romanticists. They were fighting not only the classicists of their own generation, but those of earlier centuries whose traditions had stiffened into a scheme of laws to govern painting.

"There is no recipe," said Delacroix, "by which one can attain to what is ideally beautiful. Style depends absolutely and solely upon the free and original expression of each man's peculiar qualities."

He himself painted with a restless energy, without hesitation or timidity, putting his thought and feeling into color—perhaps actually thinking and feeling in color. He used the scale of color as a musician uses the scale of sound. If Ingres could do without color, Delacroix could almost do without drawing. He seems to have composed his pictures in color without first planning the details.

THE BOLD AND VITAL ART OF DELACROIX AND THE ROMANTIC SCHOOL

His subjects were those of violence and peril. Medea and her children, Virgil and Dante in Hell (Dante's Boat), the Taking of Constantinople, and the Massacre of Scio, in the Louvre, and the Battle of Taillebourg, in the Versailles Museum—five vivid compositions painted boldly with rich color—stand for the measure of his genius to-day. Before he died he had plowed a deep furrow in the stony soil of French art.

The gifted men who grouped themselves about Delacroix, and those who followed after, imitated his choice of subjects. They painted battle scenes, historical incidents, pictures of the East—a whole gallery of courageous and sincere work. There was Decamps (1803–60), one of the finest colorists of France, who went to the Orient and painted pictures of Eastern life. He was less impetuous than Delacroix, but in his restraint there is an added richness. His Bell-ringers, in the Louvre, and Children Coming out of a Turkish School, in the Museum of Decorative Arts, Paris, are fine little pictures. Fromentin, the artist who, being able to write as well as paint, produced the finest art history of nineteenth-century France, worked under the influence of Delacroix. Then there were Flandrin, Delaroche, Meissonier, Regnault, Léopold Robert, Horace Vernet and many more. An interesting company they were, each good in his own way.

Meissonier must be singled out in this brotherhood as a favorite painter of war pictures, of which "1814," in the Louvre, stands at the head. He was not only a war painter but a history painter. The elegance of the Napoleonic period, the costume and arms of fighting men, are shown in his work with great exactness and perfection of detail. The finish of his work is almost microscopic in its fineness. There is more of the skill of the craftsman than the feeling of the man in his pictures.

He and other painters of the glory of Napoleon's career form a separate group of historical artists who have made vivid that picturesque period of French history. Messioner's "1814," one of his most typical paintings, is shown on page 2212.



Janizaries on the charge in the war in Greece, by Delacroix.



Figure of Murat—detail from The Battle of Aboukir, by Gros.

The romanticists had not all the fire of Delacroix, but their pictures have the same effect on the eye that a ballad well recited has on the ear. They awaken images in the mind and illumine events.

Delaroche was a fine teller of tales from English as well as French story. His Princes in the Tower, in the Louvre, is an excellent example. Horace Vernet and Léopold Robert were also chroniclers in color of scraps of a nation's history. Vernet's Taking of the Smala, in the Versailles Museum, has all the joy of a good illustration for a thrilling tale.

For the impulse to romanticism in painting had come through the influence of writers of tales and of romantic poetry; and the movement had been interwoven with the intense experience of France during the revolution that had meant the rebirth of the nation.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 2109.



Culver Service

John Eliot, the first English missionary to the Indians, preaching the Gospel under the great oak at Natick.

TWO MEN WHO TAUGHT THE INDIANS

FATHER JACQUES MARQUETTE AND JOHN ELIOT

AWAY in France in an old château in the city of Laon, which stands on the banks of the river Oise, a little boy named Jacques Marquette was born in the year 1637. Jacques was a round-cheeked, joyous-hearted little fellow with generous, impulsive ways which won the hearts of all about him. His mother thought there was no other boy like him in all the world. Madame Marquette was a devout Catholic, and she would often entertain Jacques for hours by telling him tales of the brave Jesuit Fathers who went out into far-away lands to carry the gospel of Jesus Christ to the heathen. Little Jacques, sitting on a hassock at his mother's feet and propping his curly head against her knee, would listen with shining eyes to the stories of daring and self-sacrifice.

The years passed and the rosy-cheeked little boy grew into a tall young man with earnest eyes. His mother's cherished dream came true. Jacques became a Jesuit priest, and in 1666 was ordered to go to Canada. One day he said good-bye to all his friends and set sail across the Atlantic for the great, new land of America. Traveling in those days was very slow, and it was many months before the young priest reached the little mission on Lake Superior in the heart of the wilderness, to which he had been appointed. Once there, however, Father Marquette set to work with vigor and enthusiasm. He began to learn the languages of the various Indian tribes; and then in an earnest, simple way told the Indians in their own tongue the beautiful story of the Saviour of men.

The Indians listened perplexedly. At first they did not understand this white man with the long black robe who talked about a Manitou who loved all men. He did not seem like the white men they had met before. He did not seem to want anything for himself, and he would travel many miles in the middle of the night to help a sick child with his simple remedies. Gradually the Indians began to trust, and then to love him. They listened, too, to what he had to teach, for surely one who had no ends of his own to gain must speak the truth.

By and by the fame of the "Young White Father" spread abroad, and Indians from the more southern tribes began to come to hear him. One day there arrived at Father Marquette's little mission a delegation of Indians from the tribe of the Illinois, who lived far away on the "Great River." The

strangers listened to Father Marquette as he preached, and then they presented themselves before him.

"Let the Young White Father come to the people of the Illinois," they said.

"I can not leave my mission now, but I will surely come," promised Father Marquette, his heart aglow at the thought of this wonderful opportunity.

From this time on Father Marquette made it his special prayer that the way might be opened for him to go to the Indians of the Illinois. One day there arrived in the camp a small band under the leadership of a young man named Louis Joliet, who had been sent by Count Frontenac to explore the "Great River." Father Marquette was instructed to go with him on the journey. It seemed so like a direct answer to his prayer that the good priest was filled with thanksgiving and eagerly prepared to join the expedition.

FATHER MARQUETTE BEGINS HIS LONG JOURNEY TO THE WEST

The journey began one bright spring morning late in May in the year 1673. The adventurers launched their canoes and paddled gaily over the sparkling waters of Lake Michigan to Green Bay, where they found an encampment of the Wild Oats Indians, who crowded around the white men. Father Marquette was able to talk to them in their own language, and he told them that his party was bound for the "Great River." The Indians listened to his words in polite silence, but when he paused they tried earnestly to persuade the voyagers not to go forward.

"What are they saying?" asked Joliet, curiously.

"They say," said Father Marquette, "that we will surely be killed. They say that there are wild Indians and great water monsters and a horrible river demon." He turned to the Indians and spoke with a ring of triumph in his voice. "People of the Wild Oats," he said, "the white men are not afraid of river monsters or demons, for they have with them always the spirit of the great Manitou, who will let no harm happen to them."

Then the white men bade good-bye to the wondering Indians and set out to paddle up the Fox River. The upper course of the stream was so shallow that the adventurers were obliged to carry their canoes and walk along the bed of the river. The way was rough, and often the sharp stones cut through the men's moccasins, but the party was in high spirits. As they marched sturdily along, now and again one of them would break into a rollicking French song, and the others would take up the refrain in a resounding chorus. Joliet and his followers were filled with excitement at the prospect of adventure, and Father Marquette was radiantly happy in the thought that he was going into a strange land on his Master's business.

When they came to the head of the Fox River, they made a portage, that is, carried their canoes across the country to the Wisconsin River, and soon were floating on its pleasant waters. After a week on this river they reached the Mississippi, on June 17, 1673. The enthusiastic young missionary wrote that he saw the great river "with a joy that I can not express."

Day after day they floated down the "Great River." They encountered strange scenery, strange animals, strange birds and strange tribes of Indians of the interior. Wherever they came upon an Indian encampment Father Marquette preached the gospel of Jesus Christ. "I know not whether they understood what I told them of God and the things which concerned their salvation. But it is a seed cast in the earth, which must bear its fruit in season," he wrote in his diary with his engaging hopefulness.

PRIEST AND SOLDIER BECOME GREAT FRIENDS

A thing that is strange to record, compared with every other narrative of the time, is that there was no quarrel between captain and priest. Father Marquette and Captain Joliet got along famously. The captain respected the shrewdness and good judgment of the young priest and often sought his advice. Joliet himself had studied to be a priest, but the wild, free life of the woods drew him away from his books to make him a famous explorer.

Although intent upon making converts of the Indians, Father Marquette was also keenly interested in the exploration end of the expedition. He tasted the mineral waters of Wisconsin; he tested on his paddle the colored clay used by the Shawnee Indians for coloring their skins; and he cheerfully wielded his canoe paddle with the best of the men. Father Marquette and Captain Joliet were well matched.

As they got farther and farther down the Mississippi the heat became intense and the mosquitoes were so thick that they were almost unbearable. The explorers found that the Indians on the lower river slept on high scaffoldings, under which they built a smudge fire; and the Frenchmen, too, were obliged

to resort to this method to escape the swarms of stinging insects. A few days more would have brought them to the mouth of the Mississippi, but Joliet had heard that the Spaniards were in possession of the land around the Gulf of Mexico, and after a consultation with his men he decided to turn back. The Spaniards did not like anyone to trespass upon the territory they claimed.

On the way back the Frenchmen turned into the Illinois and paddled to its source. Then they carried their canoes across to Lake Michigan. It is thought that they reached the lake near the present city of Chicago. Then they paddled up Lake Michigan and reached Green Bay late in September. In four months they had traveled more than 2,500 miles in their canoes.



Marquette News Bureau

Father Marquette, missionary and explorer.

On the return journey they passed through the village of the Kaskaskia Indians, who begged Father Marquette to remain with them and establish a mission. But the young priest's health had been seriously affected by the tropical heat of the midsummer sun and the unwholesome, moist climate of the lower Mississippi, and he was now very ill. He did not want to leave the Kaskaskia without telling them of his "glad tidings," but his companions refused to leave him behind in the wilderness, and Father Marquette, who was too weak to protest, promised to return to the interior as soon as he was well.

When he was again able to travel he set out with a little band of his convert Indians to keep his promise to the people of the Kaskaskia, but he got no farther than the present site of Chicago when he again became terribly ill. He was therefore obliged to stop on his journey and spend the winter among the Indians of this region. As in every place where he had gone, he soon won the devotion of the Indians. From all around they came to listen to the inspired words of the young white priest. The Indians believed in Father Marquette and loved him as they believed in and loved no other white man. And why? Because he believed in them and loved them as no other white man had ever done. He saw no guile or treachery in the Indians. Where others saw only savages, he saw men with unselfish, hospitable, generous natures and a deep religious sentiment.

In the spring of 1675 Father Marquette was again stronger, and he went on to the Kaskaskia to establish the mission, as he had promised. Here illness again overtook him, and he set out for Canada, accompanied by his Indian friends, to die among his own people. He had met all his pains cheerfully and uncomplainingly, and now he faced death with joy that he should be allowed to die in his Master's cause. He told his Indians that he was glad to go, and spoke of the joy that awaited him. Then he asked to be carried to a little hill that overlooked the sparkling waters of the lake.

"I thank you for your patience with me in my sickness," he said. "I am sorry to have given you so much trouble."

Then he told them to go to sleep and get a little rest. He would call them when he felt that death was coming. For a while he remained in silent prayer. Presently he called, and there in the wilderness, surrounded by a handful of devoted Indian converts, Father Marquette died, at the age of thirty-eight. His bones were not allowed to remain in the wilderness, but were later carried by some of his Indian converts to the chapel of the Mission of St. Ignace, which had been founded farther up the lake. So ended the life of a heroic figure in the early history of North America.

JOHN ELIOT, THE APOSTLE TO THE INDIANS

WHEN Père Marquette was a curly-haired boy listening to his mother's stories, John Eliot, the great Puritan teacher, had already begun the work among the Indians of Massachusetts which won for him the name of the "Apostle to the Indians." He aimed at providing Indian teachers as missionaries to spread the Gospel among their own people, and at that very time he was engaged in perfecting his knowledge of

their language that he might be able to teach them to read.

John Eliot was born in England, in 1604, probably at a little town called Widford, in Hertfordshire, where he was baptized. We know little about his boyhood except that he had a happy home and was well taught, so that at the age of fifteen he was able to enter Jesus College, Cambridge, where he graduated at the age of nineteen. His father, Bennett, or Benedict, Eliot, was a yeoman, that is, a man who owned land but did not have a large estate.

THE YOUNG SCHOOL TEACHER WHO PREACHED THE GOSPEL

After he left the university young Eliot became assistant in a school, where he taught for about seven years, and a delightful teacher the boys must have found him. Some time during these years it is believed that he was ordained, and possibly he preached to the people among whom he lived. Certainly he gained their friendship and confidence, and before he sailed away to the New World a number of them told him that they would follow him, and gained his promise that he would be their teacher.

By this time Thomas Hooker, the principal of the school in which John Eliot taught, and probably Eliot himself, had fallen under the displeasure of Laud, the Archbishop of Canterbury. The school had been broken up, Thomas Hooker had already left the country, and in 1631 John Eliot sailed for Boston to begin life there. The ship Lion, in which he sailed, made a good voyage. Ten weeks after he embarked he landed in Boston, where the people held a day of thanksgiving for the safe arrival of the ship, which also brought Governor Winthrop's wife and children. Throughout the winter John Eliot ministered to the church in Boston, for Mr. Wilson, the pastor, had gone to England to bring his family to their new home. The young teacher won the love of the stern Puritans of Boston; but they could not keep him, for early the next year his friends arrived, as they had promised, and made a settlement at Roxbury, and in accordance with his promise he went to them.

The following year Hannah Mumford, or Mulford, to whom he had been betrothed in England, joined him. There was a simple wedding in Boston, and they began their long and happy life together in Roxbury. For nearly sixty years thereafter he taught and preached in Roxbury and took a prominent part in the church affairs of the little colony. He was one of the three men who arranged the BAY PSALM BOOK. He was prominent, too, in educational matters, and was one of those who signed an agreement to build a free school in Roxbury and support a schoolmaster.

While he went about his duties the state of the Indians weighed heavy on his mind. He was a man of loving spirit, and their savage life and pagan beliefs grieved him sorely. At length he took into his house a young Indian, from whom he set to work to learn the language of the Algonkins so that he might teach them, and in 1646 he preached his first sermon in the Indian tongue in the wigwam of Kitchomakin, in a grove at the mouth of the Neponset River.

But this good man was not content to teach the Indians by preaching to them. He wanted them to believe intelligently the things that he taught them, and he strove to raise them up from the wretched way in which they lived. Not content with learning to speak their language, he set himself to the task of making it a written language and of making a grammar for it, and when that was done he translated the Bible into it. This took time of course. First he translated a little catechism, then the Book of Genesis, after that St. Matthew's Gospel, and so he went through the whole Bible bit by bit. This translation of the Bible into the Indian tongue was the first Bible printed in America. He translated some other books for them. A copy of one of them sold in 1925 for $34,000, probably more money than the minister had in his whole life.

HOW ELIOT TAUGHT THE INDIANS A NEW WAY OF LIFE

Meantime he continued to teach the Indians; and to help them to live in a better way he founded a town for them at Natick and taught them better methods of raising food. He taught them that cleanliness is next to godliness. His converts learned to read, and before admitting them to the church he demanded that they should follow the stern rule of life laid down by the Puritans.

Every other Sunday, year in and year out, he went on horseback from Roxbury to Natick, which is some miles away, and it is said that his horse's feet made a beaten path through the woods. Stern though he might seem, he was sweet and loving and gracious, and of a humble spirit. Always his horse was laden with comforts for the Indians, and his pockets were filled with cakes and apples and

goodies for the children, whom he loved.

"The care of the lambs," he wrote, "is one third part of the charge over the worke of God." When years told on his frame and his friends tried to induce him to give up his labors for the Indians he refused, saying, "I will never give over as long as I have legs to go." He firmly believed that the Indians were the remnants of the Ten Lost Tribes, of whom you may read in the Story of the Scattered Nation. He hoped to bring them back to the state from which he believed they had fallen, and so he labored for them year after year. At first he preached under a great oak tree, which still stands at Natick; but after a time a church was built, in which there was an upper chamber, where the apostle might spend a restful night after a day of preaching and teaching.

Not content with teaching at Natick, he went on missionary journeys, and it is said that he traveled through the woods from Cape Cod to Concord. At first he had to face not only the danger of capture and torture by hostile Indians, and to work against the opposition of the Indian chiefs, but he was also opposed by the settlers, who believed that no good could be gained by teaching Indians. Nevertheless, he persevered. As the years went on, many converts were made, and there were no less than seventeen villages of what were called "praying Indians."

HOW KING PHILIP'S WAR MADE ELIOT'S WORK MORE DIFFICULT

But in 1675 an Indian chief known as King Philip made war against the English settlers. He and his followers and allies committed such cruelties that the settlers were roused to a state of fury against all Indians, and though few of John Eliot's converts joined Philip, they were all removed from their villages to Deer Island and to Long Island in Boston Harbor.

After a time, at John Eliot's earnest request, they were allowed to help the settlers to overthrow Philip, and later they were permitted to return to Natick and three other villages; but their settlements were never so strong again. After the war was over, John Eliot protested against the sale of captive Indians as slaves. His charity was never failing, and it is known that at his own cost he brought back one man who had been sent to Jamaica, and also redeemed the wife and children of this man.

In 1687 the greatest grief of his long life came to him when his wife died. All his life she had been his greatest helper. It was she who looked after the household and saved him from all worry about his money affairs, so that he might devote himself to his teaching and translations. "I shall go to her," he said, "but she shall not return to me." He lived on three years longer and died at the age of eighty-six. One of his successors said: "His missionary spirit and earnestness were as wise as St. Paul's, his charity and sympathy as sweet as St. Francis of Assisi's, and as years go on he becomes one of the most commanding figures among all the English Puritans who entered into the early life of America."

WHEN ELIOT DIED HIS MISSION SOON CEASED TO EXIST

An Indian missionary who had been ordained some years before John Eliot's death tried to go on with the work among the Indians, but he had not the authority that a white man would have had among them, and he was not successful. John Eliot was almost alone among the settlers in his belief in the Indians. His son John, whom he had trained to take his place, died more than twenty years before him, and no one had enough interest in the mission to carry it on. Gradually the Indians fell away, and in 1716 their church was closed.

Another church has been built on the site where it stood, and close by a monument has been erected to this self-sacrificing missionary, who was one of the very few to claim justice for the Indians.

He saw very clearly that as long as they kept to their old ways of living it would be very hard for them to hold to the beliefs of Christianity, which he taught them. He believed that if they were to be really Christians they must learn the ways of Christian civilization.

His efforts as a pioneer in education are overshadowed by his fame as a missionary, but the people of Roxbury do not forget that he never ceased to declare the need for education in the colony, and that the year before his death he gave seventy acres of land at Jamaica Plain to support a school.

It is interesting to note that long after John Eliot had died those in charge of Indian affairs finally came to very much the same conclusions that the devoted missionary had reached many years before. Many difficulties and much bloodshed in the relations of white and Indian might have been avoided if the white men had only been wiser.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 2189.



DAYS WE CELEBRATE

WHAT is a holiday? Almost every boy and girl will answer, "It is a day when all the schools and many stores are closed, and we don't have to work and can have a good time." But that is only part of the answer. A holiday is a day for having a good time, certainly; but it means much more than that to every one of us.

When you hail Washington's Birthday and the Fourth of July and Thanksgiving Day so joyfully, do you ever stop to think of the real significance of the events which these holidays commemorate? Such holidays are the memorial stones raised along the path by which a nation rose to greatness. Every country has its special days set apart from the routine work of the year in memory of some great man or great event in the nation's history, or for the performance of some public duty to the nation.

And what is a legal holiday? In the United States, a state may declare a holiday by act of the state legislature. A holiday declared in this manner is called a legal holiday and its observance becomes a law. Each state is free to

decide for itself which holidays it will celebrate. A public holiday is somewhat different, for its observance is not a law. Instead, it is usually proclaimed by the governor. Thanksgiving is a public holiday that is proclaimed by the governors of all the states and by the president of the United States.

DOES THE UNITED STATES CELEBRATE NATIONAL HOLIDAYS?

Strictly speaking, there is no such thing as a "national" holiday in the United States. That is because legal or public holidays are decided upon by each state and not by the government of the nation (the federal government). The federal government declares holidays only in the District of Columbia and in the territories, but it can order the post office and other federal offices closed, wherever they may be.

Holidays observed by every state are New Year's Day, Washington's Birthday, Memorial (or Decoration) Day, Independence Day, Labor Day, Thanksgiving Day and Christmas. Other holidays are celebrated by one or more states, but not by all.

COLUMBUS DAY, OCTOBER 12, HONORS THE GREAT DISCOVERER

If we think about the holidays that have been set apart in honor of great men, we can follow some of the most important events in the story of the United States and of all America as well. One of these days is a memorial to Christopher Columbus, an Italian by birth, whose unswerving determination and courage first brought the great continent of America to the attention of Europe.

The difficulties that Columbus faced on that first voyage can never be truly known. In a strange sea, with rough weather and a mutinous, terror-struck crew, it was only the indomitable purpose of the man that kept them on their westward course. Daily the sailors implored him to turn his ships toward home. They swore that they were in a haunted sea, and a thousand unknown terrors dogged their footsteps.

"I will not turn back till, with the help of God, I find that land," Columbus said. In his poem COLUMBUS, Joaquin Miller has given us a wonderful picture of the calm courage and dogged persistency of the great discoverer.

At last one morning a cry went up from the ships. Land was in sight! It was, perhaps, the island of San Salvador in the broad Atlantic. Columbus thought that he was near India, and so the islands became known as the West Indies.

Four hundred years later the president of the great nation which had risen on the land discovered by Christopher Columbus made the following recommendation to the people of the United States:

> Now, therefore, I, Benjamin Harrison, president of the United States of America, in pursuance of the aforesaid anniversary of the discovery of America by Columbus, recommend the same as a general holiday for the people of the United States. On that day let the people, as far as possible, cease from toil and devote themselves to such exercises as may best express honor to the discoverer and their appreciation of the great achievements of the four completed centuries of American life.

This was the first celebration of Columbus Day. Now, on the 12th of October, it is celebrated every year in about thirty-five of the states.

EVERY STATE IN THE UNION CELEBRATES WASHINGTON'S BIRTHDAY, FEBRUARY 22

It is interesting to know that the first public celebration of the birthday of General George Washington took place during his own lifetime. General Washington was one of the few great men who did not have to wait until after death for recognition of his greatness. Commander-in-chief of the American army in the great struggle for independence and first president of the new nation, he was adored by his soldiers and revered by the people.

It was his friend Count de Rochambeau, who, as a graceful acknowledgment of the good will between France and the new country, first celebrated the General's birthday. The French count had been in America barely six months and was stationed at Newport, Rhode Island, with his soldiers. His letter to General Washington telling him about the holiday is as follows:

> Yesterday (Sunday) was the anniversary of your Excellency's birthday. We have put off celebrating that holiday till today, by reason of the Lord's Day, and we will celebrate it with the sole regret that your Excellency be not a witness of the effusion and gladness of our hearts.

Washington received this letter while in his winter quarters in New York State, where he was anxiously watching the movements of the British army. He replied:

> The flattering distinction paid to my birthday is an honor for which I dare not express my gratitude. I confide in your Excellency's sensibility to interpret my feelings for this and for the obliging manner in which you are pleased to announce it.

After the Revolution the celebration of the first president's birthday very naturally took the place of the observance of the king's birthday. Since then Washington's Birthday, February 22, has been celebrated more or less generally throughout the United States; today it is a legal holiday in every state in the Union, and also in the territories and the District of Columbia.

Abraham Lincoln was born on February 12, 1809, in Kentucky, in what was then almost a wilderness. He struggled upward against great odds; the contrast between the raw stripling of the western woods and the sad-eyed man at the helm of the nation through the storm of the Civil War is striking. When the country was divided against itself, the North against the South, it was Abraham Lincoln who saved the Union.

You will find the story of Abraham Lincoln on another page. He was one of the greatest men the world has yet seen, and his story should be graven on the heart of every American boy and girl as a standard of high endeavor without thought of self. His birthday is a legal holiday in nearly thirty states. Two of the greatest men in our history, Washington and Lincoln, were born in February.

The birthdays of the two great leaders of the Confederacy, General Robert E. Lee and President Jefferson Davis, are set apart as holidays in many parts of the South. Jefferson Davis and Robert E. Lee knew they owed a duty to their country, but they believed they owed a higher duty to the states in which they were born; so when their states seceded, these men followed their states.

Robert E. Lee was born on January 19, 1807. He was a distinguished engineer officer and had served in the Mexican War; many thought him the ablest officer in the United States Army at this time. When the Civil War seemed about to break out, President Lincoln offered him the command of the army of the United States. Lee was a graduate of West Point, and the command of the army in which he had spent his life was the greatest honor the President could bestow. But Lee did not hesitate an instant in taking the course that he believed to be right. "I am opposed to secession, but I will take no part in an invasion of the Southern states," he said, and resigned his commission.

A few days later he took command of the military forces of Virginia, then entered the Confederate service and finally became the general-in-chief of the Confederate army. General Lee's grasp of the situation in the South was masterly. Despite the tremendous odds against him, he was able to win many victories, but finally surrendered



Painting by Jennie Brownscombe, from The House of Art

The first Thanksgiving, Plymouth, 1621. The little band of Pilgrims had good reason to rejoice, for the seeds they had planted in the spring had yielded a rich harvest. Friendly Indians shared in this Thanksgiving feast.

with his army at Appomattox Court House.

General Robert E. Lee was not only a great commander, but a great man. He had the gift of drawing men's hearts to him, and his soldiers gladly followed him. When the Southern army was surrounded at Appomattox and General Lee, unwilling to lead his brave fellows to certain death, surrendered, the men could not understand what had come to them. General Lee had surrendered! It could not be possible! Men who had followed him through battle, hardship and starvation broke down and sobbed like children when they learned the truth.

THE BELOVED GENERAL, ROBERT E. LEE, PROVED HIS GREATNESS IN DEFEAT

General Lee bore defeat greatly, as he had borne his duties. He advised the South to accept the outcome of the war in good faith. He had risked all his possessions in the championship of the Southern cause, and at the close of the war he was offered the presidency of Washington College, at Lexington, Virginia, now Washington and Lee University. He held this position until his death, a little over five years after the close of the war. His birthday is observed in almost all of the states which were on the side of the South.

JEFFERSON DAVIS BORE GREAT HARDSHIPS AS PRESIDENT OF THE CONFEDERACY

Jefferson Davis, although perhaps not such a lovable man as General Lee, was a man of great ability and strength of character. He was popular throughout the South, and at the beginning of the Civil War was elected president of the Confederacy.

The strain of the awful years of war and the hardships of his imprisonment in Fortress Monroe after the war broke down his health, and when he emerged from prison he was an old man. The Southern people have never forgotten the hardships that this man bore for their sakes. The birthday of Jefferson Davis, June 3, is observed as a legal holiday in several Southern states. In Tennessee and Louisiana, this day is observed as Confederate Memorial Day.

Some important holidays honor, not a great man, but a great event. Among these holidays is Thanksgiving, so rich in memories and in meaning for every American. In the little colony at Plymouth, in 1621, the Pilgrims had been in the New World for nearly a year. The springtime sowing had taken place and all summer the fields had been watched with great anxiety, for the colonists knew that their lives depended upon the coming harvest. The summer crops were fruitful beyond all expectation, and one day, late in the fall, Governor Bradford sent four men into the forests to shoot wild birds. "We will hold a harvest feast of Thanksgiving," he said, and invited the Indians who had been friendly to the strangers to rejoice with the white men. The Indians came bearing gifts of venison, and the harvest feast lasted three days.

THANKSGIVING DAY IS HAILED WITH JOY THROUGHOUT THE UNITED STATES

This was the first Thanksgiving Day celebrated in America, and little by little, as new colonies settled the land, the custom of a yearly Thanksgiving spread throughout the country.

General Washington perfectly expressed the spirit of the day in his Thanksgiving Proclamation in 1789:

> Whereas it is the duty of all nations to acknowledge the providence of Almighty God, to obey his will, to be grateful for his benefits, and humbly to implore his protection, aid and favors. . . . Now, therefore, I do recommend and assign Thursday, the 26th day of November next, to be devoted by the people of these States to the service of that great and glorious Being, who is the Beneficent Author of all the good that was, that is, or that will be; that we may then all unite in rendering unto him our sincere and humble thanks for his kind care and protection of the people of this country, and for all the great and various favors which he has been pleased to confer upon us.

In 1864 President Lincoln issued the first presidential proclamation appointing Thanksgiving Day as a holiday on the fourth or last Thursday of November. Succeeding presidents continued the custom, and since then Thanksgiving Day has been regularly observed throughout the United States. The proclamation by the president is sent to the governors of the different states, each of whom issues a proclamation for his own state, though not always on the same day.

Flag Day was first recognized on June 14, 1894, when, at the request of the Sons of the Revolution and the Colonial Dames of America, the Stars and Stripes was raised on public buildings to commemorate the first use of the national flag.

The first American flag is said to have been made by Mrs. Betsy Ross, an upholsterer and seamstress who lived in Philadelphia. The thirteen white stars on a blue field in the upper left-hand corner of the new flag represented the thirteen colonies, as did also

the thirteen alternating stripes of red and white. When Vermont and Kentucky entered the Union, the number of stars and stripes was increased to fifteen, but later Congress voted to return to the original thirteen stripes and to add a new star on the Fourth of July following the admission of each new state.

THE STAR-SPANGLED BANNER PROUDLY WAVES ON FLAG DAY, JUNE 14

Before the adoption of the national emblem each colony had its own flag. But when the new flag was approved by Congress it was at once copied by patriots all over the country. Flag Day, June 14, is officially observed in Missouri and Pennsylvania; in other states, institutions and stores proudly display the flag on that day.

It was the sight of this glorious flag at Fort McHenry during the War of 1812, that inspired Francis Scott Key, who had been detained on one of the British ships, to write THE STAR-SPANGLED BANNER which you will find in the Department of Poetry.

Independence Day is a holiday that is observed in every state in the Union, and celebrates the adoption, on July 4, 1776, of the Declaration of Independence, which declared our separation from Great Britain. It was Richard Lee who proposed to Congress "that these United colonies are, and of right ought to be, free and independent states; that they are absolved from all allegiance to the British Crown; and that all political connection between them and the State of Great Britain is, and ought to be, dissolved." John Adams seconded the motion, and Thomas Jefferson drew up the Declaration of Independence which has made him famous forever.

At the time of the adoption of the Declaration, John Adams wrote his wife a letter which reads like a prophecy: "I am apt to believe," he said, "that it (the day) will be celebrated by succeeding generations as the great anniversary festival. It ought to be solemnized with pomp and parade, with shows, games, sports, guns, balls, bonfires and illuminations from one end of this continent to another, from this time forward for evermore."

WHEREVER THEY MAY BE, FEW AMERICANS FORGET TO HONOR THE GLORIOUS FOURTH

With true patriotic fervor Americans have thrown themselves into the celebration of this glorious event, and wherever they may be, few of them forget to hold festival in honor of the birthday of the nation.

The four years of the Civil War, from 1861 to 1865, cost the lives of many thousands of brave men. The custom grew up in the South of strewing flowers on the graves of Confederate soldiers who had been lost in that sorrowful conflict, and in different parts of the South different days were chosen to observe this beautiful custom. Presently, in the North, General John A. Logan, commander-in-chief of the Grand Army of the Republic, set aside May 30 as Decoration Day for the graves of Union soldiers who had died in the Civil War. Later, the name was changed to Memorial Day, the better to voice the feelings of those who observed it. Each year the governor of each of the northern and western states proclaims May 30 as a legal holiday. Most of the southern states call the day of observance Confederate Memorial Day and prefer to keep the various dates which they had originally chosen.

AN IMPORTANT AND EXCITING HOLIDAY—THE DAY THE PRESIDENT IS ELECTED

Now we come to a day which has been made a holiday for the performance of a great public duty. Presidential Election Day comes once every four years, and Congress has appointed the first Tuesday after the first Monday in November for this purpose. Many of the states elect their governors and other state officials on this day. Where they elect officials in other than a presidential year, they have generally adopted the same rule, that is, the Tuesday after the first Monday in November.

No day brings greater responsibilities than Election Day. In most states all men and women over twenty-one years of age, native-born or naturalized, may go to the polls to cast their votes for the officials who are to govern them and make their laws.

THE RIGHT TO VOTE—A GREAT PRIVILEGE AND A SERIOUS RESPONSIBILITY

In olden days, the government was in the hands of a powerful few. It is only within a few generations that the franchise—the right to vote—has passed into the hands of the citizens. This right should make us justly proud. Democracy such as ours is one of the greatest forward steps ever taken in human progress. Some nations have never taken this step; others, not realizing its importance, have progressed a little way and then gone back in the direction of dictators and tyranny.

Since the signing of the Declaration of Independence the United States has stood for liberty and equal rights, and each voter who enters the polling booth is claiming his privi-

THE SPIRIT OF SEVENTY-SIX



T. F. Healy Collection

On July 4, 1776, the Declaration of Independence was adopted. One hundred years later, Archibald M. Willard painted this scene for the Centennial celebration. The picture calls to our minds how young, old and middle-aged fought side by side to defeat the British. The painting is full of joyous patriotism, and is justly famous; yet the artist was not quite exact in every detail. He shows the Stars and Stripes; but the flag was not adopted until 1777.

lege to take part in the government of his country. The right to vote is something that every American boy and every American girl should think about very seriously, for the future welfare of our country lies in right voting, in voting for honest measures and honest men to carry out those measures. In some countries failure to vote is an offense that may be punished by law. In our country the decision is left to each person. Therefore there is all the more reason why each one should accept his responsibility and cast his vote without fail in favor of candidates who will uphold high ideals of democratic government.



Arbor Day, by the American artist, Grant Wood. From the Edwin Hewitt collection.

Arbor Day has been set aside by many states for the planting of trees and shrubs along the highways and in other places where they are needed. One purpose of this celebration is to implant in our boys and girls a love of nature. Another purpose is to keep us from forgetting the necessity of planting trees for the future.

There is no uniform date set apart for Arbor Day. It varies, of course, in different states because of the differences in climate. The first Tree-Planting Day was observed in Nebraska on April 10, 1872. Prizes were offered for counties and persons planting the largest number of trees and vines throughout the state, with the result that over a million trees were planted in the first year, and over 350,000,000 trees and vines within the twelve succeeding years. In the West there are many treeless plains, and this beautiful and useful custom of planting trees at once aroused the interest of other states, and the plan was generally taken up throughout the country.

The first Monday in September is generally observed all over the United States as "Labor's Holiday." Then the workers, rich and poor alike, all over the country, put aside their tasks.

Labor Day was made a holiday in the District of Columbia by Congress in 1894. The congressional act makes Labor Day a legal public holiday in the District of Columbia and in the territories, and requires the closing of all federal offices throughout the United States. Now Labor Day is also a legal holiday in every state.

The war which grew into the first World War broke out in Europe in 1914, and in April, 1917, the United States entered the conflict on the side of the Allies. The United States sent two million men overseas, and as many more were in training on this side of the water. The suffering and loss of life caused by that war were widespread and bravely borne, and when at last the war was ended nations went wild with joy. On November 11, 1918, representatives of Germany acknowledged that their country was too exhausted to fight any longer and signed the armistice (which means a truce). This great, good news was welcomed with rejoicing that is remembered to this day. Armistice Day is a legal holiday in all the states as well as in the District of Columbia and in the territories. Colorado, Tennessee, Texas and Hawaii hail it as Victory Day.

Some days we observe with respect and affection although they are not set apart as legal holidays. In honor of the mothers of

our land, the second Sunday in May is observed as Mother's Day. A red carnation is generally worn as a token of regard for a mother who is living, and a white carnation in remembrance of a mother who has died. On Father's Day, the third Sunday in June, fathers are honored throughout the United States and special efforts are usually made to try to show them how much we think of them. Father's Day and Mother's Day bring joy to all the family.



American Artists Group Christmas Cards

Dale Nichols' The Christmas Tree. The fragrant, new-cut tree is gaily greeted.

Two days especially dear to the hearts of children are not holidays at all, but they are observed, none the less, with customs that are ancient and beloved. The first of these is Valentine's Day, February 14, which may trace its origin all the way back to an ancient Roman festival. The pretty valentines that you may send today (taking care, if you follow tradition, not to sign your name and to disguise your handwriting) have their origin in the gifts that sweethearts used to exchange in ancient times. And what child does not love Hallowe'en? On October 31st, on the eve of All Saints Day, witches do not truly ride abroad on their broomsticks and ghosts do not really make us shiver, but it is fun to pretend that they do. In different parts of the United States, different customs have grown up around the ancient traditions of Hallowe'en, when—so people once believed—evil spirits were free for a time to work whatever mischief they pleased. Today many boys and girls cut themselves a grinning Jack o' Lantern, glowing with the candle that has been put inside it. Or perhaps they wear false faces or play games that may be traced to an earlier, simpler age.

One of the greatest days of the Christian religion is Easter, which occurs on Sunday in either March or April. In addition to its deep religious meaning, many charming customs have helped to make this day a happy one, particularly for little children, who have found a special friend in the Easter Rabbit.

Many states observe some important date in their history. For example, Massachusetts and Maine (formerly a part of Massachusetts) observe Patriots' Day, April 19, the date of the battles of Lexington and Concord. North Carolina observes May 20, the date of the Mecklenburg Declaration of Independence. Texas observes March 2, Texas Independence Day, and April 21, the anniversary of the Battle of San Jacinto. Several states observe the anniversary of the day on which they were admitted to the Union.

Both New Year's Day and Christmas are legal holidays in the United States. The old custom of making and receiving New Year's calls has almost died out, but New Year's Eve is celebrated with horn-blowing and jollity. In Pasadena, California, a lovely fête of roses is given on January 1, when beautiful processions pass through the gaily decorated streets, while automobiles, carriages, horses, bicycles and floats, often having historical significance, are trimmed profusely with roses of every hue.

Long ago, in the Puritan colonies, all exhibitions of gaiety and happiness were considered sinful and Christmas was not observed. In fact, the stern old Pilgrim Fathers made a law forbidding anyone to celebrate Christmas on pain of arrest and punishment. Nowadays, however, Christmas is celebrated in New England just as it is everywhere else because a little Child was born in Bethlehem long ago. You may read more about Christmas on page 6095 in Volume 17.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 2281.



Charles I raising his standard at Nottingham, August 25, 1642. This scene marks the beginning of the Civil War. From the fresco by C. W. Cope, R. A.; in the Peers corridor, Houses of Parliament, London.

THE STORY OF ENGLAND

IV. JAMES I TO THE CORONATION OF VICTORIA

WHEN Queen Elizabeth died in 1603, James Stuart (1566-1625), great-great-grandson of Henry VII, became James I of England. He was also James VI of Scotland. The two countries were not united under one government until 1707.

James I was not a popular ruler. The main reason for his unpopularity was his belief in the "divine right of kings." James believed that he was chosen by God to rule England and was responsible only to God. The English felt that he was responsible to Parliament, which represents the people. This difference in attitude toward the power and responsibility of the king was a cause of much conflict during the seventeenth century.

The religious question, which had caused so much argument from the time of Henry VIII, was not yet settled. Many Englishmen were Puritans, who wished to simplify the organization and services of the Church of England. The King was opposed to any further changes in the Church and wished to force all Englishmen to support it. He further angered his subjects by favoring the Catholic nation of Spain in her war against the Protestant Netherlands. (James himself, though son of the Catholic Mary Queen of Scots, was a staunch Protestant.)

King James and Parliament clashed most bitterly over the question of taxation. The King allowed his favorites to spend a great deal of money; and when the funds Parliament allowed him were gone, James levied new taxes. Parliament objected to this, claiming that only the members of Parliament

had power to levy taxes. These three questions—religion, the "divine right" of kings and taxation—caused trouble for years.

Several important accomplishments mark the reign of James I. With the settlement of Jamestown in 1607 and of Plymouth in 1620, England began her colonization of America. Settlements were also made in the West Indies; and the East India Company, which had been organized during the reign of Queen Elizabeth, became more powerful in far-away India. Another important contribution of this period was a new and beautiful translation of the BIBLE into English, known as the King James version. We tell you about this on page 476.



James I.

During this reign occurred the famous Gunpowder Plot, a plan to kill the King and the Lords and Commons by blowing up the House of Parliament with gunpowder secreted in the cellars. November 5, 1605, was the date set for the crime. The match was to be applied by a man named Guy Fawkes. The plot was discovered in time, and Guy Fawkes was caught. That was the origin of the rime

Oh don't you remember the Fifth of November,
Gunpowder, treason and plot . . .

which is still sometimes sung on that day in England, called Guy Fawkes Day.

James was a well-educated man, but did not have the special talents of judgment, tact and human understanding which make a good king. One man at his court called him "the wisest fool in Christendom."

In 1625 James I died and was succeeded by his son, Charles I (1600-1649). The new king, like his father, was determined to rule by "divine right." Parliament attempted to control the King by granting him money for only a year at a time. At first Charles managed without Parliament, but finally the need of funds to run the government forced him to call Parliament. Before the represen-



Guy Fawkes brought before King James. Fawkes was one of the leaders of the famous Gunpowder Plot of 1605.



Charles I and his wife, Queen Henrietta Maria, daughter of Henry IV of France. The Queen urged on Charles in his contests for power with Parliament.

tatives granted the King any money, they demanded certain promises from him. These were written in the Petition of Right, signed in 1628, and provided against unjust imprisonment, trial by military courts and forced loans. This Petition of Right, like the Magna Carta, is one of the foundations of the English Constitution.

Charles I seems to have had no intention of keeping his promises. In 1629 he dismissed Parliament, and for the next eleven years the King ruled without calling a meeting of the people's representatives. During this period his two principal ministers were Thomas Wentworth, Earl of Strafford, and William Laud, Archbishop of Canterbury. These men carried out the King's wishes in such matters as raising money by illegal taxes and persecuting those who criticized the Church of England.

In 1640 a rebellion in Scotland forced Charles to call Parliament in order to raise money and troops. When Parliament met it criticized the King's management of the government and Charles angrily dissolved the meeting. However, since he continued to be unsuccessful in his dealings with the Scottish rebels, Charles was forced to call another meeting of Parliament. Before Parliament would provide the army which the King needed, the King had to agree that this Parliament could not be dissolved without the consent of its members; in order to get what he wanted the King gave up his power of sending the members of Parliament home when he was dissatisfied with them. This Parliament remained in session for thirteen years and is called the Long Parliament.

The dispute between the King and Parliament broke out into civil war when Charles attempted to get control of the army. The King's supporters were mainly nobles and wealthy landowners and were called Cavaliers (that is, horsemen, or gentlemen). Parliament was supported by the middle class and the commercial towns. Those who fought on the side of Parliament were called Roundheads, from their habit of cutting their hair. The Cavaliers allowed their hair to grow and dressed it carefully in tresses. They wore rich clothing and lived as grandly as possible, while the Roundheads believed in a strict and simple life.

The Civil War lasted from 1642 to 1646, when the King was defeated by Parliament's army. Charles surrendered to the Scottish army, but the Scots turned him over to the English, for money. Although most of the nation was willing to keep Charles as king under certain terms, the more radical members of Parliament were determined to get rid of him. They accomplished this by closing the House of Lords and by sending Colonel Pride and some soldiers to prevent all members known to favor Charles from entering the House of Commons. The other members, known as the Rump Parliament, declared themselves the supreme power in England and appointed a court to try the King. Charles was found guilty of treason and sentenced to death.

Throughout his trial Charles remained calm and dignified, kingly in word and in manner. He never admitted that the court had the authority to pass judgment upon him; but when he was led out to die, on January 30, 1649, he went quietly. He was beheaded in front of his own palace at Whitehall, London. When the deed was done a groan went up from the thousands who watched the execution.

The family of Charles fled to the protection of their relatives at the French court.



Charles I and his family enjoying a ride in the royal barge on the river Thames, before the Civil War. Charles was a devoted father and his home life was happy. From a painting by F. Goodall.

The Rump Parliament remained in session as the government of England until 1653. They declared England a republic and called the new government the Commonwealth. The real power was mostly in the hands of Oliver Cromwell, a Puritan soldier who had been largely responsible for the defeat of Charles I in the Civil War. The Commonwealth was not pleasing to many groups. Finally Oliver Cromwell forced Parliament to retire, and Cromwell became dictator under the title of Lord Protector. His son Richard was Lord Protector for a year after Cromwell's death.

The government under the Protector was very successful in its foreign wars, but the English people were dissatisfied with this military government. In 1658, when Cromwell died, leading Englishmen began to plan for the return of a king; and in 1660 Charles II, son of Charles I, returned to England as its ruler. Charles II lived from 1630 to 1685; he ruled from 1660 to 1685.

Before he became king, Charles II agreed to recognize the power of Parliament, and during his reign he did not attempt to carry out measures of which Parliament did not approve. The army was disbanded soon after the King's return, and the English looked forward to a period of peace. The reign is known in history as the Restoration (restoration of the monarchy). The Restoration



Charles I at his execution, in 1649, in the forty-ninth year of his age. He was beheaded outside the Palace of Whitehall in the presence of many people. He showed great dignity and kingly bearing to the last.

saw much gaiety and even frivolity. Charles was a pleasure-loving, extravagant king, willful, but good-natured and witty. The Puritans and many other good folk in England were shocked at his easy-going ways and at the extravagance that grew up around the court and spread through the land. The Puritan way of life during the Commonwealth had suited some people, and they would have been glad to see it continue. But for others the sober Puritan code had been joyless—these were glad that a merry king was ruling England, even though he did not always meet with their entire approval.

During the reign of Charles II the religious conflict continued. In spite of the efforts of the King, who was suspected of leaning toward the Catholic faith, Parliament passed several laws against people who did not belong to the English Church. Another important law was the Habeas Corpus Act. This law provided that a prisoner had the right to be told before a judge why he had been arrested. If the reason for arrest was good, the judge must name a date for the trial; if the reason was not good, the judge must free the prisoner. This law was to prevent a king from arresting people just because they had displeased him.



Oliver Cromwell, Lord Protector of the Commonwealth from 1653 to 1658.

In spite of the political difficulties which had troubled the country since James I, England had prospered commercially. English traders and merchant ships rivaled those of the Dutch, and this commercial rivalry led to war between the two countries. As a result of the war England received



Permission, the Berlin Photographic Company, New York

Oliver Cromwell at the head of his army before the Battle of Dunbar, 1650. Here Cromwell defeated the army of Scots that had proclaimed the son of the dead Charles I king in his father's place.

control over the Dutch trading posts in India and the Dutch colony of New Amsterdam—which was renamed New York, after the Duke of York, the King's brother.

In 1665 a highly infectious disease, that came to be known as the Great Plague, killed about 100,000 people in England. In the next year a great fire swept over London, burning a large section of the city. After the fire the city was rebuilt with many fine new buildings, a number of them planned by the great architect, Christopher Wren. The new cathedral of St. Paul's was designed by Wren. In the great London blitz and fire of 1940, several of these beautiful Wren buildings were destroyed, others were damaged.

John Milton, one of England's greatest poets, and John Bunyan, author of PILGRIM'S PROGRESS, did their important work during the reign of Charles II, though neither of them had any sympathy for the King or Restoration life.

In 1685 Charles II died and was succeeded by James II, his younger brother. James II lived from 1633 to 1701. He and his wife were Catholics, but since they had no children, Parliament accepted James as king. The "heir presumptive," that is, the one who would be heir if James failed to provide a son, was his daughter Mary by a former wife. Mary was married to William, Prince of Orange. He was a grandson of Charles I, and so he also had some interest in the English throne. William and Mary were Protestants.



Oliver Cromwell did not get along with Parliament any better than Charles I had. Cromwell ruled England with an iron hand. We see him here in great anger, and with the aid of troops, dissolving the Long Parliament which had sat for twelve years and had supported the nation's rights against the King.

James II made himself very unpopular. He refused to work peacefully with Parliament; and he angered his people by using his royal powers to place Catholics in high offices. The people were patient with their king, however, until June, 1688, when a son was born to the King and Queen. Now the next heir would be a Catholic.

Acting quickly, a group of influential men invited William of Orange and his wife Mary to come to England and seize the throne. William, a staunch supporter of Protestantism in the Netherlands, felt that this was his chance to become king of England. When he arrived on November 5, 1688, he was given a warm welcome. James attempted to

resist William, but when he realized that most of England was against him, he fled to France. That was the end of James's brief rule in England.

When William arrived in London, he promptly called a meeting of Parliament. This body declared that James was no longer king and elected William and Mary as the next rulers. However, in a document known as the Bill of Rights, Parliament placed certain restrictions upon the new king. By this document the king was forbidden to levy taxes or to raise an army without consent of Parliament, to interfere with the free election of members of Parliament, to prevent freedom of speech in Parliament, to demand unfair bail or fines or to inflict cruel or unusual punishments.

William lived from 1650 to 1702; Mary lived from 1662 to 1694.

Parliament's removal of James II and election of William and Mary is called the Revolution of 1688. It marked the end of the "divine right of kings" in England, and the Bill of Rights placed the final control of the government in the hands of Parliament.

Two acts of Parliament further limited the power of the king. One provided that taxes could be levied for only one year. Since the king agreed in the Bill of Rights that only Parliament could levy taxes, this provision forced the king to summon Parliament every year. The Mutiny Act provided for an army for one year only, thus Parliament gained control of the army. Parliament also passed a Toleration Act, which allowed Protestants to worship as they pleased. This bill had William's full support.



Cromwell died in 1658. Two years later the son of Charles I returned to England from exile and became king as Charles II. His reign is known in history as the Restoration, meaning the restoration of the monarchy. In the picture we see Charles receiving the homage of the people as he lands at Dover.

Although the English had supported William against James, he was never a popular king. He was very closely controlled by Parliament. He found that the best way to get along with Parliament was to choose for officials men who were leaders of the group in power. Thus the King was forced to choose the men that Parliament wanted to head the

various departments of the government.

William became involved in two wars with France, which was becoming the most powerful nation on the European continent. Louis XIV of France refused to recognize William as king of England and the two countries officially the Kingdom of Great Britain.

Anne died in 1714 and the throne went to George (1660-1727), a great-grandson of James I. George I came from Hanover in Germany and could speak no English, so it was necessary for him to have a minister



Culver Service

During the reign of Charles II, two terrible disasters visited London. In 1665 an infectious disease, which came to be called the Great Plague, killed many thousands. The following year a fire swept over London, burning a large section of the city. The picture shows people fleeing for their lives from the flaming walls of their homes.

were also in conflict over their possessions in America and India. William died before the end of the second war, but it continued successfully under the leadership of the Duke of Marlborough, ancestor of Winston Churchill. The war was ended by the Treaty of Utrecht, signed in 1713. England kept Gibraltar, which guards the entrance to the Mediterranean Sea; she received some of the French possessions in Canada, and she won the right to trade with the Spanish colonies in America.

When William III died (Mary had died eight years before him), Mary's sister Anne succeeded to the throne. Anne lived from 1665 to 1714. During Queen Anne's reign England and Scotland were finally united under one government. Since 1707 the representatives of both countries have met in one Parliament. The united countries were called

who could express his views to Parliament and explain Parliament's desires to him. For this position George chose Robert Walpole, who became the first prime minister. Walpole kept the confidence of George I and remained prime minister under the next king, George II, until 1742.

George I died in 1727 and his son became king. George II (1683-1760) was a German, married to a German wife.

In 1739 the English were again at war with Spain. The main cause of the war was the conflicting commercial interests of the two countries. France was also drawn into this war, and the English were not very successful against their European enemies. In 1748 a peace agreement was reached in which all the countries involved agreed to give up any territory they had conquered during the war.

By 1750 England and France were rivals

for control of both America and India. In America both countries claimed the land between the Allegheny Mountains and the Mississippi River. In India, where the two countries had trading posts, there was frequent fighting. In 1754 fighting began between the French and English colonists in America, and by 1756 England and France were again at war. In America this war is called the French and Indian War; in Europe it is known as the Seven Years' War.

At first things went against the English, but the course of war changed when William Pitt became prime minister. Pitt reorganized the army and appointed able leaders to take charge of the fighting in America as well as in Europe. When the war ended in 1763, France had to sign over to England all her possessions east of the Mississippi, including Canada, some islands in the West Indies and some territory in Africa. France also agreed not to fortify her trading posts in India. Canada became an English colony, and England's interest in North America grew very important in the next few years.



Culver Service

Three years after James II came to the throne, the English had had enough of him. In 1688 William of Orange, and his wife, Mary, daughter of James, were invited to come to England and accept the throne. William was the grandson of Charles I, and thus had some claim to the throne. The picture shows William's entrance into London.

The eighteenth century was important in England because of the Industrial Revolution. The Industrial Revolution is the name given to the change from manufacturing by hand to using machines and power for manufacturing. As new machines were developed industry moved from the home to the factory and large manufacturing cities grew up. Because of this increase in manufacturing and trade, better roads were built and a system of canals was developed. The mining of iron and coal also became important occupations. Of course numbers of people who had made their living by hand labor suffered. They could not get used to machines.



Culver Service

The crown was formally offered to William and Mary by representatives of the House of Lords and the House of Commons, in 1689. Both William and Mary were grandchildren of Charles I.

The older ones could not learn the new skills and so they regarded the machines as their enemies. There was poverty, discontent and bitter rioting in many places. In the end, as you know, machines brought more leisure, more human comforts, more human dignity. But the period of change was not easy.

In the middle of the Seven Years' War George II died and his grandson became king. George III (1738-1820) was the first of the four Georges who had been raised in England. He was the last English king to make a serious attempt to rule Parliament. He appointed for his ministers men whom he liked even though Parliament did not approve.

It was in the reign of George III that the American Revolution was fought. Many books have been written on the reason for this breaking away of the thirteen colonies from the mother-country. Perhaps the real reasons were that the colonies were young, vigorous, eager to strike out for themselves; and that they were too far from England (six weeks by sailing ship) to feel the ties of kinship. However, George III and his advisers gave the colonists cause for anger, and for unity among themselves, by sponsoring unpopular laws. Some members of Parliament in London wanted these laws canceled, but the King and his chosen ministers decided to teach the colonists a lesson.

In 1776 the American colonists issued their Declaration of Independence. Fighting had started more than a year before; now it was to be a life-or-death struggle. The English failed to win a decisive victory; and after the Americans defeated them at Saratoga, France aided the rebels. When the English General Cornwallis was defeated at Yorktown in 1781, the English agreed to peace, and in the treaty they recognized the independence of the United States. Then George

TWO SEVENTEENTH CENTURY SCENES



From an old print

A great manor house, Knowle, near the town of Sevenoaks, in Kent, built between 1605 and 1607.



The T. F. Healy Collection

Friends of Daniel Defoe rallying round him as he was confined in the pillory for writing against the government.

III and his stubborn advisers lost influence in the government. George was insane during the latter years of his life. For nine years (1811-1820) his son, who afterward became George IV, acted as ruling prince, or prince regent. This period in English history is known as the Regency.

In the homeland, too, there was discontent during the last half of the eighteenth century. Many Englishmen wanted to change the system of representation in Parliament. Some "ghost" towns which no longer had any population were still allowed two representatives; while large cities had no representation because they had not been in existence when the representation had been planned. Another unfair thing was that only property owners were allowed to vote. As things worked out, only one of every ten men in England could vote. The country was a long way from being democratic.



Queen Anne, who reigned from 1702 to 1714.

William Pitt, the brilliant and successful prime minister of George II, had a son more remarkable than himself. He is known in history as William Pitt the Younger (1759-1806). At twenty-one he was in Parliament; and at twenty-four he was made prime minister, the youngest man who ever held that high office. He held the office for seventeen years (from 1783 to 1801) and later for two years more (1804-1806). Pitt worked upon various reforms in the government. He improved the country's finances. He tried to have a Reform Bill passed that would give the people fairer representation in the House of Commons; but without success.

Later attempts received even less support from Parliament because the English became frightened by the French Revolution. In France the common people seized control of the government in 1789, later executing the King, Queen and many nobles. This made the governing class just across the Channel, in England, fear any measure that would give the common people more control.

Ever since the English had conquered Ireland, in Elizabeth's time, the government of that island had been a problem. In 1800, following another Irish rebellion, the government of Ireland was combined with that of England. From that time the Irish representatives met with the English and Scottish representatives in Parliament. The official name of the nation was now the United Kingdom of Great Britain and Ireland.

By 1804 England was at war with France because Napoleon Bonaparte, who had become emperor of France, was attempting to conquer all of Europe. The war dragged on for years. Until 1813 there was little land fighting but the English won many naval victories. The leader of the British navy was Admiral Nelson. His greatest victory over Napoleon was the Battle of Trafalgar in which the French fleet was almost completely destroyed. England was now without question mistress of the seas.

In the midst of this war against France, England became involved in another war with the United States, the War of 1812. This was caused by British attempts to prevent American ships from trading with the French, and by the British policy of stopping American ships on the high seas and seizing American sailors, claiming that they were British deserters. The fighting did not last long and the war ended in 1814 without any very definite settlement.

By this time the European war was becoming more intense. Led by the Duke of Wellington, the English armies were fighting successful battles against Napoleon. Finally, at Waterloo in 1815, a combined army of English and Prussians, led by Wellington, defeated Napoleon and ended the war.

The years following the peace of 1815 were a period of reform. The criminal laws of England were, before this, very harsh. People could be imprisoned for small debts and could be executed for petty crimes. After 1815 these punishments were made less severe. The laws against people who did not belong to the Church of England were also changed, and in 1829 Catholics were per-

mitted to hold office in the government.

George III died in 1820 and was succeeded by his son, George IV (1762-1830), who took very little part in the government. In 1830 George IV was succeeded by his brother, William IV (1765-1837).

Under William IV the Whigs, a liberal political party, came into power with Lord Grey as prime minister. The greatest accomplishment of Lord Grey was the passage of a Reform Bill, in 1832. This measure took the representation away from "rotten boroughs"—villages which had very few inhabitants—and gave representation to counties or large cities which had not had members in Commons. The bill also reduced the property qualifications, so that many more people were allowed to vote. In the struggle to pass this bill the House of Commons became more powerful than the House of Lords. Here is how it happened. The members of the House of Lords refused to pass the bill. The king threatened to create enough new peers to give a majority of votes to the supporters of the bill. Then the House of Lords gave in, and the measure was passed. Since that time the House of Lords has not been able to block a measure seriously desired by the people's representatives in the House of Commons.



George III, who lost the American colonies.

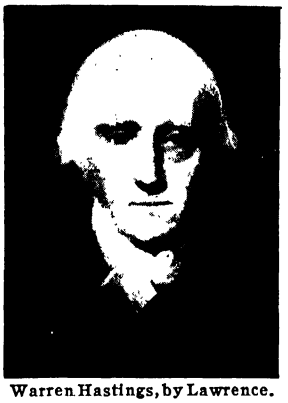
In 1837 King William died. Since he had no children, the crown went to Victoria, his niece, granddaughter of George III. Victoria was a girl of eighteen when she became queen; she reigned until 1901—more than sixty years.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 2193.



The Bettmann Archive

William Pitt the Younger addressing the House of Commons in 1793. After a painting by Henckel.



Warren Hastings, by Lawrence.



A Lady, by Allan Ramsay.



F. Bartolozzi, by John Opie.

THE GOLDEN AGE OF BRITISH ART

YOUNG as was British art in the eighteenth century, during the second half of the century England's portrait-painters held a place in the very front ranks of contemporary European art. Their fresh, unworn lustre shone the more brightly in a period that elsewhere was rather dim. Foremost on the roll of these painters of portraits stand two names side by side—Sir Joshua Reynolds and Thomas Gainsborough—for the owners of the names lived near together and knew each other, and painted famous likenesses of many of the same famous men and women. Reynolds was four years old when Gainsborough was born, and he lived four years after Gainsborough's death.

The genius of Reynolds and the genius of Gainsborough were of such different strains that they seem each to supply what the other lacks. While Reynolds was an eager student of art in books and in the works of the greatest painters, traveling abroad and copying their pictures in foreign galleries, until he became a truly learned connoisseur, Gainsborough gave himself to nature as to the supreme teacher and never traveled outside his native island, going back again and again to the woods and fields he loved best. Reynolds was a thinker, of keen, acute, well-balanced mind. He sought and learned how to get the results he wished. Gainsborough *felt* what he wished to express, and it came through his brush naturally or not at all. Reynolds was systematic and industrious, planning out his time and carefully observing his own regulations. Gainsborough followed his impulse; he might stand unoccupied for hours looking from the window of his studio, dreaming of beauty. His muse would not be driven. Therefore, although Reynolds left about four thousand paintings, Gainsborough can be accredited with not more than three hundred, and of these about eighty are landscapes. To both men we give our admiration—to Reynolds for his fine, deep color, his warm but subtle tone, his skillful and understanding way of presenting the figures and the personalities of his sitters; to Gainsborough for the soft, elusive, haunting beauty of scenes and forms in which we perceive his own tender wistfulness mingling with the unspoiled charms of nature's self.

Joshua Reynolds (1723–92) was the son of a learned clergyman of Devonshire who kept a grammar school. It was there that Joshua studied as a boy, although he spent much of the time that was due to Latin and mathematics in dreaming or

eagerly getting all that he could out of a few books on the principles of art. And because his drawings showed unusual skill and a mastery of the points he had studied out for himself, he went at the age of nineteen to London to study with a painter who was then a favorite but whose work has no value to us now. In a few years the young man confidently established himself in an independent studio. Then he had the great fortune to be offered a trip to Italy.

SIR JOSHUA REYNOLDS, FIRST PRESIDENT OF THE ROYAL ACADEMY

Among the paintings of the Italian masters in the galleries the young Englishman walked, disappointed and dismayed because he could not feel their force and beauty as he had anticipated. But devotedly he studied and copied until he gained what he had lacked, and when he returned to England his knowledge of European painting was broad and discriminating. He was an authority. Immediately favor turned toward him. People flooded him with requests for portraits, and it was not long before he had a large house in London, with a luxurious studio, where he painted industriously from eleven until four every day. From that hour on he gave himself to social life, entertaining freely the most interesting and distinguished men of the time. Garrick the actor, Goldsmith the writer, Burke the statesman, and Dr. Johnson the philosopher were a few of his intimate friends, portraits of whom he has left us. At his balls the best society of London came together, for he was as noted for his distinction of manner as for his excellence in his art.

In 1768, when the Royal Academy was instituted, he was at once chosen as its president. Then he was knighted by George II, who later made him painter to the king. The last word of his last public address was by intention the mighty name of the artist who was his greatest admiration — "Michelangelo." When Sir Joshua died he was honored in every possible way. He was buried in St. Paul's Cathedral, in London.

Reynolds had remained a bachelor, with a sister to help keep his house; but who has painted pictures of childhood that we remember better or more affectionately than some of his? Groups of little ones with their mothers, like that of Lady Cockburn and her children; portrait studies, like Master Hare and Little Miss Bowles with her dog; and others, like the Age of Innocence, and the cluster of Angels' Heads, which are really five different studies of the one darling little head of Frances Isabella Gordon. Both of the last two pictures are in the National Gallery, London. The painting of Master Hare can be seen in the Metropolitan Museum in New York, where there are several other Reynolds portraits. Many of his works are in the Royal Academy and the National Portrait Gallery in London; but numbers of them are in private collections in both Europe and America.

Sir Joshua, by experimenting in the production of the colors he most desired —warm browns and reds—used some materials that were not lasting, so that in some cases the paint cracked and sometimes even fell from the canvas. Thus a few of his paintings have been lost. He loved to give his portraits a grand manner, with heroic or historic feeling. And for pleasure he painted historic compositions. In the portrait of the actress Mrs. Siddons as the Tragic Muse we can trace his intelligent admiration for Michelangelo's style. In others we can feel the influence of Correggio, Raphael, Leonardo, Murillo and others. He did not imitate, but he had absorbed. Hogarth said: "There is only one school, that of nature." Reynolds said: "There is only one doorway to the school of nature, and of that the old masters hold the key."

THOMAS GAINSBOROUGH, WHO LOVED HIS NATIVE COUNTRYSIDE

Thomas Gainsborough (1727–88) was another English lad who neglected study for love of drawing and for love of the outdoor world, though he won greatest fame as a portrait painter. Always a dreamer and impulsive in his tendencies was Gainsborough; and his expression in line and color was spontaneous and free. Reynolds had moved with ease in a sphere of large experience in life. Gainsborough, more shy and retiring, had to be drawn into prominence. Although at fifteen he went to London to study, when three years afterward he began his career as an independent artist it was back in the retirement of his old haunts.

He loved a quiet life in his own home, with his wife and his music and his dreams. He loved the familiar countryside of his boyhood, where meadows, trees

and streams had sung to him and given him his first visions of beauty. There he lived and worked for fourteen or fifteen years before going to Bath, where he became popular as the portrait-painter of fashionable beauties and of royalty.

When he painted his rare portraits of lovely women he set them in an atmosphere of naturalness, for he seems to have perceived within them the impulses and feelings that belonged to them as human beings. His own sensitiveness helped him to catch vibrations from their hidden selves. A gentle melancholy and a brooding tenderness breathe lightly through the delicate colors with which the artist made his record of the impressions that came to him from his sitters. His pictures of children—whether peasants or gentler-born—show them moving with natural freedom through the light and air of out-of-doors. Among the most valued of his portraits are that of Georgianna, Duchess of Devonshire (now in America) and that of the Honorable Mrs. Graham (in the National Gallery of Scotland in Edinburgh). For the most part his works are in private collections on both sides of the Atlantic.

CHARACTERISTICS OF TWO GREAT PORTRAIT-PAINTERS COMPARED

Sir Joshua Reynolds held that "the chief masses of light in a picture should always be of warm, mellow color, and that the blue, gray or green colors should be kept almost entirely out of these masses." Whether or not, as has been said, Gainsborough deliberately took this as a challenge, he produced some most striking and beautiful pictures in which blue, gray and green form the central and dominant notes. Of these the most famous are his portrait of Mrs. Siddons in a blue-and-gray-striped gown and the picture known as the Blue Boy. In the latter—now in California—a charming boy in a costume of rich, pure blue stands out engagingly before a background of brown and green landscape.

As a rule, Gainsborough's color is tender, soft and cool, greens and blues and grays and delicate yellows predominating; although in his landscapes—which he loved best of all to paint—he introduced warmer tones, rich browns and sometimes red. The landscapes show the same natural way of looking at things that we have noted in the portraits, the same originality of treatment. They are quiet in tone and feeling, with something of mystery or melancholy in their clouded skies or in the forest shade. They were made for his own pleasure, and few of them were sold during his lifetime. Appreciation of their value has grown with time, and they are considered the first examples of landscape showing a modern realistic treatment.

Gainsborough had not the reliable and cultivated correctness of Reynolds; but grace and spontaneity are in all his works—a peculiar distinction due to his faculty for seeing beauty in all simple things. "He had beauty in himself, and all his life it fed on simple delights."

Sir Joshua Reynolds' tribute in an address after Gainsborough's death held a prophecy which has been fulfilled. "If ever this nation," he said, "should produce genius sufficient to acquire to us the honorable distinction of an English School, the name of Gainsborough will be transmitted to posterity, in the history of the art, among the very first of that rising name."

GEORGE ROMNEY, GREATER IN GIFT THAN IN CHARACTER

In George Romney (1734–1802) we come to an artist whose gift was great enough to make him a rival of Reynolds, but who had not the steady will, the resolution, in using his gift to carry it to the high performance for which it was fitted. In control of line he surpassed even the greater men, and his color and vivacity give his pictures true charm. While he did not make elaborate plans of composition, he had a natural ability for placing his figures so as to give a beautiful arrangement of masses and lines. The background is usually plain, laying the more emphasis on the portrait itself.

Romney's faults are due to defects of character and to insufficient early training rather than to lack of genius. He had a tendency to lay plans larger than he could carry through, and in his later life this became almost a form of insanity. With one undertaking partly accomplished, he would turn from it to some new delightful project that beckoned. Had he possessed a firmer will, he would no doubt have reached great results.

Although his best work is to be seen in some of his portraits (chiefly in private collections), he painted, besides, historical and ideal scenes. His interesting and sad story is told elsewhere.

In Scotland Allan Ramsay (1713–84), a contemporary, you see, of the English painters of whom we have been thinking, painted portraits of many Scottish gentlemen and ladies which made his name well-known in England as well as at home. While his color is sometimes hard and opaque-looking, his drawing of the features is fine, and his pictures are marked by a grace that is characteristically his. The portrait of his wife on page 2115 is one of his most charming portraits. The latter part of his life was spent in England, where he became court painter to King George III.

Henry Raeburn (1756–1823), another Scottish painter, in childhood left an orphan and early apprenticed to a goldsmith, learned for himself the arts of miniature- and oil-painting. Possessed of the very qualities that Romney had not, he lost no opportunity of improving his knowledge and technique. Scotland owes to this son of hers admirable portraits of many others of her honored children, including Sir Walter Scott. They are sincere and forceful likenesses, broad and well handled, somewhat crude in color and tone, but interesting in their vigor and power of characterization. Of Raeburn's romantic marriage, which opened the way to study on the continent, you may read elsewhere (see Index). He became president of the Society of Artists in Edinburgh and, before his death, was knighted by the king. His portraits are in the National Galleries of Scotland and England and in a number of other public and private collections. One of the finest is that of Sir John Sinclair, shown on page 2115.

Among the lesser portrait-painters of the period in England we shall speak of three—Hoppner, Opie and Lawrence.

John Hoppner (1758–1810) confessed himself to be a follower of Reynolds; and though he painted some landscapes and pictures on ideal subjects, his portraits, especially those of women and children, are considered his most successful works. They are still sought and treasured, although time has dimmed the beauty of their coloring. An attractive example of his portraiture is the group of the Sackville children on page 2118. Hoppner was a man of social accomplishments, who could count among his sitters members of the royal family and such celebrated persons as Sir Walter Scott, Wellington and Lord Nelson.



Mrs. Gardiner and Her Children, by John Hoppner.
Photo, courtesy Metropolitan Museum of Art.

John Opie (1761–1807), when as a young man he went to London from his native Cornwall, became the fashionable portrait-painter of the town, hailed as the self-taught, independent artist. After the wonder had subsided and he was less pressed with orders, he worked hard to learn how to overcome his faults, and divided his time between portraits and historical canvases. His pictures have far more vigor of treatment and more individuality than elegance and grace.

In Sir Thomas Lawrence (1769–1830) we come to the successor of Sir Joshua Reynolds in the post of painter to the king. Lawrence showed unusual talent as a boy and won fame while still in his teens. When he was only twenty-one years old, he was elected to the Academy by especial favor. Having started so young to observe and record the forms and features of society, he became very skilled in reproducing the airs and graces of its ladies and gentlemen. He drew well and painted in an easy manner, using a brilliant coloring that was sometimes hard in effect. Of all that he produced his pencil and crayon studies are rated as the most successful.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 2229.

BRITAIN'S GOLDEN AGE IN ART



REYNOLDS' FAMOUS PORTRAIT OF MRS. SIDDONS AS THE TRAGIC MUSE

From the collection of Henry E. Huntington of California. Some of the pictures on these pages are reproduced by courtesy of Lord Rothschild and Sir Edward Stern, Bt.; photographs of the paintings are by Messrs. Braun, Hanfstaengl, Mansell, The Metropolitan Museum of Art, and others.



MR. AND MRS. LINDOW, BY ROMNEY



MRS. MARK CURRIE, BY ROMNEY



MR. POYNTZ, BY THOMAS GAINSBOROUGH



LADY GOWER, BY SIR THOMAS LAWRENCE



ALLAN RAMSAY'S PORTRAIT OF HIS WIFE



LADY CRAVEN, BY GEORGE ROMNEY



SIR JOHN SINCLAIR, BY RAEBURN



RAEBURN'S PORTRAIT OF A LADY



MRS. JORDAN AS THE COMIC MUSE, BY JOHN HOPPNER



LAVINIA, COUNTESS SPENCER, BY SIR JOSHUA REYNOLDS



PORTRAIT OF MASTER HARE, BY REYNOLDS



LADY GEORGIANA SPENCER, BY GAINSBOROUGH



THE SACKVILLE CHILDREN, BY JOHN HOPPNER



LORD ALTHORP, BY REYNOLDS



A BOY WITH A KID, BY LAWRENCE



THE MARSHAM FAMILY, BY GAINSBOROUGH



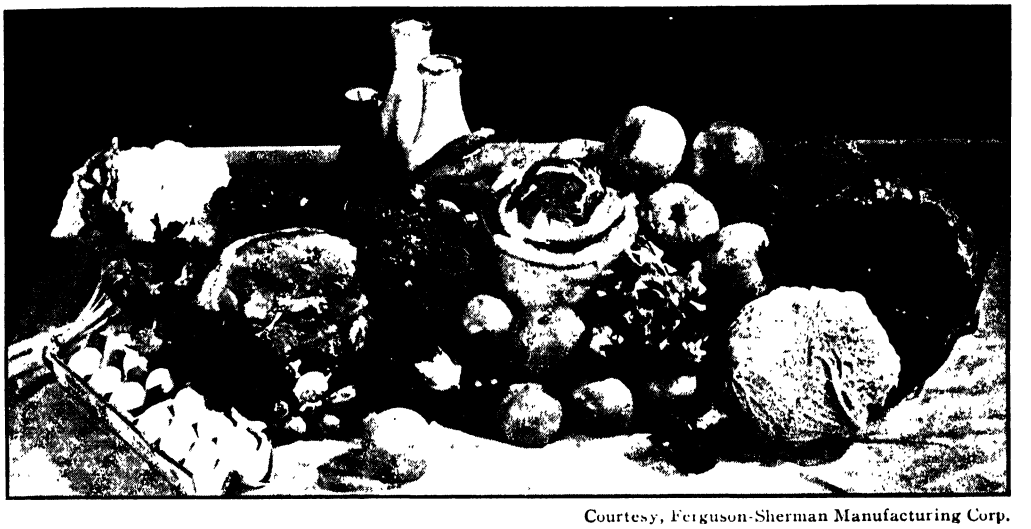
THE TWO FERGUSONS. BY SIR HENRY RAEBURN



LORD HEATHFIELD. BY REYNOLDS



HOPPNER'S PORTRAIT OF GEORGE IV



Courtesy, Ferguson-Sherman Manufacturing Corp.

FOOD AND ITS USES

IN another article you may learn something about the organs in our bodies that take in food and change its useful parts so that they can enter the blood and be carried by it to every part of the body. Here we shall learn what food is made of, and how we may be guided in our choice of what we eat. The things that our bodies receive daily from the outside world are: air, water, light, salts, fuel-food and proteins. Let us consider them one by one.

We do not think of air as a food, yet any proper idea of what is meant by food must certainly include air, or, rather, oxygen. It is constantly being used up in our bodies and new supplies are always needed. It is possible to be hungry for this very valuable food. In some kinds of illness where sufficient oxygen can get into the blood only with difficulty, the unhappy person has "air hunger."

The second thing our bodies receive every day is water. We do not often think of this as a food, but there we are wrong. By far the greater part of our bodies consists of water, and it is a notable thing, as true of an oak or a microbe as of ourselves, that for life there must be a ceaseless circulation of water.

Not merely is all life lived in water, but it is all lived in running water. No matter what kind of living creature we examine, we find that it is always giving off water, and unless this loss is made up, the animal or plant will soon cease to live. Few things in nature are more wonderful than the giving off of water—a sort of perspiration—by the leaves of a plant. The roots drink the water from the soil and send it up to the leaves. The same process is going on in ourselves. On an average each one of us loses about six pounds of water every day of our lives by the action of the skin, the lungs and the kidneys. This means that the same amount of water must somehow be taken into the body every day; and thus there is no more necessary or important food than water.

A man may fast for more than a month because his body is, during all that time, using up the fat it has stored. But no man can store up water in his body, and so the fasting man always has to have water just as he has to have oxygen.

Another of the things that enter our bodies is light. Under this we may include, not only the visible light that strikes the eyes and the skin, but all kinds of invisible radiation from the sun—such as, for example, the so-called ultraviolet rays. These are the rays that tan our skin in the summertime; but it is now also known that under their influence a very important substance is formed in our bodies. This is the famous

vitamin D, the so-called "sunshine vitamin" —also found in fish-liver oil and other foods—which is essential for proper growth and health, especially in children.

THE SALTS, OR MINERALS, WHICH ARE NECESSARY FOR LIFE

The case of salts proves to us at once that a thing may be a food even though it supplies no power to the body, not being burnable food, and even though it does not make tissues. Certain salts, or minerals, are absolutely necessary for life, and as they pass away from the body, the supply needs to be constantly renewed. We do not yet know nearly all their uses in the body, but we know some.

Many kinds of salts are necessary, though there is only one kind—ordinary table salt (sodium chloride)—that we commonly add to our food; the other kinds are usually supplied by their natural presence in food. We need calcium salts, for instance, and there is a good amount of calcium in milk. Vegetables and fruits are of value very largely because of the salts, or minerals, they contain. Yet when we cook a cabbage we dissolve into the water the most valuable part of it—the salts it contains—and then throw the water away! Meat also contains a good deal of salt. But of all our foodstuffs fruit is the best, so far as minerals are concerned.

We look upon common salt as a thing to flavor food with, but it is really a necessity of life. Not only does it play a necessary part in the blood and the tissues, but it is the source of one of the important products of the stomach, without which the digestion of our food would be difficult or impossible. If we remember that common salt is sodium chloride we shall understand at once that it is a source of the hydrochloric acid which is poured into the stomach as a part of the gastric juice, which helps to digest food so that it can be absorbed by our bodies.

CALCIUM WHICH GIVES STRENGTH TO OUR BONES AND OUR TEETH

If the body of an animal or a human being is burned, we find that there is always left an ash; and this ash consists of the salts that were in the body and can not be burned. Important among them would be calcium, which gives strength to the bones and the teeth. If a bone is placed in an acid and the salts are melted away, the bone becomes quite soft and could be tied into a knot. So these salts are specially important as part of the food of babies and children who are making their bones and teeth. Salts of iron, too, are necessary for the blood, and there is a rich and constant supply of salts of iron in milk.

Now we come to the foods which make up the bulk of our diet. They are of three kinds —carbohydrates, fats and proteins. Carbohydrates and fats are fuel foods. From them we get work, energy and heat.

STARCHES AND SUGAR, THE FUEL-FOODS WE CALL CARBOHYDRATES

Carbohydrates is the name given to compounds containing carbon combined with hydrogen and oxygen. Sugar and starch are carbohydrates. We know that every green leaf everywhere is making starch whenever light falls on it. We know how much starch we require every day, and so it is possible to say how much foliage must be at work every day for every human being, not to mention the lower animals. One square yard of leaves will produce about fifteen grains of starch in an hour. If you and I are to get all the starch we need to-morrow, each of us requires to have 500 square yards of leaf working for an hour, or 100 square yards working for five hours. That is just an average. The exact figure would vary with the intensity of the sunlight falling on the leaves, the amount of work we did in the day, the size of our bodies, and so on. But it is well that we should think of ourselves as dependent on a multitude of green leaves somewhere which are turning the energy of sunlight into a form that we can use.

If we take starch and heat it in the air to the temperature of our blood, we do not find that it burns. Yet it burns within the body. This is done by means of chemical substances called ferments, which exist in the blood and in every living cell in the body. They act upon the food in a way not fully understood, and prepare it so that it will burn at low temperatures.

For immediate result, and for simplicity of digestion, sugar is undoubtedly the best fuel-food. That is why children, who are so active and are specially in need of heat-producing foods, are naturally so fond of sugar and sweet things.

FAT, ANOTHER FUEL-FOOD LESS DIGESTIBLE THAN CARBOHYDRATES

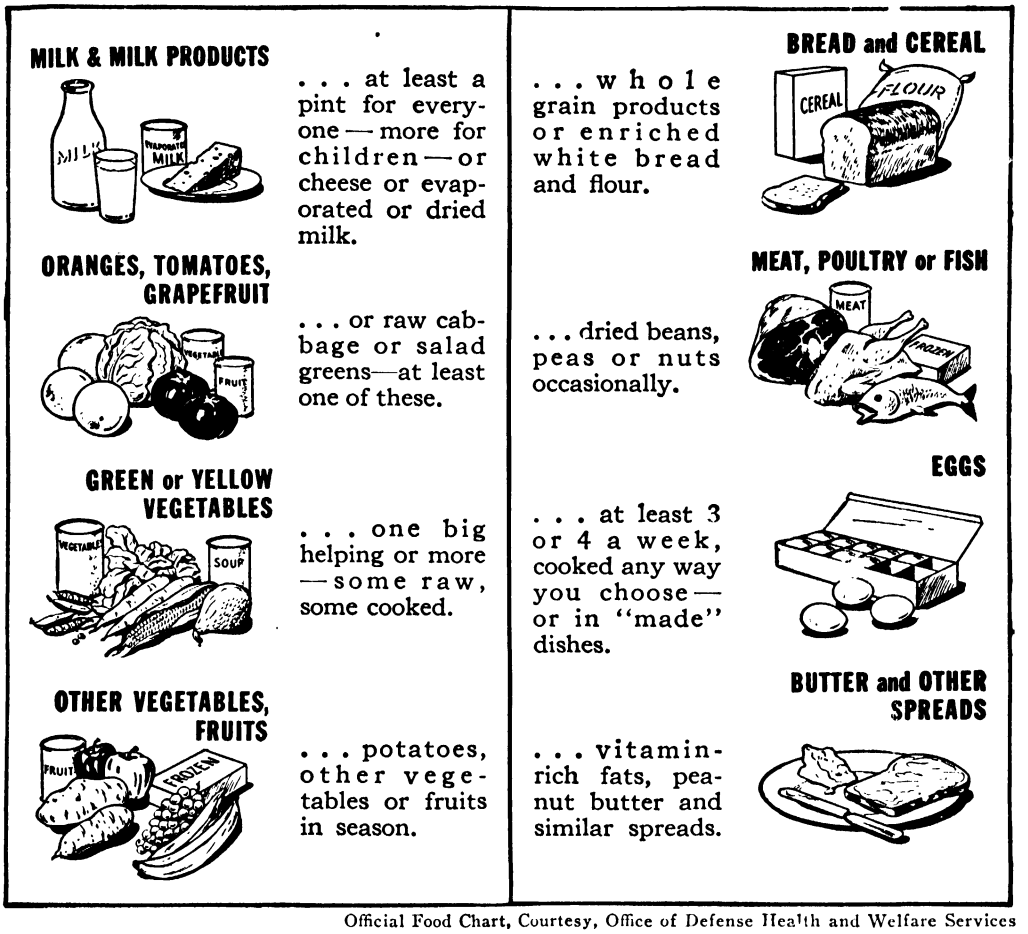
Fat is another fuel-food. Much of the fat we eat is of animal origin, such as the fat of meat, the fatty part of the yolk of an egg, and the fat of milk, cream and butter. It seems to matter not at all to the body whether its fuel is supplied as fat, sugar or starch, but perhaps sugar and starch have

this advantage over fat, that they are more easily digested, besides being cheaper.

Proteins are the last class of foods that we need, and there is something special about them which raises them above all other foods in importance. We have described the body as a sort of engine which needs fuel, and it is a living engine, burning and being destroyed from day to day. If it is to go on living it must be supplied with food which will make good its wear and tear. The only food which will do this is protein.

Proteins are the important compounds—containing carbon, hydrogen, oxygen, nitrogen and, generally, sulphur—that are found in all animals and vegetables. Every living creature requires a supply of proteins to make good its wear and tear; but only one kind of living creature, those that have chlorophyl, can make protein for themselves. All others must have ready-made protein supplied.

However richly a man was supplied with water, salts, starch, sugar and fat, he could not live without proteins. We should clearly understand that the protein is required, not as fuel, for sugar and starch are better fuels, but as a means of repairing the body waste. Protein can be used as a fuel if necessary, so that it is possible to live without fats or carbohydrates. Very many people take far too much protein food, especially in the form of meat. They take it simply because they like it, but they do not know the consequences. If sugar and starch and fat are taken in excess, they can be stored up as fat;



Official Food Chart, Courtesy, Office of Defense Health and Welfare Services

Every day you should eat some foods from each of the eight groups above—milk or milk products; citrus fruits, tomatoes or cabbage or raw greens; green or yellow vegetables; other vegetables or fruits; cereals; meat, poultry or fish; eggs; butter or another vitamin-rich spread. You may also eat other foods which you enjoy.

protein can not be stored in the body and if too much protein is taken, there is a serious strain on some of the organs, which have to get rid of the excess protein.

Of course, we ought to know about how much of these various things are required in our food every day. What we need varies very much according to many circumstances. Some people are more economical with their food than others; they can get out of a small diet as much work as other people get from a much larger amount.



Photograph by Fred Machetanz from Here Is Alaska, by Evelyn Stefansson

Eskimo cutting up a white whale. Pieces of skin with blubber attached are eaten, cooked or raw.

The size of the body affects its needs. The Japanese have small bodies, and as a race are able to make a little food go a long way.

Climate and clothing also affect the amount of food we need. In warm air we lose heat less rapidly and so require much less fuel. Our appetites are naturally lessened in hot weather. In very cold climates large quantities of heat-producing food are needed. Thus, the Eskimo eats a great deal of blubber, which is fat.

Muscular work greatly affects the quantity of food we need. The appetite of men doing really hard muscular work is very great. It has to be, if sufficient fuel is to be supplied to the muscular engines. Mental work scarcely affects the amount of food needed.

In all these cases it is the quantity of the heat foods and work foods—fat and carbohydrates—that should vary. The need for protein does not vary so much. An average diet for a man would be about 6 pounds of water, 1 ounce of salts, 15 ounces of sugar and starch, 3 ounces of fat; of protein, probably 3 ounces or a little more is abundant. The quantities of foods must be increased for severe labor, and very much lessened if a person is going to stay in bed.

THE BODY'S NEED FOR FUELS IS MEASURED IN CALORIES

You have probably heard of calories. You know that if a person eats too much fuel-food (sugar, starch and fat), he is taking too many calories and may become overweight. A calorie is a unit of measurement of the heat or energy the human body needs. See calorie in the Index.

Of course, the figures vary in proportion to the size of the individual; but a small man requires far less food than a boy of the same weight. Children need a quantity of food quite out of proportion to their weight, for while adults merely have to maintain their bodies, children are making their bodies. Children therefore require, not merely a large supply of food in proportion to their weight, but a specially large proportion of protein, for protein alone will make living tissue.

Another special need for children is calcium, for bones and teeth; and so we should give children plenty of foods that are rich in calcium, such as milk and eggs and vegetables.

The study of food, and of the human body's special needs, was much advanced during World War II. We now have a considerable knowledge of vitamins, though we are still near the beginning of our studies of these strange, powerful food factors. Look up vitamins in the Index.

THE EIGHT GROUPS OF FOODS WE NEED EVERY DAY

Scientists have helped us to plan our diets so that we shall have the proper vitamins, fuel-foods, proteins and mineral salts. They have placed the common foods in eight classes, or groups, as the chart on page 2123 shows. We should eat some foods from each of the eight groups, every day. We should also learn how to cook food properly, so that vitamins and minerals are not thrown away.

The body is a factory. Let us keep it running in good order. Then we shall feel well, work better, get more joy from work and play and, probably, live longer.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 2127.

What Makes Me Hungry?

YOU know you are hungry when you have a very special kind of feeling in your stomach. Even babies know when they are hungry. Their cries say very plainly, "I want my bottle!" Animals, too, have many ways of showing that they need food. Living creatures of all kinds become hungry, and the desire to satisfy this hunger is one of those important life urges that are called instincts.

When you are hungry, you have a sinking feeling in the pit of your stomach. This uncomfortable feeling is caused by movements of the stomach. During the time when the stomach is filled with food, we do not feel discomfort unless we have eaten too much food, or the wrong kind of food. But when all the food has passed through the stomach into the intestines, the stomach begins to expand and contract, like a fist opening and closing. This movement gives us the hollow feeling that tells us instinctively that the body needs more food.



Frigidaire

"Oh, that tastes good—and I was so hungry!"

WHY IS OLD BREAD MORE DIGESTIBLE THAN NEW BREAD?

The digestion of bread takes place very largely in the mouth. The starch of the bread is converted by the saliva into dextrins (carbohydrates) and maltose (a crystalline sugar). To change the starch into these substances we must chew the bread very thoroughly and grind it with our teeth into tiny fragments. It is because toast and biscuits can be ground up more easily by the teeth that they are more digestible than bread. For this reason, too, old bread is more easily digested than new bread, and crusts are more easily digested than the soft inner part of the bread. Freshly baked bread contains much moisture, which makes the bread difficult to chew and which also prevents it from soaking up the saliva.

WHY DO WE COOK THE FOOD WE EAT?

We cook our food chiefly for three reasons. Cooking makes some foods more appetizing. It softens some hard and tough foods that we can not eat raw. It also kills any microbes that may be in the food.

Although it is more pleasing to eat some foods after they have been cooked, there are many foods that can be eaten either cooked or raw, such as carrots, apples and other kinds of fruits and certain kinds of seafood. Some people like them cooked and some prefer them raw. Some raw or half-raw foods are more digestible and retain their vitamins better than they would if they were cooked.

You would not want, however, to eat potatoes raw, for they, like many other foods, are almost indigestible until cooked.

The milk that we drink today is mostly pasteurized—heated to a high temperature, and then rapidly cooled. Although such temperatures do not boil the milk, they are high enough to kill any bacteria within it.

WHY DO WE HAVE DIFFERENT TASTES IN EATING?

No two people in the world are just alike, and no two people have exactly the same tastes. It is natural, then, that no two people should like exactly the same foods.

There are other reasons, however, why people have different tastes in eating. One person's body may have different needs from those of another person's. Some people require a good deal of fat and their bodies will very probably be quite capable of digesting fat. Those people will usually like fat and oily foods—which may not at all suit the

needs of others, who will also like them less.

At different ages we need different kinds of food. Children, for instance, are very active, and quickly use up the energy supplied by their food. They therefore need a great deal of the kind of foods that will supply them with energy. Perhaps the best of such foods is sugar, and that may be why children and young people like sweet things so much.

Tastes differ, too, in different climates. A child in the cold Arctic region enjoys blubber and oil, because these foods furnish extra heat for the body. A diet of this kind, however, would not suit a child living in the heat of the tropics.

WHAT DO WE MEAN WHEN WE SPEAK OF A CALORIE?

The Calorie is a measuring rod for heat, something like a degree on the scale of a thermometer. We do not, however, speak of the temperature of a room in terms of Calories. Calories measure the amount of heat produced by various foods when those foods are burned up and turned into energy within the body. We say that a certain combination and amount of foods will provide a person with 2,000 Calories a day, which is the average amount needed by most people. People of different ages and different kinds of occupations, however, have different caloric needs.

By careful experiment scientists have discovered how many Calories are supplied to the body by a certain amount of any given food. One large fresh apple will furnish about 100 Calories, as will also four or five small pieces of bacon. In making up a diet list, however, it is not only the Calories that must be considered, but also the various types of foods. We must have, to be healthy and well, proper quantities of protein, fats and carbohydrates. A person who ate 2,000 Calories of bacon each day, and nothing else, would not be getting the proper food. The fats and carbohydrates provide heat for the body, especially, while the proteins are the building blocks with which our bodies build and repair themselves.

There are two kinds of calories—the smaller calorie, the measure of heat required to raise one gram of water one degree Centigrade, and the greater Calorie, spelled with a capital *C*, which is the amount of heat necessary to raise one kilogram (about 2.2 pounds) of water one degree Centigrade.

THE NEXT WONDER QUESTIONS ARE ON PAGE 2185.



A growing boy in his teens needs more food than most adults. Here is a good diet for three meals. It includes fruit, vegetables, meat, eggs, milk, butter and other foods to supply the necessary vitamins.

HOW WE DIGEST OUR FOOD

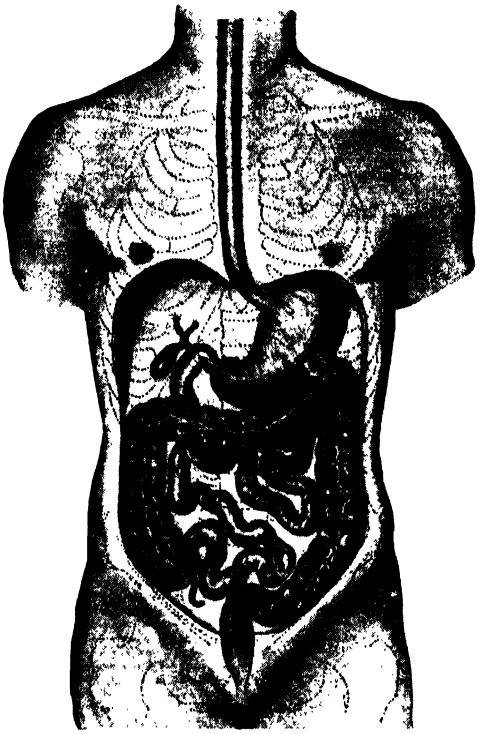
MOST of the food that we eat, especially the solid part, must be changed in various ways before it can be absorbed, or taken in, by the body and its nourishment made use of. The process by which the food is changed is called digestion; and it takes place in a long tube, the digestive tube or alimentary canal, which begins at the mouth.

Water, simple salts and the small quantities of vitamins are absorbed easily, with little change. The body can use these substances very much as they are. However, carbohydrates (sugars and starches), fats, and proteins (animal foods, such as meat, eggs and fish) must be changed a great deal. Carbohydrates and fats are chemical compounds of the elements carbon, oxygen and hydrogen. Proteins have these elements and, in addition, a fourth element, nitrogen. Living matter consists chiefly of these chemical elements. But their arrangement in the molecules of the various food substances must be altered or broken up before the body can absorb them, and thus digestion is largely a chemical act.

Certain parts of the digestive system are supplied with substances called enzymes, or ferments, each of which acts chemically on a certain kind of food. We shall tell you about some of these enzymes later on.

The main parts of the digestive tube are the mouth, the pharynx (the passage through the throat), the esophagus, the stomach, the small intestine, the large intestine and the rectum. Intestines and rectum are sometimes called the bowels. In addition to the main canal there are ducts, or narrow canals, which open into the first part of the small intestine from certain glands, the liver and the pancreas, which also have work to do in digestion. We shall speak of these later.

Mucous membrane lines the whole of the digestive tract and keeps it moist. There are tiny glands in this membrane which secrete, or give out, a moist substance called mucus. The mucus makes it possible for food to slip along the canal easily; and the mucus also helps to soften the food. The walls of the canal are made of muscle, and there are two muscular coats for most of the way. In one coat the muscle fibers go up and down; in the other coat the fibers are arranged circularly—rings of muscle. The stomach has a third coat in which the fibers are arranged diagonally. These extra muscular layers enable the stomach to work harder than other parts of the digestive tract. Throughout the



The digestive tract shown as it fits into the framework of the trunk. The dotted lines indicate ribs and other bones. The greater part of the system, in the abdomen, is protected only by muscles.

system, the walls have a rich supply of blood vessels and nerves. Between each part of the tube are valves, that is, circular bands of muscle which can tighten up, or relax, and thus regulate the flow of food from one part to the next.

As soon as food enters the mouth, the nerves send messages ahead and the digestive tract gets ready for action. Even the smell or sight of food can stimulate the flow

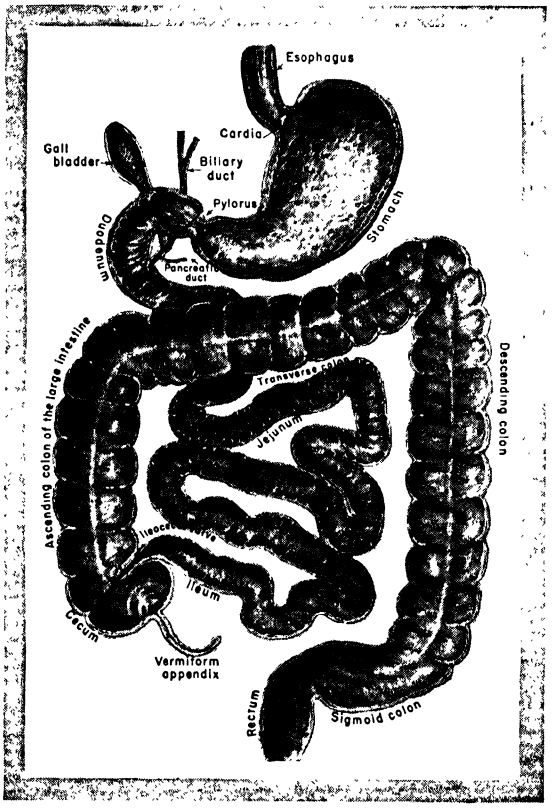
of digestive juices in the mouth and in the stomach. People are often speaking quite truthfully when they exclaim "How that makes my mouth water!" at the sight and smell of a delicious roast or cake. Beneath the mucous membrane of the mouth and cheek are special glands which secrete a watery substance called saliva. Saliva is produced more freely when we eat than at other times; and so prompt are the salivary glands that they may start to speed up their action even by the thought of food. The mouth really does water in anticipation of food.

In the mouth the tongue moves the food about for chewing, the teeth cut and grind it, and the saliva moistens and softens it and begins to treat it chemically. The saliva contains an enzyme that immediately starts to break down, or digest, the starchy part of carbohydrate into a more simple form, that is, sugar. Saliva too is swallowed with the food, and so the process of breaking down the starch continues for a time in the stomach. Thus digestion begins in the mouth; and therefore it is quite important that we allow our food to start the process of digestion properly. We do this by chewing each morsel of food thoroughly and slowly, so that it is reduced to tiny bits, well mixed with saliva. This chewing operation is called mastication.

After leaving the mouth, the food passes through the pharynx, that is, it is swallowed. Chewing is a voluntary act. Swallowing is voluntary also, though we generally do it unconsciously. Now here is an interesting fact. When we swallow, we say the food "goes down," and so it does, as if it were obeying the law of gravitation. Yet many animals "drink up hill." This proves the strength of the muscles that control this act. The food now enters the esophagus, a tube that runs down the back of the chest cavity and enters the abdomen through an opening in the diaphragm. The lining of the esophagus is fairly thick and tough—a special form of mucous membrane. That is a good thing, because the food is still fairly rough. Here the remarkable arrangement of the esophagus muscles comes into play. They contract, or tighten up, behind the food and relax in front of it in a rhythmical wave-like motion, forcing the food along with some rapidity into the stomach. All of these movements are involuntary. As a matter of fact, after food is swallowed, digestion goes on involuntarily. We need not give the process another thought.

The stomach is a marvelously elastic organ. It is slung across the upper part of the abdomen, partly beneath the left side of the liver. The stomach, which is shaped somewhat like a J, has two openings. The one on the upper side, the cardia, is the passageway from the esophagus; and on the right side, the pylorus, is the opening into the small intestine. The stomach bulges somewhat on the left, and grows rather narrow to the right. When the stomach contains no food, it shrinks in size and its walls rest against each other. But it can stretch to fit exactly around the amount of food reaching it. It can be stretched

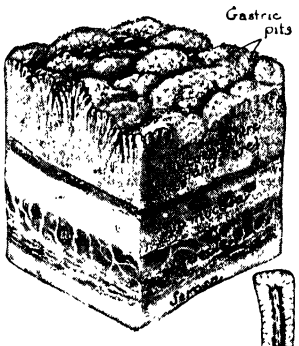
WHERE FOOD IS CHANGED AND ABSORBED



The small intestine has many more coils than are shown here.

too much, of course, but sensible people do not stuff themselves.

It is in the stomach that the chief part of the digestive process begins. The powerful stomach muscles turn the food over and over and around and around so that every part comes in contact with the stomach lining. At the same time the food is thoroughly mixed with the gastric juice, which is pouring from glands in the mucous membrane that lines the stomach. The gastric juice contains an especially important enzyme called pepsin. Since pepsin can do its work only when an acid is present, the gastric juice also contains a considerable amount of hydrochloric acid.



Cross section of the stomach wall, with the innermost layer at the top. The serosa is a membrane which protects the stomach on the outside.

Pepsin acts on protein food. This is difficult to digest because the protein molecules are huge—a single molecule may contain thousands of atoms in a complicated arrangement. Pepsin begins the work of splitting these molecules. Two other important enzymes in the gastric juice are rennin, which clots milk, and lipase, which begins the work of splitting fat. The food in the stomach is finally transformed into a pulpy mass, called the chyme, and is now ready to enter the small intestine.

Up to this point, practically no food has yet been absorbed by the body. Absorption begins in the duodenum, the first part of the small intestine.

Food in the intestine is pushed along by the muscular walls much as it was in the esophagus, but at a much slower rate. The small intestine is more than twenty feet long in an adult, and lies in numerous coils in the abdominal cavity. This length helps to give it a large area from which food may be absorbed. In addition, the internal surface area is increased by tiny outgrowths from the mucous membrane, called villi, which give the lining a velvety appearance. Each villus (the singular form of villi) contains a network of blood capillaries and the beginning of one or more tiny ducts. These ducts are special lymphatic vessels called lacteals, and they play an important part in the absorption of fats. We tell you more about the lacteals later. Between the bases of the villi are the openings of tiny glands which secrete juice. This is called the intestinal juice, and is one of the three digestive juices in the small intestine.

We have said that the liver and the pancreas have ducts leading into the first part of the small intestine. The liver is the largest gland in the body, and it occupies most of the upper part of the abdominal cavity, just beneath the diaphragm. Little ducts drain from it into the gall bladder, a little bag just in front, where the liver's secretion, the dark-colored bile, is concentrated and stored until needed. The bile passes from the gall bladder by another duct into the duodenum. The bile's importance in digestion seems to be that it contains certain salts which help to break up fatty materials. Another use has to do with getting rid of waste products collected from the blood by the liver. We tell you about this work in the article, Some Important Glands, where we discuss the liver.



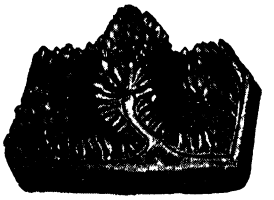
Gastric glands, which lie close together in the mucous membrane. The grooves between are gastric pits.

The pancreas is a pink-white gland, lying just below and slightly back of the stomach. While this gland has other functions, it also plays an extremely important part in digestion. The pancreatic juice, which empties into the duodenum, mixes with the intestinal juice, and together they are extremely powerful. By means of the enzymes which they contain, the partially digested proteins from the stomach are changed into amino-acids, fat is broken down into glycerol and fatty acids, and the carbohydrates are broken into simple sugars, mainly glucose. In other words, the nourishing parts of the chyme are changed into soluble substances which can be easily absorbed, and then carried by blood and lymph to other tissues.

Most of these substances now pass by means of the villi into the blood. The substances broken down from fats, however, do not pass directly into the blood, from the intestine, but first enter the little canals we call lacteals. During digestion the lacteals are filled with a milky white fluid called the chyle. (Lacteal comes from the Latin word for milk, *lac.*) The lacteals lead into the

thoracic duct, the largest lymphatic vessel, which passes up the back wall of the body just in front of the spinal column and empties into a blood vein at the left side of the base of the neck. There are numerous lymphatic vessels in the body, and their chief purpose seems to be to drain the tissues of excess fluid. They are also very useful in combating the spread of infection throughout the entire body.

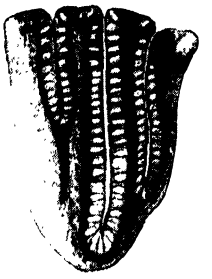
Just how the food is absorbed, or passes into the blood capillaries and lacteals in the villi, is not fully understood as yet. We do know, of course, that the villi and the blood and the lymph vessels in them have very thin walls, and the now liquid food must in some way leak through the walls into the blood vessels and lacteals. But absorption can not yet be fully explained by any known natural laws.



Cross section of the wall of the small intestine, showing one of the numerous folds. The thickly crowded outgrowths are the villi.

The large intestine is called large because the passage between its walls is quite a bit wider than that of the small intestine. However, the large intestine is only about two to three feet long. It lies folded along three sides of the abdominal cavity, beginning near the bottom on the right side. In its course, the large intestine runs upward as far as the liver, crosses in front of the upper coils of the small intestine, and then goes down on the left side, leading finally to the rectum.

The coils of the small intestine are so arranged that it opens into the large intestine a little above its beginning. Below the opening there is a blind sac in the large intestine, and at the end of this sac is a worm-like outgrowth, the appendix. The appendix has lost any use it may once have had in the body. It can sometimes cause considerable trouble, and then must be removed by surgery.



Lieberkühn's glands. They line all of the intestines, opening between the villi in the small intestine.

There are glands in the large intestine, but no villi. However, a large quantity of water is absorbed through the mucous membrane, and some further nourishment is extracted from food which the higher parts of the system have failed to take. But the chief purpose of the large intestine is to act as a storage place for waste material until it can be disposed of. Certain parts of food, such as cellulose (the cell walls of vegetables, for instance), are not affected by the digestive juices. So the body can not absorb them, and must get rid of them. There are other waste products that must be got rid of. Individual cells of the body do not have a very long life, as you know. Bits of dead cells (think of the ashes of a coal furnace) are picked up by the blood as it passes through the body, and strained out of the blood by the liver, and passed into the intestine by way of the bile. At the end of the large intestine is a short tube, the rectum, through which these wastes are expelled from the body.

How long does it take for a meal to be thoroughly digested? By the quickness with which water relieves thirst and liquid food revives people suffering undernourishment, fluids must reach the small intestine rapidly. Solid food, however, may remain in the stomach for as long as three hours, depending upon the size of the meal and the kind of food it contained. It takes food about four and a half hours to pass through the small intestine; and the passage through the large intestine takes the longest time of all, about thirteen and a half hours. From this you can see that the thorough digestion of an ordinary meal must take more than twenty hours.

Digestion is an important part of the sum total of processes which is called metabolism. Metabolism has two sides. On one side are the processes which have to do with building living material and repairing its destruction. Here digestion comes in. It supplies the nourishishment by which cells are kept alive and new cells are made. This side is called anabolism, meaning to build up. The other side of metabolism has to do with the burning of body cells or living material to produce energy, heat, vitality and so on. This side is called catabolism, meaning to tear down. In other words, the body is constantly taking in food, building it into new body material, and then combining it with oxygen and getting rid of the ashes and using more food to build more living material, and so on. These changes in the tissues are all chemical; and so metabolism means the sum total of the building-up and tearing-down processes of the entire body. Anabolism plus catabolism equals metabolism.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 2185.



TOM SAWYER is one of the most entertaining characters in American fiction. He appears in Mark Twain's famous novel THE ADVENTURES OF TOM SAWYER and its sequel, HUCKLEBERRY FINN, as an amusing "bad boy" in a sleepy river town in Missouri. His companion in mischief is an engaging ragamuffin, Huck Finn. The two lovable urchins are always ready for a new adventure and their chief joy is to outwit the respectable but dull citizens of the town, including Aunt Polly, with whom Tom lives. One of their exciting escapades is their attendance at their own funeral. The story of how Tom Sawyer whitewashed the fence is one of the world's classics. It has been translated into many languages and is probably the best known of Mark Twain's writings. The story is given here in the author's own words. Though written solely to amuse, it reveals a sound knowledge of human nature, on which the best humorous writing is always based.

HOW TOM SAWYER WHITEWASHED THE FENCE

By MARK TWAIN

SATURDAY morning was come, and all the summer world was bright and fresh, and brimming with life. There was a song in every heart; and if the heart was young the music issued at the lips. There was cheer in every face and a spring in every step. The locust trees were in bloom and the fragrance of the blossoms filled the air. Cardiff Hill, beyond the village and above it, was green with vegetation, and it lay just far enough away to seem a delectable land, reposeful and inviting.

Tom appeared on the sidewalk with a bucket of whitewash and a long-handled brush. He surveyed the fence, and all gladness left him and a deep melancholy settled down upon his spirit. Thirty yards of board fence nine feet high. Life to him seemed hollow, and existence but a burden. Sighing he dipped his brush and passed it along the topmost plank; repeated the operation; did it again; compared the insignificant whitewashed streak with the far-reaching continent of unwhitewashed fence, and sat down on a tree-box discouraged. . . .

He began to think of the fun he had planned for this day, and his sorrows multiplied. Soon the free boys would come tripping along on all sorts of delicious expeditions, and they would make a world of fun of him for having to work—the very thought of it burnt him like fire. He got out his wordly wealth—bits of toys, marbles and trash; enough to buy an exchange of *work,* maybe, but not half enough to buy so much as half an hour of pure freedom. So he returned his straitened means to his pocket, and gave up the idea of trying to buy the boys. At this dark and hopeless moment an inspiration burst upon him! Nothing less than a great magnificent inspiration.

He took up his brush and went tranquilly to work. Ben Rogers hove in sight presently —the very boy, of all boys, whose ridicule he had been dreading. Ben's gait was the hop-skip-and-jump—proof enough that his heart was light and his anticipations high. He was eating an apple and giving a long, melodious whoop, at intervals, followed by a deep-toned ding-dong-dong, ding-dong-dong, for he was personating a steamboat. As he drew near he slackened speed, took the middle of the street, leaned far over to starboard and rounded to ponderously and with laborious pomp and circumstance—for he was personating the *Big Missouri,* and considered himself to be drawing nine feet of water. He was boat and captain and engine-bells combined. So he had to imagine himself standing on his own hurricane-deck giving the orders and executing them:

"Stop her, sir! Ting-a-ling-ling!" The headway ran almost out and he drew up slowly toward the sidewalk.

"Ship up to back! Ting-a-ling-ling!" His arms straightened and stiffened down his sides.

"Set her back on the stabboard! Ting-a-ling-ling! Chow! ch-chow-wow! Chow!" His right hand, meantime, describing stately circles—for it was representing a forty-foot wheel.

"Let her go back on the labboard! Ting-a-ling-ling! Chow-ch-chow-chow!" The left hand began to describe circles.

"Stop the stabboard! Ting-a-ling-ling! Stop the labboard! Come ahead on the stabboard! Stop her! Let her outside turn over



slow! Ting-a-ling-ling! Chow-ow-ow! Get out the headline! *Lively* now! Come—out with your spring-line — what're you about there! Take a turn round that stump with the bight of it! Stand by that stage, now—let her go! Done with the engines, sir! Ting-a-ling-ling! *Sh't! s'h't! sh't!*" (trying the gauge-cocks).

Tom went on whitewashing—paid no attention to the steamboat. Ben stared a moment and then said:

"Hi-*yi! You're* up a stump, ain't you!"

No answer. Tom surveyed his last touch with the eye of an artist, then he gave his brush another gentle sweep and surveyed the result as before. Ben ranged up alongside of him. Tom's mouth watered for the apple, but he stuck to his work. Ben said:

"Hello, old chap, you got to work, hey?"

Tom wheeled suddenly and said:

"Why, it's you, Ben! I warn't noticing."

"Say—*I*'m going in a-swimming, *I* am. Don't you wish you could? But of course you'd druther *work*—wouldn't you? Course you would!"

Tom contemplated the boy a bit, and said:

"What do you call work?"

"Why, ain't *that* work?"

Tom resumed his whitewashing, and answered carelessly,

"Well, maybe it is, and maybe it ain't. All I know, is, it suits Tom Sawyer."

"Oh, come, now, you don't mean to let on that you *like* it?"

The brush continued to move.

"Like it? Well, I don't see why I oughtn't to like it. Does a boy get a chance to whitewash a fence every day?"

That put the thing in a new light. Ben stopped nibbling his apple. Tom swept his brush daintily back and forth—stepped back to note the effect—added a touch here and there — criticized the effect again — Ben watching every move and getting more and more interested, more and more absorbed. Presently he said:

"Say, Tom, let *me* whitewash a little."

Tom considered, was about to consent; but he altered his mind:

"No—no—I reckon it wouldn't hardly do, Ben. You see, Aunt Polly's awful particular about this fence—right here on the street, you know—but if it was the back fence I wouldn't mind and she wouldn't. Yes, she's awful particular about this fence; it's got to be done very careful; I reckon there ain't one boy in a thousand that can do it the way it's got to be done."

"No—is that so? Oh come, now—lemme just try. Only just a little—I'd let *you*, if you was me, Tom."

"Ben, I'd like to, honest injun; but Aunt Polly—well . . . don't you see how I'm fixed. If you was to tackle this fence and anything was to happen to it—"

"Oh, shucks, I'll be just as careful. Now lemme try. Say—I'll give you the core of my apple."

"Well, here — No Ben, now don't. I'm afeard—"

"I'll give you *all* of it!"

Tom gave up the brush with reluctance in his face, but alacrity in his heart. And while the late steamer *Big Missouri* worked and

sweated in the sun, the retired artist sat on a barrel in the shade close by, dangled his legs, munched his apple, and planned the slaughter of more innocents. There was no lack of material; boys happened along every little while; they came to jeer, but remained to whitewash. By the time Ben was fagged out, Tom had traded the next chance to Billy Fisher for a kite, in good repair; and when *he* played out, Johnny Miller bought in for a dead rat and a string to swing it with—and so on, hour after hour. And when the middle of the afternoon came, from being a poverty-stricken boy in the morning, Tom was literally rolling in wealth. He had besides the things before mentioned, twelve marbles, parts of a jews'-harp, a piece of blue bottle-glass to look through, a spool cannon, a key that wouldn't unlock anything, a fragment of chalk, a glass stopper of a decanter, a tin soldier, a couple of tadpoles, six firecrackers, a kitten with only one eye, a brass doorknob, a dog-collar —but no dog—the handle of a knife, four pieces of orangepeel, and a dilapidated old window-sash.

He had a nice, good, idle time all the while —plenty of company—and the fence had had three coats of whitewash on it! If he hadn't run out of whitewash, he would have bankrupted every boy in the village.

Tom said to himself that it was not such a hollow world after all. He had discovered a great law of human action, without knowing it—namely, that in order to make a man or a boy covet a thing, it is only necessary to make the thing difficult to attain. . . .

TOM SAWYER'S NOBLE DEED

THE master, Mr. Dobbins, had reached middle age with an unsatisfied ambition. The darling of his desires was to be a doctor, but poverty had decreed that he should be nothing higher than a village schoolmaster. Every day he took a mysterious book out of his desk and absorbed himself in it at times when no classes were reciting. He kept that book under lock and key. There was not an urchin in school but was perishing to have a glimpse of it, but the chance never came. Every boy and girl had a theory about the nature of that book; but no two theories were alike, and there was no way of getting at the facts in the case. Now, as Becky was passing by the desk, which stood near the door, she noticed that the key was in the lock! It was a precious moment. She glanced around; found herself alone, and the next instant she had the book in her hands. The title-page—Professor Somebody's *Anatomy*—carried no information to her mind; so she began to turn the leaves. She came at once upon a handsomely engraved and colored frontispiece. At that moment a shadow fell on the page and Tom Sawyer stepped in at the door, and caught a glimpse of the picture. Becky snatched at the book to close it, and had the hard luck to tear the pictured plate half down the middle. She thrust the volume into the desk, turned the key, and burst out crying with shame and vexation.

"Tom Sawyer, you are just as mean as you can be, to sneak up on a person and look at what they're looking at."

"How could *I* know you was looking at anything?"

"You ought to be ashamed of yourself, Tom Sawyer; you know you're going to tell on me, and oh, what shall I do, what shall I do! I'll be whipped, and I never was whipped in school."

Then she stamped her little foot and said:

"*Be* so mean if you want to!"—and she flung out of the house with a new explosion of crying.

Tom stood still, rather flustered by this onslaught. Presently he . . . joined the mob of skylarking scholars outside. In a few moments the master arrived and school "took in." Tom did not feel a strong interest in his studies. Every time he stole a glance at the girls' side of the room Becky's face troubled him. Considering all things, he did not want to pity her, and yet it was all he could do to help it. He could get up no exultation that was really worthy the name. . . .

A whole hour drifted by, the master sat nodding in his throne, the air was drowsy with the hum of study. By and by, Mr. Dobbins straightened himself up, yawned, then unlocked his desk, and reached for his book, but seemed undecided whether to take it out or leave it. Most of the pupils glanced up languidly, but there were two among them that watched his movements with intent eyes.

Mr. Dobbins fingered his book absently for a while, then took it out and settled himself in his chair to read! Tom shot a glance at Becky. He had seen a hunted and helpless rabbit look as she did, with a gun leveled at its head. Instantly he forgot his quarrel with her. Quick—something must be done! done in a flash, too! But the very imminence of the emergency paralyzed his invention. Good! —he had an inspiration! He would run and snatch the book; spring through the door and fly. But his resolution shook for one little instant, and the chance was lost—the master opened the volume. If Tom only had the wasted opportunity back again! Too late. There was no help for Becky now, he said. The next moment the master faced the school. Every eye sank under his gaze. There was that in it which smote even the innocent with fear. There was silence while one might count ten, the master was gathering his wrath. Then he spoke:

"Who tore this book?"

There was not a sound. One could have heard a pin drop. The stillness continued; the master searched face after face for signs of guilt.

"Benjamin Rogers, did you tear this book?"

A denial. Another pause.

"Joseph Harper, did you?"

Another denial. Tom's uneasiness grew more and more intense under the slow torture of these proceedings. The master scanned the ranks of boys — considered awhile, then turned to the girls:

"Amy Lawrence?"

A shake of the head.

"Gracie Miller?"

The same sign.

"Susan Harper, did you do this?"

Another negative. The next girl was Becky Thatcher. Tom was trembling from head to foot with excitement and a sense of hopelessness of the situation.

"Rebecca Thatcher?" Tom glanced at her face—it was white with terror—"did you tear—no, look me in the face" her hands rose in appeal—"did you tear this book?"

A thought shot like lightning through Tom's brain. He sprang to his feet and shouted—"*I* done it!"

The school stared in perplexity at this incredible folly. Tom stood a moment, to gather his dismembered faculties; and when he stepped forward to go to his punishment the surprise, the gratitude, the adoration that shone upon him out of poor Becky's eyes seemed pay enough for a hundred floggings. Inspired by the splendor of his own act, he took without an outcry the most merciless flaying that even Mr. Dobbins had ever administered; and also received with indifference the added cruelty of a command to remain two hours after school should be dismissed—for he knew who would wait for him outside till his captivity was done, and not count the tedious time as loss, either.

Tom went to bed that night . . . with Becky's latest words lingering dreamily in his ear—

"Tom, how *could* you be so noble!"

THE NEXT STORIES ARE ON PAGE 2213.





Culver Service

Robert Burns reading one of his poems to the guests at a fashionable house in Edinburgh in 1787.

ROBERT BURNS

THE MASTER OF THE PEOPLE'S SONGS

IT was a Scot, Robert Burns, who showed most clearly that poetry can be simple and tender and understood by a small child—yet be authentic and beautiful verse.

Inspired by deep and true feeling, the songs of Robert Burns will be remembered and sung for many a generation to come.

His writings, which have been preserved because it was believed that everything he wrote must have a value, divide themselves, on an ascending scale, into four classes.

There are the squibs and rough rimes of a clever man, who had a vulgar side to his character and liked to show off before vulgar people with less active brains. Few men have been more mixed than Robert Burns. He had gifts that place him among men of rarest genius. At the same time he had weaknesses of character which, as he said, "laid him low." A good number of his rimes prove it. Then there are his frolicsome, critical poems, amusing, satirical, sometimes bitter and perhaps publicly useful. Burns was a born satirist in one of his humors and a scorner of hypocrisy and humbug. He lived in a time when pretense abounded and he loved to lash it. This humor, in good-natured moods, led him into lively fancies less biting. The best example is the breezy rush of TAM O'SHANTER, describing a tipsy man's ride home through a witch-haunted night.

Next there is Burns in his serious mood, being a poet like other poets, and, in prose, a formal letter writer like other letter writers. On this level, he would have been a respectable sort of poet, ranking with fifty others. Many poems which he published are not distinctive, and only one of them, THE COTTER'S SATURDAY NIGHT, reveals the Burns who has won the heart of the world.

Then at last we come to his songs, and the poems which expressed his love of nature and animal life. Here he reigns alone, if intensity of feeling be the test. No other poet has ever put love into his line as often, or with such simplicity and charm, as Robert Burns.

This quality in his songs might be put to the test of a single line.

> Yestreen, when to the trembling string,
> The dance gaed through the lighted ha',
> To thee my fancy took its wing;
> I sat, but neither heard nor saw;
> Though this was fair and that was braw,
> And you the toast of a' the town,
> I sighed, and said amang them a',
> *Ye are na' Mary Morison.*

Robert Burns (1759-1796) was brought up amid simple surroundings, son of a struggling farmer who was a dreamer rather than a practical man. Gifted with great force of



The T. F. Healy Collection

Robert Burns was born in the little cottage in the middle of the picture above. It is in the little parish of Alloway, now included in Ayr, a city about thirty-five miles from Glasgow. Burns's father was a poor farmer.

mind and warm impulses, the boy found much in life to learn and to enjoy. He could not resist any adventure with a touch of romance, and his active imagination saw romance in almost everything. His special reading was the old Scottish songs which had been collected and published by Robert Fergusson and Allan Ramsay.

Burns soon felt that he could trim and reshape some of these, or write new words to the old airs, and so he was led into tinkering with songs as Shakespeare was led into tinkering with plays. Soon he began to write such songs as never were before, as Shakespeare wrote such plays as never were before. In that way came the beginning of the greatest of all song-writers; and the secret of Burns's success, after he had mastered the art of composition, was the deepness of the feeling he was trying to express. He succeeded by the direct simplicity of his outpoured feeling where more elaborate expression would have failed. Who can fail to respond to such an ecstasy of feeling as this outburst?

She is a winsome wee thing,
She is a handsome wee thing,
She is a bonny wee thing,
This sweet wee wife o' mine.

The world's wrack we share o't,
The warstle and the care o't,
Wi' her I'll blithely bear it,
And think my lot divine.

The whole Burns family was unfortunate with farming, though the children as well as the father worked hard. Robert was the eldest son. Such spare time as he had spent in study, in writing poetry, in love-making, and, as he grew older, in seeking society where his conversational powers would be admired. Unfortunately in this circle hard drinking was regarded as a permissible amusement. It was a dangerous life for a man who plunged into whatever he was doing with a wholehearted impulsiveness. He was not deceived about himself. He knew his own weakness of will, and how he gave way to the whim of the moment. He wrote his own epitaph with severe unerring justice.

Is there a man whose judgment clear
Can others teach the course to steer,
Yet runs himself life's mad career
Wild as the wave?
Here pause, and, through the starting tear,
Survey this grave.
The poor inhabitant below
Was quick to learn and wise to know,
And keenly felt the friendly glow
And softer flame;
But thoughtless follies laid him low
And stained his name.
Reader, attend! Whether thy soul
Scars fancy's flights beyond the pole,
Or darkling grubs this earthly hole
In low pursuit;
Know, prudent, cautious self-control
Is wisdom's root.

Robert Burns had not that self-control at any time in his life. The sorrowful admission must be made, however great our admiration of him may be. It was largely because of that want of wise self-command that he found himself at the age of twenty-seven in such difficulties that the only way to freedom seemed to be emigration, or, in other

words, flight. But he had a number of poems in hand, many of them among the best he ever wrote, as, for example, THE COTTER'S SATURDAY NIGHT, the ADDRESS TO A DAISY uprooted by his plowshare, and the ADDRESS TO A MOUSE, whose nest he had destroyed. His friends urged him to publish them before he sailed for Jamaica, which was his intended destination. There was the chance that he might make a little much-needed money. And so, at Kilmarnock, Scotland, he published his first collection of verse in 1786.



Photo from Brown Brothers
One of the best-known pictures of Burns.

It was one of the great immediate successes of English literature. It brought him $2,500. Today one single copy of that edition would sell for more money. Burns was at once famous throughout his native land. He was invited into the best society in Edinburgh as the literary lion of the season, the plowman-poet. He seemed in no way out of place in the literary society of the capital.

Of course, the idea of emigration had now vanished, but his future was not yet clear. No suitable public appointment that would make him independent and give him leisure and opportunity to develop his undoubted genius was offered to him. Soon many of his fine friends fell away, and he returned to his unsatisfactory farming, where the old familiar temptations once more surrounded him. Presently, however, Burns obtained an appointment in the Customs which allowed him to keep up farming, but the two interests clashed, and from 1791 he relied for a living on his Customs appointment, which now stationed him at the town of Dumfries. He was still writing, chiefly the songs that have made him famous, shaping them to fit old Scottish melodies. Shortly before he went to Dumfries he wrote TAM O'SHANTER, which many have regarded as his best poem. Certainly it is the most vigorous. Customs inspection was about the worst work that Burns could have undertaken, for it led him where social drinking was encouraged.

The poet did not get the promotion that might have been expected, possibly because he was outspoken in his public opinions. These favored the principles of the French Revolution and the reforms in Great Britain which those in authority regarded with a vague dread. Dissatisfied and downhearted, he gave way to intemperance, lost his health, and died at the early age of thirty-seven. More than ten thousand people, rich and poor, great and humble, young and old, followed his coffin to the grave. Few poets have been more beloved by their fellow-countrymen.

His is a tragic life. If he had only had a little more self-control and if suitable work could have been found for him, his undoubted genius might have grown and developed. No one has felt more truly the beauty to be found in poor and simple lives, or has expressed it with quite such genuine clearness and sincerity. No lover has written more passionately to his lady. No manlier man than Burns has ever used a pen, when he was in his inspired mood. Who has gone straighter to the mark than he in his swinging lines "A man's a man for a' that"?

Is there, for honest poverty,
  That hangs his head, and a' that;
The coward slave! We pass him by,
  We dare be poor for a' that!
  For a' that, and a' that,
  Our toil's obscure, and a' that,
The rank is but the guinea's stamp,
  The man's the gowd, for a' that.

A prince can mak a belted knight,
  A marquis, duke, and a' that;
But an honest man's aboon his might,
  Guid faith he mauna fa' that!
  For a' that, and a' that,
  Their dignities, and a' that,
The pith o' sense, and pride o' worth
  Are higher rank than a' that.

Then let us pray that come it may,
  (As come it will for a' that),
That sense and worth o'er a' the earth
  May bear the gree, and a' that.
  For a' that, and a' that
  It's coming yet for a' that,
That man to man, the warld o'er
  Shall brothers be, for a' that.

Burns was one of the most tender-hearted of men. His sympathy was wide enough to



Culver Service

The poet and his bonny Jean.

include animals and even flowers among his circle of friends. Take his feeling toward the field mouse he had disturbed with his plow.

I'm truly sorry man's dominion
Has broken Nature's social union,
And justifies that ill opinion
  Which makes thee startle
At me, thy poor, earth-born companion,
  An' fellow mortal!

Or take his apology to the uprooted daisy.

Wee, modest, crimson-tippèd flower,
Thou's met me an evil hour;
For I maun crush amang the stoure
  Thy slender stem;
To spare thee now is past my power,
  Thou bonnie gem.

Nay, his heart is big enough to hold a kind sentiment for Satan himself with whom he has been remonstrating.

But fare you weel, auld Nickie-ben!
O wad ye take a thought an' men'!
Ye aiblins might—I dinna ken—
  Still hae a stake.
I'm wae to think upon yon den
  Even for your sake!

But best of all is his speech straight from the heart to the heart.

My luve is like a red, red rose,
  That's newly sprung in June;
My luve is like the melody,
  That's sweetly played in tune.

As fair art thou, my bonnie lass,
  So deep in luve am I;
And I will luve thee still, my dear,
  Till a' the seas gang dry.

Till a' the seas gang dry, my dear,
  And the rocks melt wi' the sun;
I will love thee still, my dear,
  While the sands o' life shall run.

And fare-thee-weel, my only luve!
  And fare-thee-weel a while!
And I will come again, my luve,
  Though it were ten thousand mile.

Or this from one of the world's best-known songs:

We twa hae run about the braes
  And pu'd the gowans fine,
But we've wandered many a weary fit
  Sin' auld lang syne.

We twa hae paidl't i' the burn
  Frae mornin' sun till dine;
But seas between us braid hae roared
  Sin' auld lang syne.

And here's a hand, my trusty fiere,
  And gie's a hand o' thine;
And we'll tak a right guid willie-waught
  For auld lang syne.

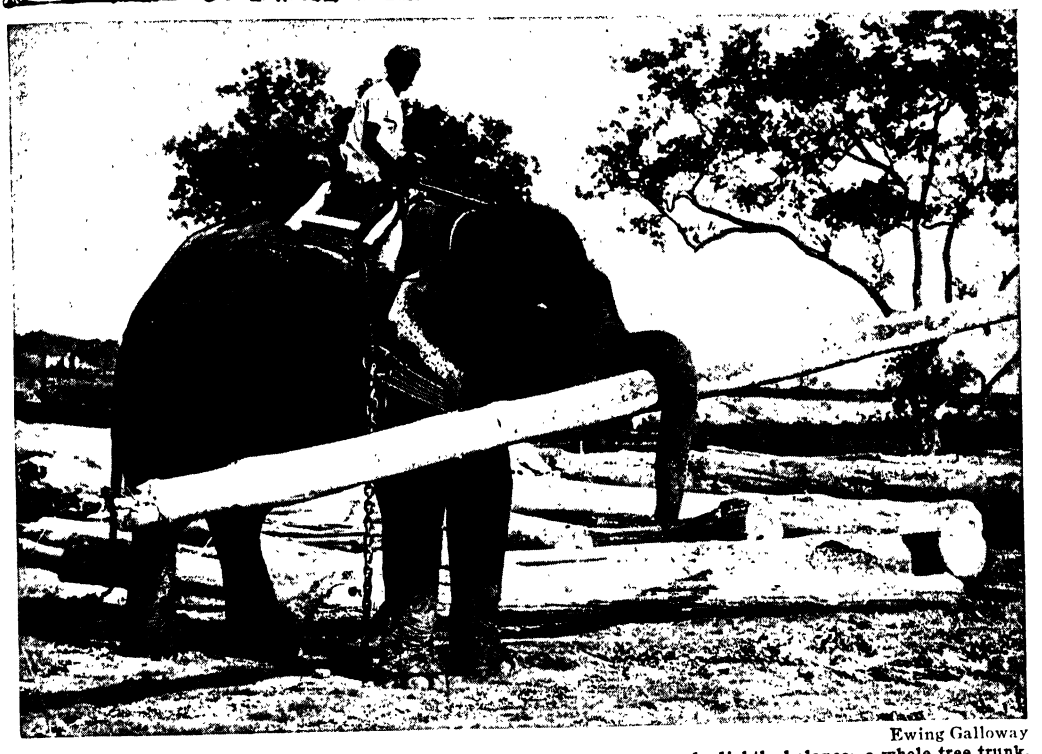
And surely ye'll be your pint-stowp,
  And surely I'll be mine,
And we'll tak a cup o' kindness yet
  For auld lang syne.

Such wealth of simple song is not to be found elsewhere, so fresh and impassioned. It brings poetry in its purest form into life, and appeals straight to the heart.

Criticism is out of place in the presence of the finer songs of Robert Burns. An attempt to find flaws is baffled by the quick response of the human heart everywhere to the plowman-poet's manly tenderness. Burns has said, with a simplicity and grace unequaled, what everyone who has felt the thrills of love and friendship and kinship with nature has felt but could not say. So all who know him are his grateful debtors, and all who do not know him are the poorer for their lack of his acquaintance.

And so it comes about that we feel a sense of ungraciousness in making any reference to the parts of his life that show disappointment and failure. As a poet he is by far the greatest of the Scots. And surely that is enough.

THE NEXT STORY OF LITERATURE IS ON PAGE 2253.



Ewing Galloway

An elephant in a teak forest of Burma shows his strength and cleverness as he lightly balances a whole tree trunk.

ELEPHANTS AND HYRAXES

NOW we come, in our study of animal life, to a strange and interesting order of hoofed mammals, the Proboscidea. The order includes those hoofed mammals that have a proboscis, or long, tube-like appendage in front. We call the appendage a trunk. Everybody knows the elephant with its trunk. The order Proboscidea takes in elephants and their ancestors, the mammoths and the mastodons, and others.

The elephant is wonderful in many respects. Its long, flexible trunk is extremely useful, for it serves as a kind of hand and arm, strong, yet capable of delicate "fingering," too. The trunk is really a prolonged upper lip and nose. The two nostrils run the whole length of it; they are surrounded by a marvelous construction of muscles. The trunk is tough on its outer side, so tough that the animal can push heavy things over with it; but it is delicate on its under side, and the animal is careful not to deliver too hard a blow, when using the trunk as a striking weapon. It is not used for eating, of course, though you sometimes hear it said that a baby elephant takes its milk through the trunk. That is not true. An elephant does draw water up its trunk and then squirts the water into its mouth. Grains and similar food it may take in the same way.

The elephant's eyes are small, and its vision is poor; but it has wonderfully acute senses of hearing and smell.

The elephant is the biggest land animal today, and probably very few animals ever lived that were bigger. The elephant's great size is possible because the heavy body is well supported on massive, strong, straight legs, ending in broad feet with pads on the soles which cushion the beast from the shock of its own weight. The number of toes varies with the groups, as we shall see. The skin of the elephant is thick and tough and lies in loose folds in places. You will hear elephants called "pachyderms." That word is from Greek words for thick and skin.



British Information Service

A combination of old and new—an elephant pulling a modern steel plow through the mud of Ceylon's rice paddies. In many Eastern countries, some forms of agriculture are largely dependent on the labor of these great beasts.

The elephant's teeth are very strange. There are no front teeth, or incisors, at all; but two front teeth, the second upper incisors, grow out in the form of tusks. The tusk material is hard dentine, and has been valued by man since early days. You know it as ivory. The elephant's grinding teeth, or molars, come in, one after another as though they were on the rim of a wheel. Each tooth, as it wears away, travels forward in the jaw, and finally drops out and the one next behind moves upward and forward to take its place. If the animal lives out its normal life, six such teeth follow such a course on each side of the upper and lower jaws. These teeth are flat on top, with fifteen or twenty small ridges of hard enamel crossing them.

Elephants spend much of their lives in eating. They eat grass, but seem to prefer leaves and twigs, and often break down good-sized trees in order to reach the foliage. They rest generally through the heat of the day. Their usual gait is a walk, and they can travel many miles in a night. When in a hurry, they shuffle along at a good clip; but they never gallop. They are able to go up and down steep banks which a horse would be unable to climb; but they can not jump, so a ditch too wide for them to step across will confine them. They love water, and bathe and splash with every sign of enjoyment.

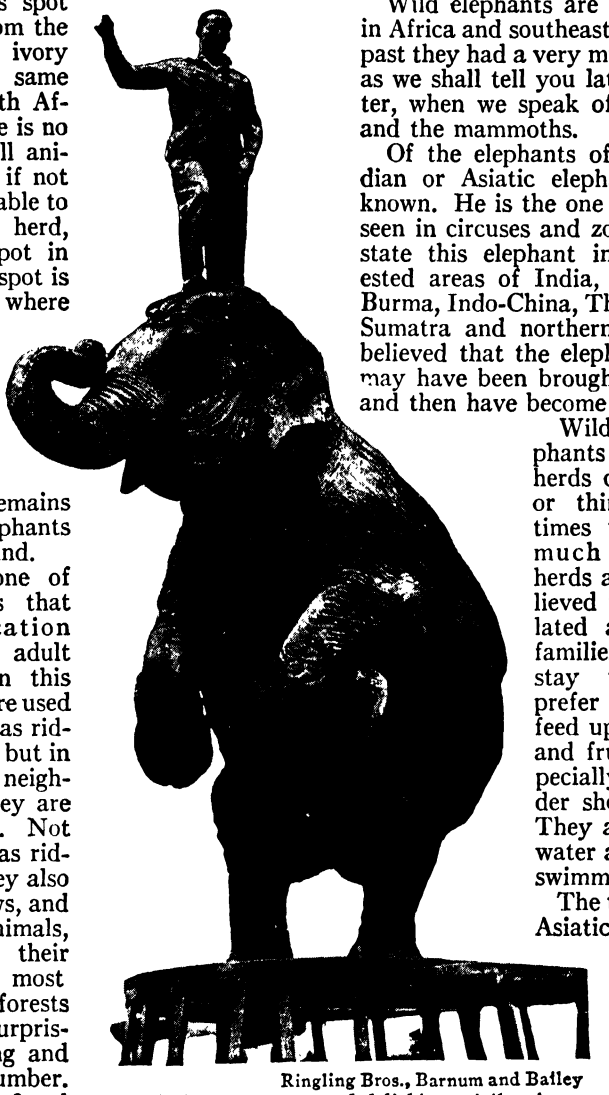
A mother elephant has one young at a birth. The babies are often covered with coarse black hair. Their little trunks, which are only about a foot long, hang limply down, for the baby does not have the muscular control of its trunk until it is older.

The mother takes good care of her baby, nursing it on milk for its first two years, and tenderly watching over the young one for two years more.

The age to which elephants live is often overestimated. Elephants reach maturity when they are from 12 to 14 years old, but they will grow considerably in size for a number of years after that. There is a record of an elephant in India which lived in the government service until she was over 80 years old, but this is exceptional. An elephant shows its age when it reaches 50 years and may then be considered an old animal. Occasionally one will live for 60 years. The span of an elephant's life, is, therefore, less than that of a man's. Circuses often used to exaggerate the age of one of their elephants; but as the elephant may have been caught

in the wild and changed hands many times, the true age of an elephant was seldom known.

Another myth often told is about an "elephant's graveyard," where all the elephants of a district go to die. The story says that anyone finding this spot can become rich from the great quantity of ivory found there. The same story is told in both Africa and Asia. There is no truth in it. Like all animals, the elephant, if not feeling well, and unable to keep up with the herd, finds a secluded spot in which to die. This spot is often in thick cover where vines and other vegetation will soon grow over the bones left by the animals, birds and insects after they have eaten the meat. The remains of single dead elephants have often been found.



Ringling Bros., Barnum and Bailey
Trained elephants amaze and delight us at the circus.

Elephants are one of the few mammals that take to domestication even if they are adult when captured. In this country elephants are used only in circuses, or as riding animals in zoos, but in India, Burma and neighboring countries they are put to many uses. Not only are they used as riding animals, but they also draw carts and plows, and are used as pack animals, carrying loads on their backs. They are most useful in the teak forests where they show surprising skill in handling and piling logs and lumber. The bulls are better fitted for this kind of work than the cows because they have the advantage of having tusks with which to carry the logs. They show great skill in balancing and carrying a log on these tusks and steadying it with their trunk. Males are more likely to be dangerous than females, and therefore are not so often kept in circuses.

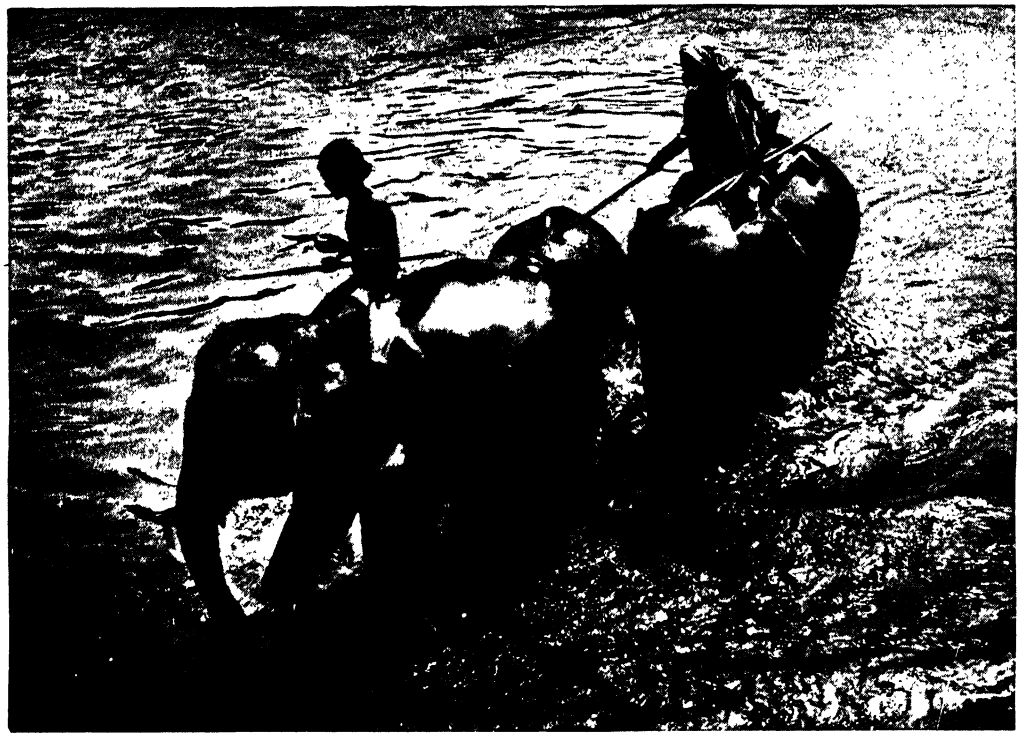
The body of an elephant is covered with short, inconspicuous, stiff hairs. In the circuses, where the elephants perform with girls, the animals are often shaved by having this hair burned off with a blow torch, so that it will not injure the girls' tender skins.

Wild elephants are now found only in Africa and southeastern Asia. In the past they had a very much wider range, as we shall tell you later in this chapter, when we speak of the mastodons and the mammoths.

Of the elephants of today, the Indian or Asiatic elephant is the best known. He is the one most frequently seen in circuses and zoos. In the wild state this elephant inhabits the forested areas of India, Ceylon, Assam, Burma, Indo-China, Thailand, Malaya, Sumatra and northern Borneo. It is believed that the elephants of Borneo may have been brought there by man and then have become wild again.

Wild Asiatic elephants go about in herds of about twenty or thirty, but sometimes these herds are much larger. These herds are generally believed to consist of related animals, as the families are inclined to stay together. They prefer thick cover, and feed upon grass, leaves and fruits, and are especially fond of the tender shoots of bamboo. They are very fond of water and are excellent swimmers.

The tusks of the male Asiatic elephant sometimes grow to a large size, the record being about 9 feet, 10 inches long. A single tusk has weighed more than 160 pounds. The females have very small tusks which do not project beyond the lips. Large male Asiatic elephants may reach a height of about 9 feet, and rarely 10 feet. The females are about a foot less. A large male will weigh about 3½ tons, but there are records of some which weighed more than 6 tons.



James Sawders

Crossing a river in Ceylon is no great task for these elephants. They love the water, and will frolic in it much as people do. And they "wash each other's backs," squirting water through their trunks.

Indian elephants have seldom been bred in America. The first baby elephant born in the United States was at Philadelphia in 1880. This calf weighed about 214 pounds when born, and was 2 feet, 11 inches high. The second recorded birth in America was at Bridgeport, Connecticut, in 1882. In 1912 a calf was born to one of the elephants in the herd belonging to the Sells Floto Circus. The mother was named Alice, and between the years 1912 and 1918 she became the mother of four calves whose weight at birth ranged between 160 and 180 pounds.

In India and Burma elephants breed more readily in captivity, but not in sufficient numbers to supply the demand for working animals. Wild elephants are caught with the aid of domesticated animals. A large stockade, or keddah, is made from the trunks of trees; or sometimes, instead of a stockade, a deep ditch is dug, over which the animals can not pass. Into the trap the herd is driven. The elephants wanted are selected from the herd, and with the help of tame elephants they are tied to trees or posts. After a few days of this confinement, and with careful handling, the elephants quiet down so that they may be tied to the tame elephants and led away. In a few months' time the animal is tamed and trained and becomes a fully domesticated elephant.

The African elephant differs in appearance from the Asiatic, or Indian, in a number of ways. The great ears of the African elephant are about three times the size of those of the Asiatic. As a general rule, the Asiatic elephant has five toes on the forefoot and four on the hind, while the African has but three toes on the hind foot. There is a finger-like process on both the front and hind edges on the tip of the trunk of the African elephant, while the Asiatic has this process only on the front edge. The female African elephants carry tusks. These are generally smaller than those of the males, but a cow with a tusk 5 feet, 10 inches has been recorded. The African elephant is a taller animal than the Indian, several specimens over 11 feet having been measured. The African males usually have larger tusks than those of the Asiatic bulls. The record tusk is 11 feet, 5½ inches. The heaviest tusk ever recorded was 10 feet, 2½ inches long and weighed 226 pounds.

The African elephant at one time ranged over much of that continent but has been so extensively hunted for its ivory that it is now rare in much of the territory where it was once common. In Cape Province, South Africa, it has been exterminated except for a small herd in the Addo Bush near Port Elizabeth. This is now a National Park, and the elephants are protected there. In Equatorial Africa the elephant has fared better, and, thanks to protecting laws, it is holding its own. In some sections, especially in Uganda, the elephant is still numerous, but males with exceptionally large tusks are rare.

African elephants are found in many kinds of country, from mountain forests, where they are sometimes found at an altitude of over 10,000 feet, to semi-desert land. There are two distinct types of African elephants, the common, large kind, with large ears, and the forest elephant which inhabits the rain forests along the west African coast from Sierra Leone south to northern Angola and eastward throughout most of the Congo River basin. It seldom comes out into the open. It is a smaller animal, an 8 foot male being exceptionally large, although individuals have been recorded up to 9 feet, 7 inches. The ears are smaller and more circular than are those of the common African elephant. The tusks are generally smaller and more slender. The forest elephant generally has four toes on the hind foot, like the Indian, although this is not always the case.

You may have heard stories about pigmy elephants. Probably no true pigmy exists. The few animals that have been exhibited as pigmies have proved to be young bush elephants, and those that lived continued to grow. The original "pigmy" elephant, the one that is used as the type, was purchased by the New York Zoological Park from the German animal dealer, Carl Hagenbeck. He was 3½ feet high and weighed about 600 pounds, and was thought to be a full-grown animal. However, he continued to grow, and at the time of his death, about ten years later, he stood 6 feet, 8 inches high, and weighed 2,700 pounds. During the last few years of his life, he was badly crippled, and that may have retarded his growth. Wild, adult males of the forest elephant often stand only 7 feet, so this animal could hardly be called a pigmy. Other captive elephants, classed as pigmy, have either died when still young, or have continued growing.

You may hear it said that the African



Ava Hamilton

There are two types of African elephants. One has large, fan-like ears.

elephant can not be trained for service to man as can the Asiatic or Indian. That is not true. Jumbo, the most famous of all elephants, was an African elephant. At Gangara-na-Bodio, in the northeastern Belgian Congo, the Belgian Government has an elephant farm and school where wild African elephants are caught and trained. These animals are trained chiefly for farm work, such as pulling carts and plows and removing stumps. There is practically no lumbering in the region, so the animals are not needed for such work. The elephants appear to learn as quickly and to prove just as intelligent as the Asiatic ones.

African elephants were used in warfare as early as the third centry B.C. The Carthaginians used numbers of them in the Punic Wars, and in 218 B.C. Hannibal used thirty-seven elephants when he crossed the Alps in his effort to conquer Rome.

JUMBO, THE WORLD'S MOST FAMOUS ELEPHANT

Jumbo is undoubtedly the best-known elephant that ever lived. In 1861 he was captured as a baby in Abyssinia (Ethiopia). At that time he was only 3½ feet tall. He was shipped to Paris where he remained in the Zoological Gardens for three years. He was then transferred to the London Zoological Gardens, and was used for a riding animal, countless numbers of children riding on his back. He became very popular with the boys and girls of England. He was in London seventeen years, growing all the time, until he was so big that P. T. Barnum, American circus man, became interested. He paid $10,000 for the great creature, and brought him to the United States in 1882. As you can imagine, the children of England were filled with sorrow when their friend sailed away.

In the United States and Canada, Jumbo was placed on exhibition, and he became very famous. His life in America was short, however, for after three years of travel with the Barnum circus he was struck and killed by a locomotive as he was being loaded on a train at St. Thomas, Ontario. At his death, Jumbo was about twenty-five years old. His skin was mounted and sent to Tuft's College, Boston, Massachusetts, and his skeleton is mounted in the American Museum of Natural History in New York. There has been much controversy about Jumbo's actual height. He was advertised as 11½ feet tall, but the taxidermist who mounted his skin found his height to be, by actual measurement, 10 feet, 9½ inches.

Now let us consider briefly the elephants of the past, the mastodons and the mammoths. There are none of these great beasts today, yet we know a good deal about them, since many fossil remains have been found. This is the story as it has been pieced together. The Proboscidea seem to have originated in Africa, and for a very long time they remained on that continent; but some of the forms finally moved north into Europe and Asia and spread out over those two continents.

ELEPHANT STEAK— THOUSANDS OF YEARS OLD!

Later two groups, the mastodon and the mammoth, crossed over the land that once connected Asia with North America at Bering Strait, and spread over the Western Hemisphere, some going as far south as Bolivia and Argentina. So you see, these ancient relatives of the elephants once roamed over the very country in which we are now living.

The mammoths are much closer relatives of the elephants than the mastodons. The Siberian, or northern, mammoth is the best known. Several complete animals have been found in a frozen condition, in the icy gravel of northern Siberia. These animals were in such good state of preservation when they were found that bears and wolves had been feeding upon their flesh, and the inhabitants of that country had been using the meat as food for their dogs. Try and imagine the wonder of such a thing—the animals had been lying there for thousands of years—yet their flesh was still edible, so well preserved it was by the cold! In 1901 one of the specimens was brought to St. Petersburg, now Leningrad, and mounted. Much of the original skin of this animal could be used in the mounting, and although the hair came off the skin, a great deal of it was fastened back on. The longest hair in this shaggy coat was about eighteen inches long. There was also a thick, woolly underfur, in places two inches long. In color it was a deep rusty brown.

In North America the range of this mammoth was from northern Alaska to New England; and remains have been found as far south as Florida. It was very common in Alaska, and great numbers of mammoth's tusks have been found there.

The Columbian mammoth had a more southern range, being most common in the southeastern United States. Close relatives

were found on the Pacific coast and in the Mississippi Valley.

The largest of our mammoths was the Imperial mammoth and its relatives. It stood as much as fourteen feet high, taller than any of the elephants of today. The Imperial mammoth liked a warm climate; fossils have been found from Oregon south along the Pacific coast to Texas, Mexico, and east to Florida.

It is a known fact that mammoths still roamed this earth when mankind was young.



Photo from European

A gorgeously attired elephant carrying Indian dignitaries to a conference, during World War II.

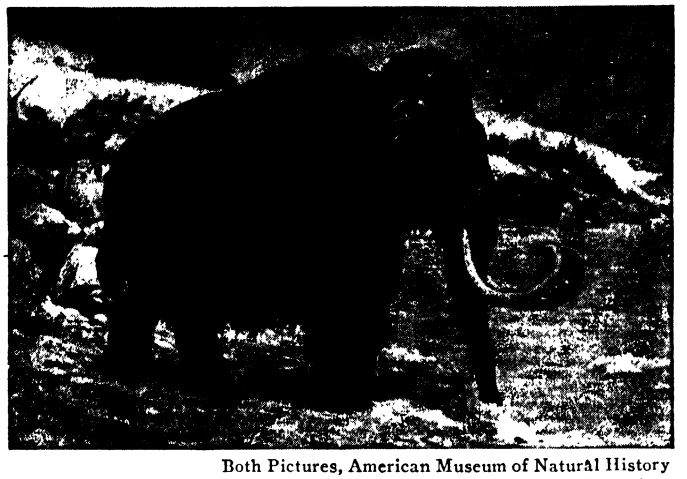
Figures of mammoths have been found carved on the walls of caves inhabited by man. Figures have been found carved on the tusks of the animals themselves. The mammoths carried huge tusks which sometimes reached a length of sixteen feet; they generally had a sweeping curve, the points sometimes crossing each other at the ends. The structure and growth of the teeth of mammoths resembled the elephants'.

The mastodon grew first and second sets of teeth in about the same way as ourselves; that is, the second teeth did not travel forward in the mouth, but were rooted to the spot where they came up. The three or four ridges on a mastodon's tooth (we have many fossils) look very much like the teeth of a saw when viewed from the side. There are deep valleys between the ridges, with a much lesser valley between the outside and inside cusps, or points.

As the formation of the teeth would indicate, the mastodons were browsing animals, and chewed-up twigs of evergreen trees have been found with their remains. They appear to have been especially fond of hemlock and spruce, and were undoubtedly forest-living animals. They had long, parallel tusks with a moderate upward curve; as the males grew older, the tusks became larger and heavier and acquired a greater upward curve.

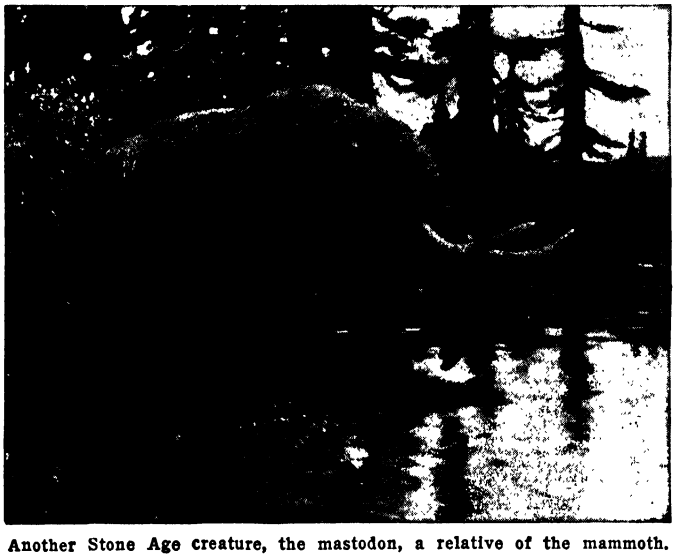
The best known of the mastodons is the American mastodon which once inhabited North America, Siberia and Russia. It was common in the central and eastern United States, and several entire skeletons have been recovered. The most famous of these is known as the Warren mastodon. It was discovered in 1845 near Newburgh, New York, and is now in the American Museum of Natural History, New York City. There are more American mastodon remains found in the eastern United States than there are remains of any other elephant-like mammals. These mastodons were about the size of a small, full-grown Indian elephant.

The long-jawed mastodons, which were found in both hemispheres, differed from the true mastodons in having very long lower jaws with short, stubby lower tusks



Both Pictures, American Museum of Natural History

The woolly mammoth roamed over much of the earth during the Stone Age.



Another Stone Age creature, the mastodon, a relative of the mammoth.

and upper tusks that were nearly straight.

The hyrax, or dassie, is an interesting small mammal found throughout most of Africa. It is also found in Sinai, Palestine, Syria and Arabia, and is the coney of the Bible. This little animal has the size and general appearance of a short-eared rabbit, although it is classified with the hoofed animals. It differs from any of the other hoofed animals, and is consequently placed in an order by itself, the Hyracoidea. Fossil remains show that at one time its ancestors were much greater in size, being about as large as a good-sized pig. Some of these early ancestors had characteristics of both the hyraxes and the elephants, showing that these small creatures and the large elephants are distantly related.

There are pads on the soles of the feet of the hyraxes, so constructed that the animals are able to climb steep rocks and even to climb trees without slipping. The toes, four on the front foot and three on the hind foot, end with rounded, blunt nails, or hoofs. Hyraxes are divided into two groups, the rock hyraxes, animals living on the ground, which seek safety among the rocks; and the tree hyraxes, which, as their name implies, spend their lives among the branches of trees.

Hyraxes are generally brownish gray, but the different forms may run from buff to a very dark brown or black, and there is great individual variation between different animals of the same form. There is a gland in the center of the back, surrounded by a spot of yellow or white hairs. In some forms this spot is barely visible, but on others it is very conspicuous.

Hyrax skins are often sewed together to form large blankets, or karrosses. A hyrax karrosse can easily be identified by the light spot in the center of the back of each skin. Baby hyraxes, two to four in each litter, are born with their eyes open and are able to run about soon after birth.

The rock hyraxes are never found away from the protection of their rocky home. Throughout much of Africa, wherever there is a large outcropping of rocks, affording numerous crannies and holes where the animals can hide, one is likely to find a family of these animals. I have seen them in South Africa along the rocky shores of the ocean where the animals were often wet by the spray of the sea; I have seen them high in the mountains at an altitude of over 10,000 feet, but always among the rocks.

While encamped on the shores of Lake

Abaya, in southern Ethiopia, I had a good opportunity to study a colony of rock hyraxes. Our camp was pitched at the foot of a steep mountain cliff not far from great heaps of rocks that had broken from the mountain side. The mountain side itself was the home of baboons and klipspringers, but the hyraxes lived among the pile of boulders at the base.

Upon approaching the rock pile early one morning, I saw hyraxes running about, but as I drew nearer, the animals disappeared into the holes among the rocks, for their eyes are keen and they are timid. I concealed myself in some brush growing among the boulders, and waited. Soon I heard a squeal, and a head appeared. The head remained motionless for some time. One by one, other heads peered out. Some of the more venturesome little creatures came out and sat very still on the rocks in front of their holes. More appeared, and soon they were all out, some feeding on the grass and leaves growing between the stones, others hunched up like little balls, and still others stretched out in the sun. The young ones chased each other around the rocks, playing like puppies. I could hear their faint squeals.

Suddenly a movement in the undergrowth on the cliff above caught my eye. A leopard, his attention fixed on the hyraxes, was working his way down toward the group. The leopard spied me a moment after I had seen him. He stood stock-still for an instant, then made off. It was very evident that he had been planning on a hyrax for his breakfast. The fact that baboons and klipspringers were common in the locality may have been the reason for his coming, but when he found none of these he had decided that a hyrax would be better than nothing. Leopards are not the only enemies of the hyraxes, for I noticed that when one of the large eagles that were common in that district sailed into view, the animals would stop whatever they were doing and remain motionless. In case the bird came close the hyraxes would dive for cover.

Tree hyraxes differ from rock hyraxes not only in their habit of living in the trees, but also by their voices. A rock hyrax is a comparatively quiet animal, but this can not be said about its cousins living in the trees. If you camp in the forest inhabited by these animals, shortly after sundown you are likely to hear a peculiar chucking noise, gradually swelling in volume until it reaches a series of shrill, tremulous screams. It is indeed startling. This call will be answered by another from a neighboring tree, then another, and another, until a great number of hyraxes are screaming. The noise is likely to continue throughout the early part of the night, making sleep impossible until one becomes accustomed to it. Anyone unfamiliar with the sounds of the African forest during the night would have a hard time believing that a noise of such great volume could be coming from such small animals.

Tree hyraxes are more solitary than the rock hyraxes. Usually but a single individual is found in a tree. The animals prefer the larger trees of the forest and seldom come to the ground. They are nocturnal, feeding on the leaves of the trees during the night, and spending the daylight hours asleep, hidden among the foliage or else in a hollow in the trunk or large limb. They have fewer young than the other hyraxes, one or two being the usual number in a litter. Like the rock hyraxes, these young are born with their eyes open and are able to run about very soon after birth. Even if caught when adult, they often become very tame, allowing themselves to be freely handled. They make interesting pets, for they are continually climbing about. In this they differ from the rock hyraxes, which, even if caught young, seldom get over a tendency to bite.

By T. DONALD CARTER.



New York Zoological Society

These shy little hyraxes, mother and child, stay close to home. It is hard to believe that they are related to the elephants.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 2341.



SHIPS AND THE SEA

Illustrated by Lynd Ward

Ships That Pass in the Night

From TALES OF A WAYSIDE INN

By HENRY WADSWORTH LONGFELLOW (1807-1882)

SHIPS that pass in the night and speak
each other in passing,
Only a signal shown and a distant voice in
the darkness;
So on the ocean of life, we pass and speak
one another,
Only a look and a voice, then darkness again
and a silence.

The Sands of Dee

By CHARLES KINGSLEY (1819-1875)

"O MARY, go and call the cattle home,
And call the cattle home,
And call the cattle home
Across the sands of Dee!"
The western wind was wild and dank with
foam,
And all alone went she.

The western tide crept up along the sand,
And o'er and o'er the sand,
And round and round the sand,
As far as eye could see.
The rolling mist came down and hid the land:
And never home came she.

"Oh! is it weed, or fish, or floating hair—
A tress of golden hair,
A drownèd maiden's hair
Above the nets at sea?
Was never salmon yet that shone so fair
Among the stakes on Dee."

They rowed her in across the rolling foam,
The cruel crawling foam,
The cruel hungry foam,
To her grave beside the sea:
But still the boatmen hear her call the cattle
home
Across the sands of Dee!

The Inchcape Rock

By ROBERT SOUTHEY (1774-1843)

NO stir in the air, no stir in the sea,
The ship was still as she could be;
Her sails from Heaven received no motion,
Her keel was steady in the ocean.

Without either sign or sound of their shock,
The waves flowed over the Inchcape Rock;
So little they rose, so little they fell,
They did not move the Inchcape Bell.

The holy Abbot of Aberbrothok
Had placed that bell on the Inchcape Rock;
On a buoy in the storm it floated and swung,
And over the waves its warning rung.

When the rock was hid by the surges' swell,
The mariners heard the warning bell;
And then they knew the perilous Rock,
And blessed the Abbot of Aberbrothok.

The sun in heaven was shining gay,
All things were joyful on that day;
The sea-birds screamed as they wheeled
around,
And there was joyance in their sound.

The buoy of the Inchcape Bell was seen,
A darker speck on the ocean green;
Sir Ralph, the Rover, walked his deck,
And he fixed his eye on the darker speck.

He felt the cheering power of spring,
It made him whistle, it made him sing;
His heart was mirthful to excess;
But the Rover's mirth was wickedness.

His eye was on the Inchcape float;
Quoth he, "My men, put out the boat;
And row me to the Inchcape Rock,
And I'll plague the Abbot of Aberbrothok."

The boat is lowered, the boatmen row,
And to the Inchcape Rock they go;
Sir Ralph bent over from the boat,
And cut the Bell from the Inchcape float.

Down sank the Bell with a gurgling sound;
The bubbles rose, and burst around.
Quoth Sir Ralph, "The next who comes to the Rock
Will not bless the Abbot of Aberbrothok."

Sir Ralph, the Rover, sailed away,
He scoured the seas for many a day;
And now, grown rich with plundered store,
He steers his course for Scotland's shore.

So thick a haze o'erspreads the sky
They cannot see the sun on high;
The wind hath blown a gale all day;
At evening it hath died away.

On the deck the Rover takes his stand;
So dark it is they see no land.
Quoth Sir Ralph, "It will be lighter soon,
For there is the dawn of the rising moon."

"Canst hear," said one, "the breakers roar?
For yonder, methinks, should be the shore."
"Now where we are I cannot tell,
But I wish we could hear the Inchcape Bell."

They hear no sound; the swell is strong;
Though the wind hath fallen, they drift along,
Till the vessel strikes with a shivering shock,—
"O Christ! it is the Inchcape Rock."

Sir Ralph, the Rover, tore his hair;
He cursed himself in his despair.
The waves rush in on every side;
The ship is sinking beneath the tide.

But, even in his dying fear,
One dreadful sound he seemed to hear,—
A sound as if, with the Inchcape Bell,
The Devil below was ringing his knell.

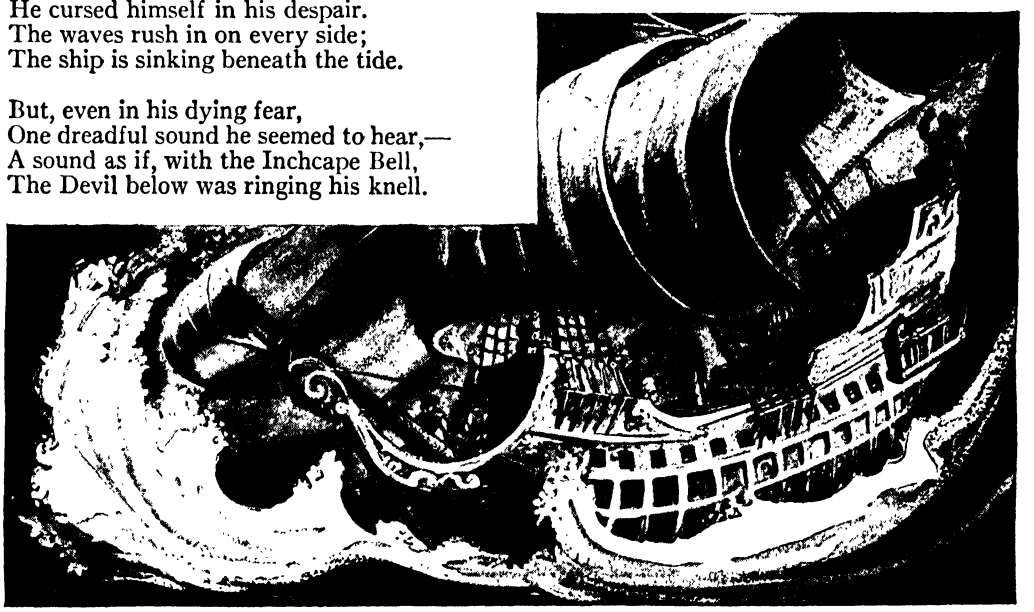
The Three Fishers

By CHARLES KINGSLEY
(1819-1875)

THREE fishers went sailing away to the West,
Away to the West as the sun went down;
Each thought on the woman who loved him the best,
And the children stood watching them out of the town;
For men must work, and women must weep,
And there's little to earn, and many to keep,
Though the harbor bar be moaning.

Three wives sat up in the lighthouse tower
And they trimmed the lamps as the sun went down;
They looked at the squall, and they looked at the shower,
And the night-rack came rolling up ragged and brown.
But men must work, and women must weep,
Though storms be sudden, and waters deep,
And the harbor bar be moaning.

Three corpses lay out on the shining sands
In the morning gleam as the tide went down,
And the women are weeping and wringing their hands
For those who will never come home to the town;
For men must work, and women must weep,
And the sooner it's over, the sooner to sleep;
And good-by to the bar and its moaning.





Dover Beach

By MATTHEW ARNOLD
(1822-1888)

THE sea is calm to-night,
The tide is full, the moon lies fair
Upon the straits;—on the French coast the light
Gleams and is gone; the cliffs of England stand,
Glimmering and vast, out in the tranquil bay.
Come to the window, sweet is the night-air!
Only, from the long line of spray
Where the sea meets the moon-blanched land,
Listen! you hear the grating roar
Of pebbles which the waves draw back, and fling,
At their return, up the high strand,
Begin, and cease, and then again begin,
With tremulous cadence slow, and bring
The eternal note of sadness in.

Sophocles long ago
Heard it on the Ægean, and it brought
Into his mind the turbid ebb and flow
Of human misery; we
Find also in the sound a thought,
Hearing it by this distant northern sea.

The sea of faith
Was once, too, at the full, and round earth's shore
Lay like the folds of a bright girdle furled.
But now I only hear
Its melancholy, long, withdrawing roar,
Retreating, to the breath
Of the night-wind, down the vast edges drear
And naked shingles of the world.

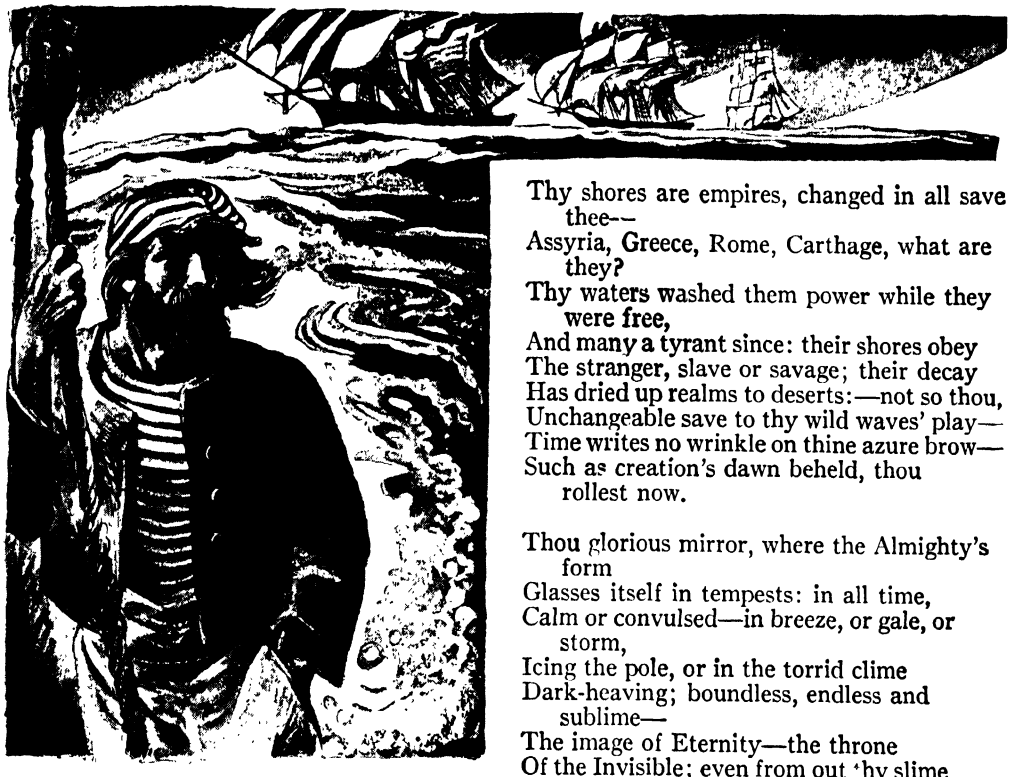
Ah, love, let us be true
To one another! for the world, which seems
To lie before us like a land of dreams,
So various, so beautiful, so new,
Hath really neither joy, nor love, nor light,
Nor certitude, nor peace, nor help for pain;
And we are here as on a darkling plain
Swept with confused alarms of struggle and flight,
Where ignorant armies clash by night.



Song for All Seas, All Ships

By WALT WHITMAN
(1819-1892)

FLAUNT out, O sea, your separate flags of nations!
Flaunt out visible as ever the various ship-signals!
But do you reserve especially for yourself and for the soul of man one flag above all the rest,
A spiritual woven signal for all nations, emblem of man elate above death,
Token of all brave captains and all intrepid sailors and mates,
And all that went down doing their duty,
Reminiscent of them, twined from all intrepid captains young or old,
A pennant universal, subtly waving all time, o'er all brave sailors,
All seas, all ships.



Ocean

From CHILDE HAROLD'S PILGRIMAGE
By LORD BYRON (1788-1824)

ROLL on, thou deep and dark blue Ocean—roll!
Ten thousand fleets sweep over thee in vain;
Man marks the earth with ruin; his control
Stops with the shore; upon the watery plain
The wrecks are all thy deed, nor doth remain
A shadow of man's ravage, save his own,
When for a moment, like a drop of rain,
He sinks into thy depths with bubbling groan,
Without a grave, unknelled, uncoffined and unknown.

His steps are not upon thy paths—thy fields
Are not a spoil for him—thou dost arise
And shake him from thee; the vile strength he wields
For earth's destruction thou dost all despise,
Spurning him from thy bosom to the skies,
And sendst him, shivering in thy playful spray,
And howling, to his gods, where haply lies
His petty hope in some near port or bay,
And dashest him again to earth—there let him lay.

Thy shores are empires, changed in all save thee—
Assyria, Greece, Rome, Carthage, what are they?
Thy waters washed them power while they were free,
And many a tyrant since: their shores obey
The stranger, slave or savage; their decay
Has dried up realms to deserts:—not so thou,
Unchangeable save to thy wild waves' play—
Time writes no wrinkle on thine azure brow—
Such as creation's dawn beheld, thou rollest now.

Thou glorious mirror, where the Almighty's form
Glasses itself in tempests: in all time,
Calm or convulsed—in breeze, or gale, or storm,
Icing the pole, or in the torrid clime
Dark-heaving; boundless, endless and sublime—
The image of Eternity—the throne
Of the Invisible; even from out thy slime
The monsters of the deep are made; each zone
Obeys thee; thou goest forth, dread, fathomless, alone.

Break! Break! Break!

By ALFRED, LORD TENNYSON
(1809-1892)

BREAK, break, break,
On thy cold gray stones, O Sea!
And I would that my tongue could utter
The thoughts that arise in me.

O, well for the fisherman's boy,
That he shouts with his sister at play!
O, well for the sailor lad,
That he sings in his boat on the bay!

And the stately ships go on,
To their haven under the hill;
But O for the touch of a vanished hand,
And the sound of a voice that is still!

Break, break, break,
At the foot of thy crags, O Sea!
But the tender grace of a day that is dead
Will never come back to me.



Off Rivière du Loup*

By DUNCAN CAMPBELL SCOTT (1862-1947)

O SHIP incoming from the sea
With all your cloudy tower of sail,
Dashing the water to the lee,
And leaning grandly to the gale,

The sunset pageant in the west
Has filled your canvas curves with rose,
And jeweled every toppling crest
That crashes into silver snows!

You know the joy of coming home,
After long leagues to France or Spain
You feel the clear Canadian foam
And the gulf water heave again.

Between these somber purple hills
That cool the sunset's molten bars,
You will go on as the wind wills,
Beneath the river's roof of stars.

You will toss onward toward the lights
That spangle over the lonely pier,
By hamlets glimmering on the heights,
By level islands black and clear.

You will go on beyond the tide,
Through brimming plains of olive
sedge,
Through paler shadows light and wide,
The rapids piled along the ledge.

At evening off some reedy bay
You will swing slowly on your chain,
And catch the scent of dewy hay,
Soft blowing from the pleasant plain.

Old Ironsides

By OLIVER WENDELL HOLMES
(1809-1894)

This poem was published in a Boston newspaper in 1830, when the famous frigate, U.S.S. Constitution, was condemned to be broken up. The poem aroused such a demand to save the ship that the Navy had her repaired and she served for many years longer. In 1937 the Constitution, or Old Ironsides, was again restored and was moored at the United States Navy Yard at Boston as an historic shrine.

AY, tear her tattered ensign down!
Long has it waved on high,
And many an eye has danced to see
That banner in the sky;
Beneath it rung the battle shout,
And burst the cannon's roar;—
The meteor of the ocean air
Shall sweep the clouds no more.

Her deck, once red with heroes' blood,
Where knelt the vanquished foe,
When winds were hurrying o'er the flood,
And waves were white below,
No more shall feel the victor's tread,
Or know the conquered knee;—
The harpies of the shore shall pluck
The eagle of the sea!

Oh, better that her shattered hulk
Should sink beneath the wave;
Her thunders shook the mighty deep,
And there should be her grave;
Nail to the mast her holy flag,
Set every threadbare sail,
And give her to the god of storms,
The lightning and the gale!

*This poem is reprinted by special permission of the author, Duncan Campbell Scott.

A Life on the Ocean Wave

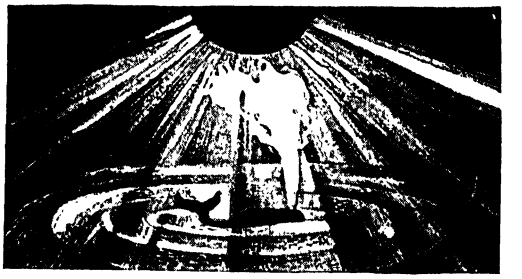
By EPES SARGENT (1813-1880)

A LIFE on the ocean wave,
A home on the rolling deep,
Where the scattered waters rave,
And the winds their revels keep!
Like an eagle caged, I pine
On this dull unchanging shore:
Oh! give me the flashing brine,
The spray and the tempest's roar!

Once more on the deck I stand
Of my own swift-gliding craft:
Set sail! farewell to the land!
The gale follows fair abaft.
We shoot through the sparkling foam
Like an ocean-bird set free;—
Like the ocean-bird, our home
We'll find far out on the sea.

The land is no longer in view,
The clouds have begun to frown;
But with a stout vessel and crew,
We'll say, Let the storm come down!
And the song of our hearts shall be,
While the winds and the waters rave,
A home on the rolling sea!
A life on the ocean wave!





Whale*

By WILLIAM ROSE BENÉT (1886-)

RAIN, with a silver flail;
Sun, with a golden ball;
Ocean, wherein the whale
Swims minnow-small;

I heard the whale rejoice
And cynic sharks attend;
He cried with a purple voice,
"The Lord is my friend!

"With flanged and battering tail,
With huge and dark baleen,
He said, 'Let there be whale
In the Cold and Green!'

"He gave me a water spout
A side like a harbor wall;
The Lord from cloud looked out
And planned it all.

"With glittering crown atilt
He leaned on a glittering rail;
He said, 'Where sky is spilt,
Let there be Whale.'

"Tier upon tier of wings
Blushed and blanched and bowed;
Phalanxed fiery things
Cried in the cloud;

"Million-eyed was the mirk
At the plan not understood;
But the Lord looked on his work
And saw it was good.

"He gave me marvelous girth
For the curve of back and breast,
And a tiny eye of mirth
To hide His jest.

"He made me a floating hill,
A plunging deep-sea mine.
This was the Lord's will;
The Lord is divine.

*Reprinted by permission of the publishers, Dodd, Mead & Co.

"I magnify His name
  In earthquake and eclipse,
In weltering molten flame
  And wrecks of ships,

"In waves that lick the moon;
  I, the plough of the sea!
I am the Lord's boon,
  The Lord made me!"

The sharks barked from beneath,
  As the great whale rollicked and
    roared,
"Yes, and our grinning teeth,
  Was it not the Lord?"

Then question pattered like hail
  From fishes large and small.
"The Lord is mighty," said Whale,
  "The Lord made all!

"His is a mammoth jest
  Life never may betray;
He has laid it up in His breast
  Till Judgment Day;

"But high when combers foam
  And tower their last of all,
My power shall haul you home
  Through Heaven wall.

"A trumpet then in the gates,
  To the ramps a thundering drum,
I shall lead you where He waits
  For His Whale to come.

"Where His cloudy seat is placed
  On high in an empty dome,
I shall trail the Ocean abased
  In chains of foam,

"Unwieldy, squattering dread;
  Where the blazing cohorts
    stand
At last I shall lift my head
  As it feels His hand.

"Then wings with a million eyes
  Before mine eyes shall quail:
'Look you, all Paradise,
  I was His Whale!' "

I heard the Whale rejoice,
  As he splayed the waves to a fan;
"And the Lord shall say with His
    Voice,
  'Leviathan!'

"The Lord shall say with His Tongue,
  'Now let all Heaven give hail
To my Jest when I was young,
  To my very Whale!' "

Then the Whale careered in the Sea,
  He floundered with flailing tail;
Flourished and rollicked he,
  "Aha! Mine Empery!
For the Lord said, 'Let Whale
    be!'
  And there was Whale!"

THE NEXT POEMS ARE ON PAGE 2241.





Courtesy, The Dromedary Company

Picking dates in Iraq. The date-palm, which bears the date, sometimes reaches a height of eighty feet.

FIGS AND DATES

AMONG all fruits there are two that stand out conspicuously for high food value. They are the date and the fig. Weight for weight, dried figs are more nourishing than bread. A pound and a half yields four-fifths of the nourishment required daily by a grown man; while half a pound of dates with half a pint of milk make a satisfying meal.

The date is really a berry, and the stone inside, unlike the stone of the plum, which is merely a hard seed-case, is the seed itself.

When the seed germinates, the reserve of food stored up in it is converted into sugar by a ferment called cytase, produced by the first green leaves of the plant. Gradually the plant forms fresh cells and increases in height, throwing out leaves; but as the stem grows, the lower leaves die, so that the tree always shows a crown of leaves on top with only the remains of former leaves below. They give the stem of the palm a rough appearance; in fact, the stem may be said to be made up largely of the remains of leaves.

When young the leaves are twisted together and matted up with loose fibers, which open as the leaf expands. Then the leaves split down to the main stalk along the folds, and a fully grown leaf, although large, offers very little resistance to the wind, so that the tree is able to stand firm in the fiercest storm.

The average date-palm grows sixty or seventy feet high; many reach eighty feet. The plant is not ordinarily propagated by seed, but by suckers that spring out of the base of the tree. The palm begins bearing fruit when seven years old, and will go on bearing for 200 years. A single tree will give from ten to fifteen clusters a season. So valuable are the trees in Iraq that they pass as wealth from father to son, and often form the dowry of a daughter. A man's social position there may be reckoned according to the number of date-palms he owns.

The date stones are ground up and form a nourishing food for camels, while the fibrous parts of the plant are made into

A CROWNED MONARCH AMONG TREES



Philip D. Gendreau, N. Y.

A date-palm at Biskra, Algeria. Date-palms have a crown of leaves above with only the remains of former leaves below. Note the shaggy appearance of the stem; it really consists largely of the remains of old leaves. Each tree gives from ten to fifteen clusters a season, and it will keep on bearing for 200 years. The date is one of the most nourishing of fruits; it forms an important article of diet for millions of people.

ropes, baskets and mats. Much of the cordage used by ships on the Red Sea is made from the fibrous part of the palm. However, the most important part of the palm tree is the fruit. It is rich in sugar and also contains proteins and pectin. (Pectin, derived from plant tissues, yields a jelly used in making fruit jellies.)

To be fully appreciated, the dates should be gathered ripe and eaten immediately, but for export or for preserving they are laid out on mats and dried in the sun. The large amount of sugar prevents them from fermenting under the process. Dates are also made into jam with sugar by the natives of Iraq. For this they are gathered before they are fully ripe.

The most remarkable thing about the date-palm is that every tree is fertilized by hand. The male and female flowers grow on different trees, and though a certain amount of pollen might be blown by the wind from the male flowers and find a lodging in the female flowers, this would be too uncertain a process where the food supply of millions of people is involved. Man must come to Nature's aid.



Philip D. Gendreau, N. Y.

A scene in the date market of Biskra, in French Algeria.

From time immemorial, therefore, it has been the practice for the cultivator to collect flowers from the male tree and, climbing to the top of the female tree, to arrange the male flowers above the blossom there, so that the pollen may fall into the female flowers.

Without this pollination by hand the date-palm will seldom bear fruit. Once during a civil war in Persia one side destroyed all the male palms to deprive the other side of food. The people on that side saved the situation by collecting and storing pollen, so that when times became quieter they were able to fertilize the female blossoms once more.

In case the male flowers should fail and there should be no pollen to fertilize the female palms, which would mean starvation over wide areas, the natives always preserve a supply from one year to another.

The date-palm thrives particularly in western Asia and northern Africa, where it is an important part of the daily food of the natives. Large quantities of dried dates are exported from these lands to other countries. The date-palm is also cultivated in other warm areas, including China, Italy, France, Spain and parts of the United States. The date industry is important in California and other southern states.

The fig is even more interesting than the date. Its life-story has become fully known only during the last century, thanks to the studies of American scientists and fruit growers when introducing the plant into California. The fig is a native of the Persian Gulf countries, and is cultivated all along the Mediterranean shore, as well as in India, Australia and California. Figs are also produced to a limited extent in South America and South Africa. The tree grows from fifteen to thirty feet high.

It is a relative of the mulberry, the banyan and the India-rubber tree. When a ripe fig is gathered, a sticky milky substance adheres to the fingers, and this is not unlike the milky fluid of the rubber tree that hardens into rubber.

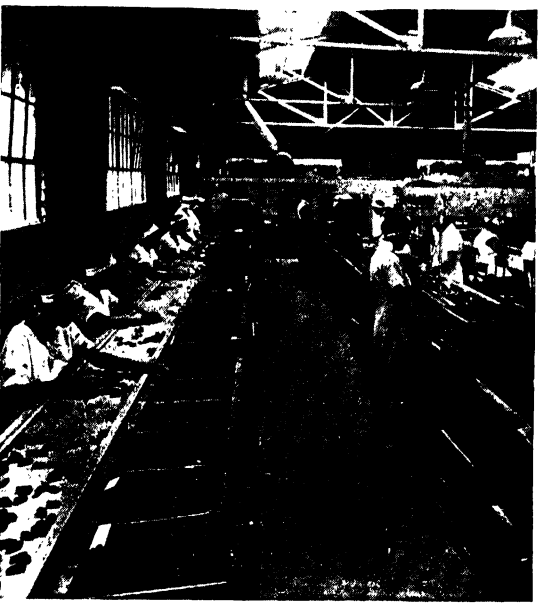
Many varieties of figs do not require cross-pollination in order to produce a crop of edible fruit (that is, fruit that can be eaten). However, in Smyrna and also in California there is produced extensively a variety

DATE-PALMS OF THE UNITED STATES



Date-palms near the city of Phoenix, in Arizona.





Photos by G. W. Ackerman—U. S. Dept. of Agriculture

Picking dates and (right) grading them in Riverside County, southern California, where the date-palm flourishes. Compare these bushy, low-growing American trees with the tall variety of date-palm grown in Iraq (page 2155).

of fig that must be pollinated by means of a tiny wasp before the fruit will develop into an edible product. In the Old World this variety is commonly known as the Smyrna fig, but in California it is known and marketed as the Calimyrna fig.

The Smyrna or Calimyrna fig is a fine, rich, sweet fruit, most delicious in its dried form. The story of this fig is truly a wonderful romance. In ancient times it was known that figs came to maturity and ripened properly only when the wild variety, called the caprifig, was grown in the same plantation as the cultivated figs; but why this should be so was a mystery, and so it remained till the end of last century. Even the Romans knew of this mystery, and one of their naturalists, Pliny, suggested that an invisible insect had something to do with it.

People sometimes refer to the fig as a fruit without a blossom, because no visible blossom develops before the fruit. As a matter of fact, the fig itself is actually a blossom or flower cluster, which, however, never blooms or opens up to form a typical blossom or flower with petals. The closed blossom itself develops into the fruit. The fig, therefore, is a very interesting botanical specimen.

In form it is constructed on the same principle as the daisy and the dandelion and the sunflower. These have hundreds of tiny florets arranged round a center, radiating to form a disc; but in the fig blossom the small flowers are drawn together to form a pear-shaped bag with the flowers inside.

In the end opposite the stalk which holds the fig to the tree is a little hole, which is called the eye of the fig. This eye is the door into the flower head. In the orchards of Turkey the cultivators plant with the Symrna fig the wild caprifig tree which produces pollen but not good fruit; and men cut off the staminate blossoms of the wild fig and hang them in the trees of the cultivated variety.

When Smyrna-fig trees were planted in California, the figs dropped off, so the grow-

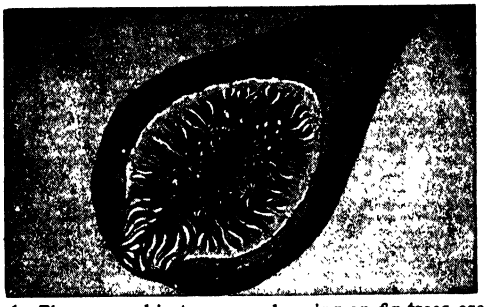




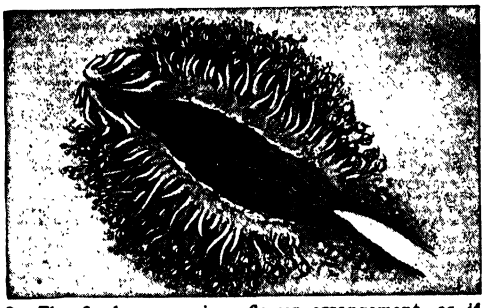
Both photos, courtesy, California Fig Institute

The lower photograph shows a typical Black Mission fig orchard in southern California. The upper picture gives a close-up view of the figs. Black Mission figs bear two crops a year in California and in other southern states.

THE STRANGE LIFE-STORY OF THE FIG



1. The green objects we see hanging on fig trees are really flower-clusters, not fruits, and this section, cut lengthwise, shows male and female flowers clustered inside.



2. The fig has a curious flower arrangement, as if we took a daisy and curled all the flowers together inside. This section of a fig, turned inside out, shows the flowers clearly.



3. The male and female flowers are on the same plant, and are clustered in the figs which we see. On the left the male flower is shown magnified; on the right is the female.



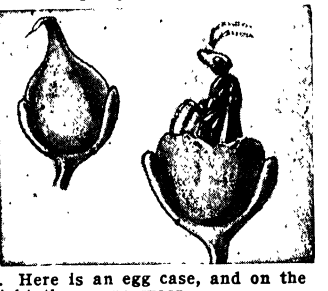
4. The wild fig (caprifig) has three crops, in spring, summer and autumn, and a little wasp enters the autumn caprifigs and lays its eggs. Young wasps hatch from these in the spring and leave the figs.



5. They enter the spring caprifigs, which are ripe by this time.



6. They lay their eggs in the spring caprifigs. New wasps hatch.



7. Here is an egg case, and on the right the young wasp.



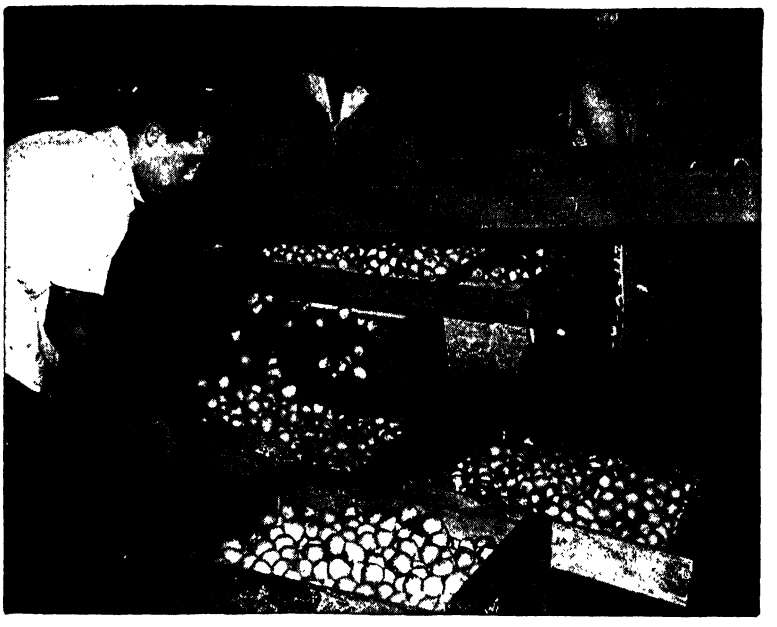
8. The young wasp now comes out of the spring caprifig covered with pollen.



9. Looking for a home, it enters one of the edible figs and fertilizes it.



10. Finding no suitable place to lay its eggs, it comes out and enters the autumn caprifigs, but it has pollinated the edible figs and they develop.

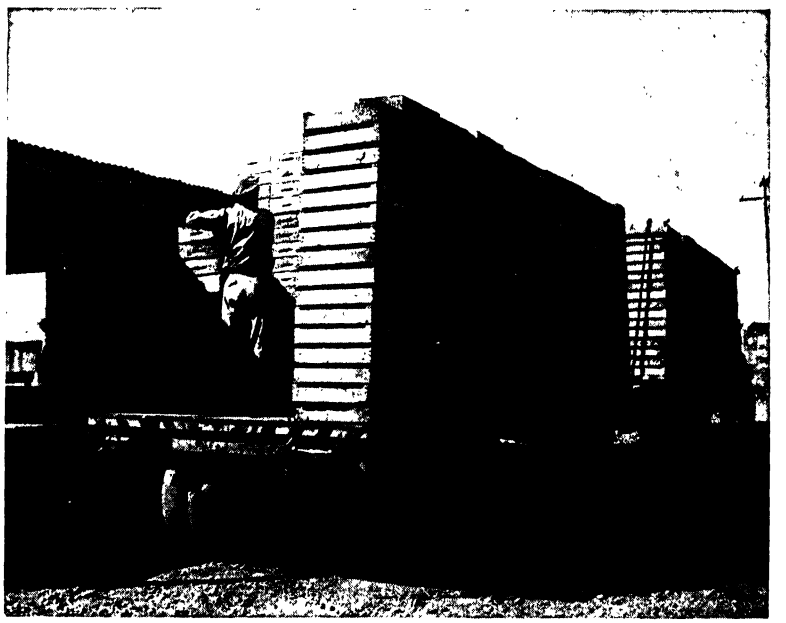


Packing fresh figs in boxes for delivery to the cannery. The canned-fig industry has become important in California and various other southern states.

ers sent to Turkey for knowledge of the cultivation there. Soon they discovered the curious fact about the need of growing caprifigs in the same orchards, and they did so, but without result. One planter, however, took the pollen from caprifig flowers and inserted this by hand in a few Smyrna-fig blossoms, and those figs matured and became sweet fruits. The next year he blew the caprifig pollen into many Smyrna figs with a glass tube, and 150 of them matured and ripened.

Scientists now set to work to solve the problem. They discovered at last that the insect referred to by Pliny, which was really a wasp, visited both the caprifig and the Smyrna-fig blossoms, and as this insect evidently did the pollinating, men began to study its life-history.

The story is this. The caprifig has three crops—in spring, summer and autumn. The autumn crop remains on the tree through the winter. The little fig-wasp enters the caprifig through the eye, and it deposits its eggs in the seeds of the fig; each seed is a nest for a single egg. In the spring, the little wasps hatch from the eggs. The young females make their way out through the eye of the caprifig and as they do so they are covered with pollen. They now fly to the next crop of caprifigs (the spring crop) on the same tree or on a near-by tree; they lay their eggs in the figs of this particular crop. And so it goes. Each female wasp lays its eggs in the crop of caprifigs following the



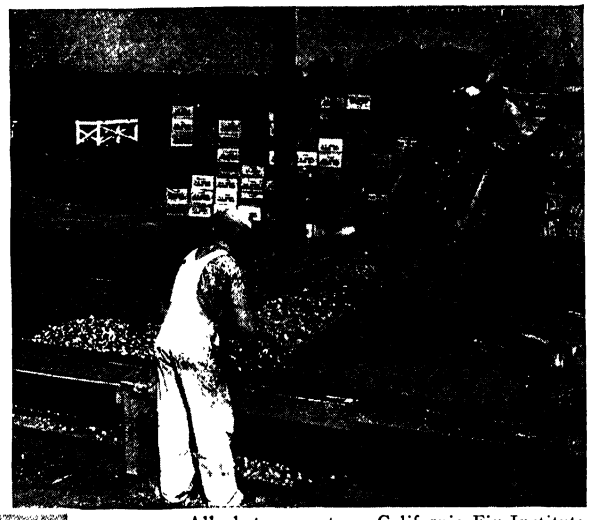
Both photos, courtesy, California Fig Institute

Boxes of fresh figs are loaded on trucks and are then delivered to the cannery.

crop in which it was hatched itself.

Now it often happens that the wasp, deceived by the blossoms of the Smyrna fig, will enter in order to find a nesting place. As it does so, it dusts the Smyrna fig with pollen from the caprifig and thus fertilizes it. It can not lay its eggs in the Smyrna fig's seeds, because it can not penetrate their long tassels. So it makes its way out of the fig again. It has failed to lay its eggs, but from the point of view of the fig-grower it has performed its task: that of fertilizing the Smyrna fig.

When the California fig-growers learned about all this, they decided to import some of the wasps and set them to work in California. After



All photos, courtesy, California Fig Institute

The photographs on this page show various steps in preparing dried figs for the market. The above picture shows workers spreading figs on trays.



many unsuccessful attempts they succeeded at last in making the wasps settle down and carry on the task of pollinating the Calimyrna figs. As a result California produces every year a large crop of big sweet figs.

The countries of the Old World produce far more figs than are grown in California. But few foreign dried figs can enter the United States market, because of the high standards set by the Federal Food, Drugs and Cosmetics Act. The result is that California produces over 90 per cent of the dried figs consumed in the United States.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 2409.

These smiling women are sorting dried figs in a California "dry yard."



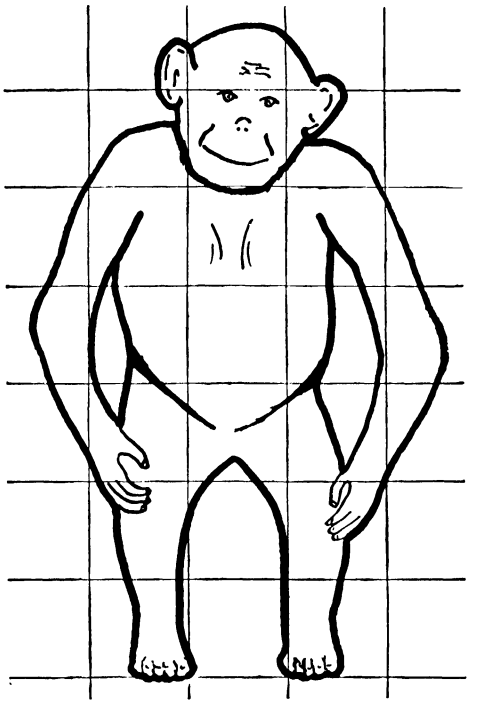
Here we see workers packing dried figs for shipment to many markets.



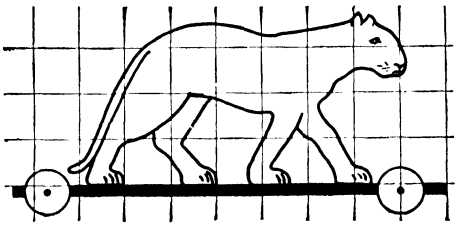
MORE WILD ANIMAL TOYS

YOU have already learned to make several wild animals, with bases to help them stand up, for your circus; or perhaps you preferred the jointed animals, which make more lifelike toys. (See Index, under Animals—toy.) In this article we give you four new animals for your collection—a monkey, a panther, a camel and a giraffe. You should be very careful to follow the pattern as closely as possible. If you make the legs and the outer parts of the animal's body too fragile, you will find it difficult to cut them out. For example, the tails of most animals should not be separated from the rest of the body, as they would easily break off once the outline has been cut. If you want to have particularly sturdy animals, it might be well to use light packing boxes, rather than cigar boxes, for your material in making the animals.

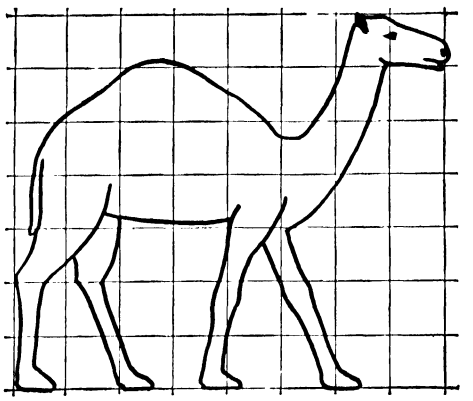
As we have remarked, the animals may be made in several different ways. They may be made solid and then mounted on a base; or else they may be made with joints, in which case they are not to be mounted. Perhaps you would prefer to have these animals and some of your others on wheels, so that they may be drawn by means of a string. It is very easy to provide wheels. First of all, the animal is mounted on a base about 1¼ inches wide and somewhat longer than the total length of the animal. Spools make particularly good wheels. Get four small spools, which must all be of the same size.



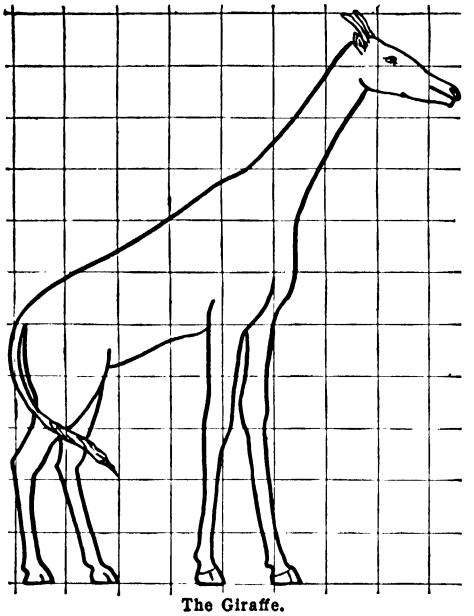
The Monkey.



The Panther.



The Camel.



The Giraffe.

As shown in the pattern of the panther, small wood disks may be made for this purpose, if spools are not available. In either case the small wheels should be nailed or screwed to the sides of the base as shown. The wheels should be placed far enough apart to balance the particular animal in question. It is important therefore that the base should be made long enough.

You are referred to the earlier articles for directions as to the methods for planning, constructing and finishing these toy animals so that they may be worthy additions to your circus.

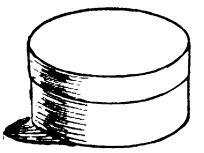
You may add other animals to your circus by using the same methods. You may obtain all the designs that you wish by tracing the pictures found in The Book of Knowledge or in magazines and newspapers and then by transferring these tracings, by means of carbon paper, to the wooden materials. Animal trainers, ringmasters, clowns, acrobats and the like may be constructed in the same way to complete your circus.

THE WANDERING COIN

WE can make a box which has the power to make a silver quarter placed within it disappear at our command, coming back when we desire that it shall do so.

To start with, we must get a pill-box of wood or cardboard, as seen in the picture, and of such size that a quarter lying flat inside it will exactly cover the bottom. If the box is of cardboard it will serve as it is, but if it is of wood we must line it inside at the bottom with paper pasted down smoothly. For the sake of uniformity, it is as well to line the inside of the lid in the same way. We must then take a quarter and cover one side of it with the same sort of paper, trimming the paper nicely round the edges and then pasting it to the quarter. The coin will on one side look like an ordinary quarter, but on the other like a mere round piece of paper.

To show the trick, we borrow a quarter. After it has been handed to us, we say that someone may like to see the box, and we hand it round for inspection. While the general attention is thus occupied, we secretly exchange the borrowed coin for the prepared one. This we must have concealed beforehand in the right hand, held, by bending the fingers slightly, against the lower joints of the second and third fingers. We lay the prepared coin, papered side downward, on the table where all can see it. The borrowed quarter we deposit secretly somewhere just out of sight, but where we can instantly get at it again when we want it—say, behind a book or other object that lies handy.



The coin box.

Having got so far, we take the open box in the left hand, and the prepared quarter between the forefinger and thumb of the right, taking great care to keep the uncovered side toward the company assembled in front of us. We then place the quarter in the box, but in doing so we tilt the coin so that it will fall with the papered side uppermost. We now close the box, and shake it up and down several times, which makes the coin rattle, and proves that it is still

there. Then we say: "Quarter, go!" The spectators will be curious, of course, to see whether or not the quarter has obeyed our command. To show that this is indeed the case, we shake the box again, but this time from side to side. When we shake the box in this way, the coin has no room to move, as it just fits the box; consequently there is no rattle. "It is gone!" we say. Opening the box, we allow anyone of the spectators to look into it. They see the paper side of the coin and naturally they take this to be the bottom of the box.

We have not yet finished our exhibition of magic. "Now," we say, "I will bring the very same quarter back again." We close the box, saying: "Come, quarter!" Once more we shake the box vigorously, this time up and down. The coin is once more heard to rattle; apparently it has returned from its wanderings. "It has come back!" we cry triumphantly. We open the box and we toss the coin into the palm of the left hand; it will fall there with the papered side downward. All those present take it for granted that it is the borrowed quarter and they congratulate us on our performance. Of course we must exchange the papered quarter for the borrowed one as soon as possible. We gain the opportunity to do so by once more inviting the spectators to examine the box. Boxes, as you know, tell no tales!

THE PROBLEM OF THE MAGIC SQUARE

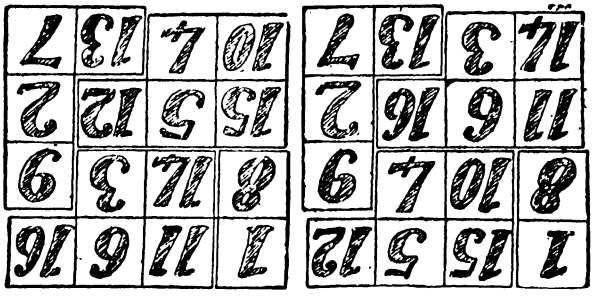
IN former times magic squares were thought to have magic powers. They were sometimes worn as charms to keep off disease or to bring good luck to the wearers. What is a magic square? It consists of numbers arranged in the form of a square—arranged in such a wonderful way that, whether they are added up by vertical columns, by horizontal rows or by the two diagonals, they give the same total in every single case.

We show here certain numbers arranged in the form of a square. This is not a magic square, as you will see when you do the additions that we indicated above. But we can make a magic square out of this one by cutting it into four pieces and putting these pieces together in a different way. You will then have a magic square in which the addition of the numbers in each row, column and diagonal gives the sum of 34. The solution is given below in reversed type.

1	15	5	12
8	10	4	9
11	6	16	2
14	3	13	7

SOLUTION OF THE MAGIC SQUARE PROBLEM

The illustrations given here show how the square made up of numbers was cut up and put together again in order to form a magic square. The first picture shows the original square, cut in such a way as to form four pieces. As you see, one of the pieces contains two numbered spaces; another, four numbered spaces; the two others, five numbered spaces each. The second picture shows how these four pieces have been arranged to form a new and magical order. Add the figures in the columns, horizontal rows and diagonals, and in each case you will have the same answer, 34.





SCISSORS PAINTING

YOU need crepe paper in several bright colors, clear transparent shellac, paste, paper plates and white writing paper.

From wrapping paper cut patterns of animals, flowers or fish. Cut squares of white writing paper a bit bigger than your patterns. Cover the writing paper with a thin, smooth coat of paste. Place a square of crepe paper over the paste and rub it with the crinkles to make it stick. Place a pattern over the pasted paper and cut around it. Cut out each part of the pictures and paste in place on the plate.

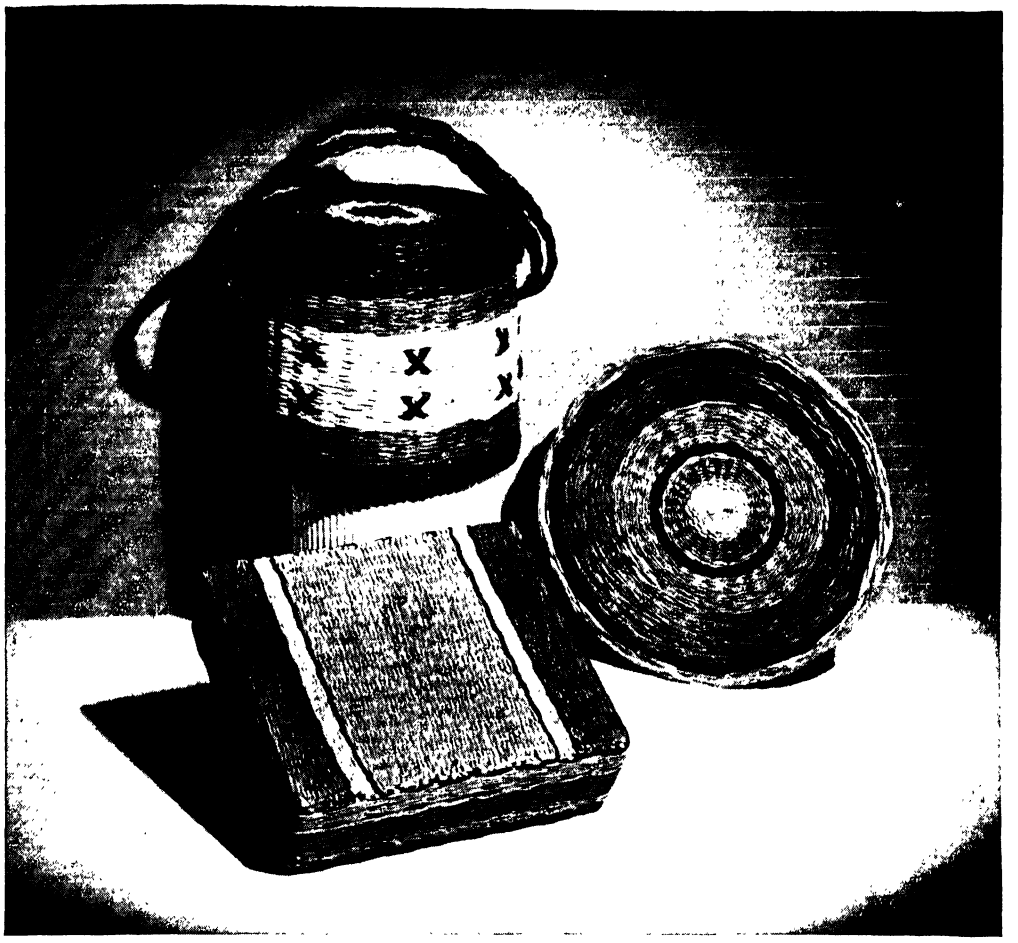
Rub the picture till it has stuck, then give the plate four coats of shellac. Let each coat dry before giving it another.

Good fun can be had at a party by giving each guest a paper plate to decorate, and a pair of scissors. Pile the working materials in the centre of the table. Give a prize to the one who makes the prettiest or the most original design.

CREPE PAPER HOMESPUN

YOU can make baskets, boxes and mats of pulled crepe paper, almost as easily as you can darn a hole in a sock. The stitch is the same. How do the articles get their shape? They are made over a form that is removed when the weaving is complete.

Start first with the round basket. Find a cardboard hatbox. Divide the edge in halves, making dots with a pencil. Divide into quarters, and so on until there is an even number of divisions about one inch apart. Between any two dots make one extra dot. Cut notches one-quarter inch deep, at each dot. Rub a light coating of floor wax over the



Two boxes and a mat made of crepe paper strips pulled and woven in darning stitch.

form. Now you are ready to start weaving.

Paste the end of a strand of pulled crepe at the centre of the form, on the under side. Bring this strand up through a notch around the back and down across the centre of the bottom to a notch on the opposite side. Continue winding from notch to notch and across the centre of the bottom each time. Two strands will come together as you go through the last notch. Bring the strand across the centre and thread it into a big darning needle.

Start weaving anywhere, weaving over one strand and under the next strand, as if you were darning a hole in a sock. Do not go over or under two strands except in the one place where two strands come together. Weave snugly at the centre, keeping cross piece in centre of form. Relax the weaving the further out you go, making it very loose over the sides and bent parts. It is extremely important that the strands must always alternate in weaving. Make sure the one you went under in the first row is the one you go over in the second row. Weave around once or twice at top to fill in the loops; then slip the loops off at the edges and paste them down. Apply paste on the last few rows to make the edges firm.

Push the form from the inside and apply at least three coats of shellac to your basket, both inside and out. Allow time for drying thoroughly between coats. The cover is made in the same way. The handle is braided crepe paper. You may combine colors as you wish. The box shown here was made in three shades of rose. Other interesting combinations of colors may also be used.

The pictures for Scissors Painting and Crepe Paper Homespun, courtesy, Dennison Manufacturing Company, Framingham, Mass.

PROTECTING PLANTS AGAINST COLD

MANY amateur gardeners prefer to do their planting in the spring of the year, although certain plants are set out in the fall. Yet even if you prefer to plant in the spring, you must not neglect your gardens in the late autumn and winter months, or your plants will be sure to suffer. Here are some useful suggestions.

Suppose that two or three new rose trees and perhaps some rose cuttings have been planted in our garden. Suppose now that a spell of frost comes, and after that, naturally, a thaw. The ground becomes quite soft and loose. The plants—whether roses or anything else, for that matter—that are not firmly established in the soil, become loosened with the soil, and lose the little grip they had obtained upon it.

This is the one thing to fear, for if it happens and is not remedied, without a doubt the plants will die. But, fortunately, it is a state of things quite easy to remedy. It simply means treading or otherwise making the soil firm and close about the plants, as it was before the frost acted upon it. The loose-soil danger is then avoided.

ACTION OF FROST

Though the action of the frost on the soil may be a source of danger to newly planted trees and cuttings, we must bear in mind that, apart from this, the frost does a great deal to sweeten the soil and to put it in excellent condition. For this reason any bit of the ground that is not occupied by plants should be dug up so that the frost may penetrate and do the utmost good.

How does a gardener regard a heavy fall of snow over his many plants? As Nature's wisest and best protection from the bitter winds and frosts. No wind can hurt our plants when they are safely under their snow blanket. But often the winter winds and frosts are keen and biting when there is no snow upon the ground. This is the hardest trial our plants have to bear.

If we are able to gather a few armfuls of fresh straw, we may put it round such plants as the rhododendron, and even round about a rose tree that is unusually fragile and anything else for which we have reason to fear. If some of these rather tender subjects die down completely, and are below ground for the winter, we may cover the earth above them with dry leaves or with ashes. Either of these is very helpful in keeping the frost from reaching them.

VIOLETS IN COLD FRAMES

We have hitherto dealt with plants that grow in the open. Even in the case of violets or other flowers that grow in cold-frames or hotbeds (beds of earth covered with glass tops) there are some simple rules that should be observed if these flowers are to thrive when the cold weather comes.

Never coddle violets; they are hardy, brave little plants, and they strongly object to being treated as if they were tender and fragile. If they could speak, how often they would plead for air, air, air, more air! You ought to have gathered many pretty blooms from the violets before the cold weather sets in. They will be protected by their frames when sharp autumn winds threaten. You will continue to pick pretty bouquets and have the prospect of gathering a fine bunch on Christmas morning, though the time the plants flower will, to a certain extent, depend upon the variety which is being grown.

Very little water—generally none at all—is needed for weeks at a time at this season. Unless the thermometer shows that it is freezing, or there is a sharp wind, raise the lid during the warmest portion of the day. Even at night, unless very cold, the lid need not be closed entirely, but the opening can be covered with a bit of sacking, and in this way there will be a slight amount of ventilation.

You will think, perhaps, that great importance is being laid on giving plants sufficient air. But there is nothing like it to keep them healthy. Insufficient air generally means that leaves become affected with mildew, and whole plants may "damp off," as it is called. But in really severe weather, we must run the risk of that for a short time. During sharp frosts the lids go down, and mats or anything we can lay hands on may be used to cover them. Do not forget to remove the coverings when warmer weather sets in.

POT PLANTS

Our pot plants that we are sheltering in the house or in a greenhouse will now need less water than at other seasons when they are growing freely. In the winter a great many of them go almost to rest; at any rate, they are not pushing out new growths unless kept at a high temperature. Never let a pot plant stand in a saucer of water.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 2259.



Courtesy, Du Pont Company

Left: pile of carrots. Center: space they occupy after dehydration. Right: what is left after compression.

WAYS OF PRESERVING FOOD

WE humans are at war with an army of foes so tiny that we have to use a magnifying glass to see them. Yet, small as they are, they are so numerous that if we relaxed our guard they would swarm over our food and make it unfit for our use and so starve us or even poison us.

These foes, as you have guessed, are bacteria, which are everywhere—in water, in air, on almost every object. We have learned some ways by which to kill those that are on food and to keep them from multiplying. These methods are: drying, freezing, cooking, pickling, spicing, sweetening, salting and smoking.

Bacteria do not multiply rapidly except in the presence of moisture. Sunlight even kills many kinds. That is the reason why such foods as beans and wheat which have ripened in the sun do not spoil quickly if they are kept dry. Many foods which ordinarily contain a good deal of water—meat, fish, vegetables and fruits—may be preserved if we remove some of the water. This is called dehydrating (de-watering) the food. The method has long been used, but the war made it much more common.

When the water is taken away, food shrinks in bulk. Therefore millions of tons of vegetables, meat, fish, even milk and eggs, were dehydrated before they were shipped abroad. Dehydrated foods take only a fraction of the space that would be needed if the water were not removed; therefore fewer ships are needed to carry the dry articles. Thus we see that drying preserves the food and saves shipping space and shipping labor.

When dried food is to be eaten, water is added. Even in normal times we use millions of pounds of dried fruits and vegetables. Raisins are dried grapes, of particular varieties only, and prunes are a kind of dried plum. Some apples, peaches, apricots and small fruits and berries are still dried in the sun, but more are dried by artificial heat in evaporators, which are simply great ovens that are not allowed to become too hot. If a partial vacuum is produced in the evaporator, the fruits and vegetables dry more quickly and there is less change of color. California alone sends hundreds of trainloads of evaporated and dried fruits to other states, and ships carry them to foreign countries.

American Indians used to cut buffalo and deer meat into thin strips and dry them in the sun. The American settlers on the Western Plains called this "jerked meat." The Indians also preserved meat by making pemmican. They pounded it into a powder and poured boiling fat over it, sealing it away from bacteria. Sometimes pounded berries were mixed with the meat to give it flavor.

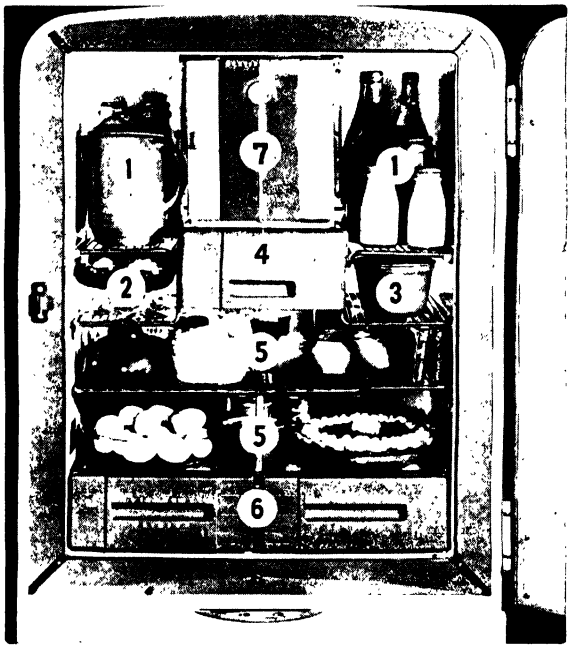
Keeping food at a very low temperature—below freezing—will kill most bacteria. Below 40° Fahrenheit the bacteria multiply slowly, if at all. This discovery has changed many of our food habits.

For example, instead of local butcher shops which slaughter animals for food, we have a few packing houses which dress thousands of animals every day. The meat is then hung in cold rooms, kept just above the freezing point, where it may remain for weeks. Then it may be placed in large refrigerator cars and sent a thousand miles or more to the city, where it may again be placed in cold rooms or else delivered to the local butchers who keep it in great iceboxes until sold. Your mother buys a steak or leg of lamb, and may keep it in your refrigerator for several days. It is possible that the steak you ate yesterday came from a steer that fed on the Western Plains and was dressed in a packing house hundreds of miles away.

This way of doing things has many advantages. If all the meat used in a great city came from animals killed in the city, much land would be required for the slaughterhouses, and unpleasant odors would spoil many neighborhoods for residences. The meat would probably be higher in price and not so good in quality. Refrigeration brings good meat to the doors of most of the people. Refrigeration also brings fish which are almost as good as when they came from the water.

When the writer was a boy, living in a small town, people depended almost entirely upon local supplies for fresh food. We had no green vegetables except those grown in the neighborhood, and no fresh fruits from other regions except oranges and lemons. Strawberries, peaches and grapes lasted only a few weeks and we had no more until the next year. Apples, potatoes and even hard cabbage would keep for a time in a cool cellar; but in late winter and early spring we had almost no fresh fruit or vegetables.

Fruits ripen in Florida and along the Gulf Coast, or in California, much earlier than in the regions farther north, and nowadays fresh strawberries and green peas are in the markets of northern sections before the snow has gone from the country. Long trains of refrigerator cars, or ships fitted with refrigerating rooms, bring these and other things from the south before summer has begun in the cooler regions, and from farther north after the near-by supply has gone. In some countries of Europe much of the meat eaten comes from Australia, the Argentine, or from the United States and Canada; and Europeans receive much chilled fruit from far away also.



Courtesy, Westinghouse

Since various foods require different kinds and degrees of cold, care should be taken to place food in the proper section of the refrigerator. In the above photograph we show a refrigerator in which the food has been correctly put away. (1) Milk, cream and beverages in general—right beside the freezer. (2) Custards and puddings—in the top middle section. (3) Butter—in the top middle section. (4) Meat and fish—right under the freezer, in the meat-keeper if your refrigerator is equipped with one; otherwise in the chill tray, covered lightly with waxed paper. (5) Leftovers; eggs; also foods prepared in advance, such as salads and desserts; also some fruits, such as berries, grapes and melons. (6) Vegetables and most fruits—in the crisper, or humidrawer, if there is one; if not, they should be tucked into a waterproof bag before they are put into the refrigerator. (7) Ice cubes, frozen desserts and frozen foods.

The great ocean liners are sometimes called floathotels. All have great refrigerating rooms where meat, poultry, fish, milk, cream, butter and eggs, vegetables, fruit and flowers are kept to supply the tables. The meals served are quite as good as those in the better hotels on land, and the choice of foods offered is almost as great.

When frozen food comes to a city in great quantities, it often goes into special buildings called cold-storage warehouses. From there it is delivered to the neighborhood stores. Generally the temperature in cold-

storage warehouses is kept just above freezing. If allowed to fall below the freezing point (32° F.), the water in many articles expands just before it becomes ice and breaks down the cell structure. When thawed the article is no longer so firm as before freezing and must be used at once. This can be avoided by "quick freezing." Small packages of meat or fish or vegetables or fruits are frozen almost instantaneously. The ice crystals formed are smaller and less harm is done to the structure of whatever is frozen.

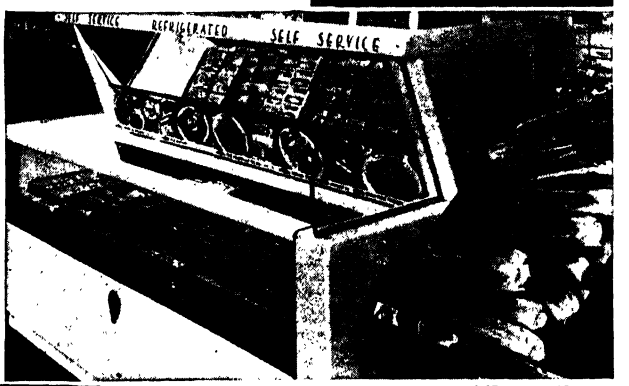
Heat also kills bacteria. Cooking alone, however, will not preserve food, for after it has cooled again, fresh bacteria from the air will attack it. So we can the food.

The fact behind the whole canning industry is simply this. If food which is sterile, that is, does not contain live bacteria, is placed in vessels which are sealed while still hot, so that air can not enter, it will remain sterile. Everyone knows this and we do not hesitate to eat food which was packed months ago.

In 1795, the French government offered a reward for a method of preserving food for the army and navy. The reward was claimed in 1804 by François Appert, who may be called the father of the canning industry. Though he had never heard of bacteria and thought that the air itself caused decay, his method was absolutely correct. The method was introduced into England in 1810; and in 1819 William Underwood started a little factory in Boston, which is now the second oldest canning factory in the world. Its products are well known.

At first there was a great deal of prejudice against canned food, but this gradually disappeared. Now there are thousands of factories, some very large, which preserve some of the following articles:





Top, courtesy, Honor Brand Frosted Foods; center, courtesy, Hussmann Refrigeration, Inc.

The top picture shows frozen fruits being used in a commercial bakery for making pies. In the center picture we see a modern combination refrigerator-self-service counter containing only frosted foods.



Sarra Inc.—Swift and Co.

Refrigerator cars, iced from the top, make it possible to ship fresh meats over long distances.

meat and meat products, poultry, fish, lobsters, crabs, oysters, shrimps, soup and almost every fruit and vegetable. Many fruit juices are preserved for us. All of you have drunk grape or tomato juice. Millions of housewives also preserve more or less food for home use. Perhaps you have seen your mother cooking fruit or vegetables in the kitchen, then filling glass jars and screwing the tops down tightly; or canning by the cold-pack method, which means boiling or steaming the cans of food in great kettles or pressure cookers.

At first glass or porcelain vessels were used, but they were expensive and broke easily. Vessels of tin, called at first "canisters" (shortened to cans) came into use after 1823. Later iron cans were used, with a thin coating of tin. They are wrongly



U. S. D. A. photograph by Knell

A 4-H Club girl of New York State, storing vegetables she and her mother have put up at home. Below, canning in a factory.

called tin cans. Before World War II these were most used, though you would see also much glass on the grocer's shelves or in the pantry. There is hardly a household in the nation which does not use more or less canned food, and it is difficult to see how city people, at least, could exist without it. The British, by the way, generally speak of "tinned" food.

Some of the great establishments employ hundreds, and even thousands of workers. Many are near the sea or the fields, from which their materials come. They use much improved machinery and make the attempt to can the food the same day it is received. They also try to preserve the flavor of the article and are so successful that the best brands of canned goods are excellent.

The commercial canners place the food in the cans, which are then placed in a pressure cooker, a strong airtight vessel. Live steam is admitted, and the temperature may be raised far above the boiling point. No bacteria can endure such temperatures. When the contents are sufficiently cooked and it is certain that all bacteria are destroyed, the steam is allowed to escape from the cooker. The lids are put on the cans and are sealed on a machine. Many

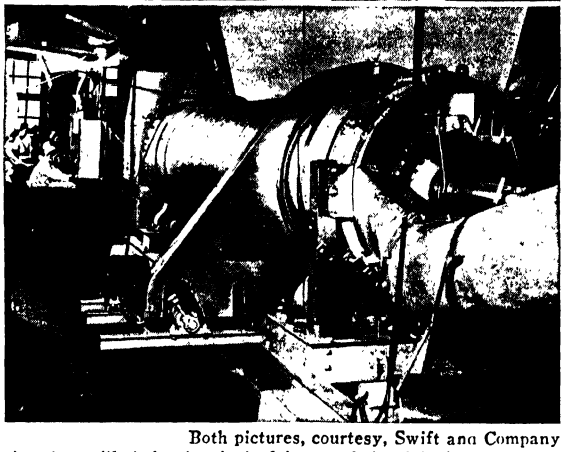


Courtesy, H. J. Heinz Company

Workers in a large American cannery paring vegetables. The workers, clad in spotless uniforms, use only the choicest of vegetables for canning. American canned goods of all kinds enjoy a world-wide reputation.



In a beef-dehydrating plant. Dehydration begins with boning. This process separates the meat from the bones and removes tendons, heavy blood vessels and excess fat.



Both pictures, courtesy, Swift and Company

A rotary (that is, turning) drier used in dehydrating meat. Dehydration helps preserve meat, since bacteria do not multiply rapidly except in the presence of moisture. Besides, dehydrated meat takes up much less space than fresh meat.

metal cans are coated on the inside with lacquer which is not affected by acids.

The great scientist Pasteur discovered that many bacteria are destroyed at less than the boiling point, and this fact has been valuable in the preservation of milk and a few other foods. Boiling changes the taste of milk and makes it less digestible. But if subjected to a temperature of about 150° F. for thirty minutes, most of the common bacteria which turn it sour or make it dangerous to drink are destroyed. It is then called pasteurized milk. If the bottle is sealed at once, the milk will keep sweet and wholesome for many days. Of course if other bacteria are allowed to enter, it will soon spoil.

Some foods are sterilized by germ-killing radiation from specially constructed ultraviolet lamps.

The law permits the use of certain chemicals which prevent the growth of bacteria. Benzoate of soda is the most commonly used chemical preservative. Some students of health say that it is harmless, but others are not so sure. Such preservatives certainly do not improve any food.

Pickling is another way of preserving food. Man very early learned to make wine from grapes and cider from apples, and he also found that both turned sour and became what we now call vinegar, though he did not know the reason. How he found out that this liquid would preserve food we do not know. We still use the process, which is called pickling, though many improvements have been made. Not much meat is pickled now, but thousands of tons of vegetables and a smaller quantity of fruits are pickled every year. If sugar is added we have sweet pickles. Great establishments turn out many varieties of pickles, though perhaps cucumbers, onions, cauliflower and beets are most common. A small quantity of fruit is pickled in alcohol.

In the great factories, materials to be

pickled are usually allowed to stand in brine for a time, and slight fermentation takes place. Afterward they are placed in fresh water to remove most of the salt, after which they are placed in vinegar. Long ago man also discovered that certain seeds or fruits which we call spices helped to keep food from spoiling as well as improving the flavor. This is one reason why spices brought almost their weight in gold during the Middle Ages. The preserving power of spices is not very great, however.

Early man also found that very sweet substances do not spoil easily, and so began what we now often call "preserving." Your family probably consumes many jars of jams and jellies, mixed fruit conserves and, of course, marmalade each year. Sometimes whole fruits are boiled in sugar syrup, which prevents them from decaying. Sugar is also used to preserve milk. Condensed milk is milk from which a part of the water has been removed and to which sugar has been added.

We have come to think that salt is a necessary article of food. Animals love it and will go long distances to get it. Man learned, long ago, that salt would preserve food, and



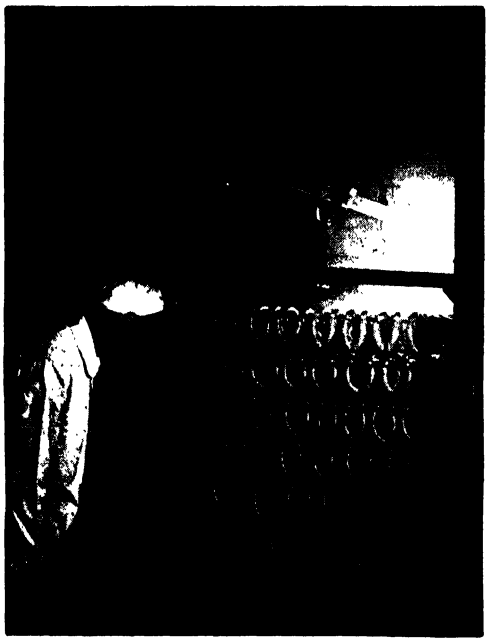
H. J. Heinz Company

Big kettles where soup simmers before it is put in cans. Everything in a great modern cannery must be spotless and shining.

for thousands of years this was the chief method used to preserve meats. The meats or fish were either covered with dry salt or they were placed in brine, which is simply strong salt water. In the old days people living far away from the water had to eat salt or smoked fish, or go without fish. Even now, more salted cod is eaten than fresh cod. Salt beef or pork were the only meats sailors had on long sea voyages, and armies were fed principally on salted meat. Not so many years ago people living on farms or in villages too small to support a butcher had little meat except what was salted during most of the year.

A few vegetables are preserved by salting. For example, sauerkraut is cabbage cut into fine strips, salted and allowed to ferment. Food preserved by salting has not the same flavor as when fresh, and some salt foods are not quite so digestible; but still millions of pounds are eaten every year, though not so many as formerly were consumed.

Perhaps some early man, when trying to dry meat or fish above a fire of sticks, discovered that smoke helped to preserve the food. The smoke left traces of certain chemicals, which kept away or killed the bacteria, and besides often gave a flavor which men came to like. Smoked salmon has a flavor quite different from either fresh or salted salmon. Hams and bacon and poultry are smoked, and salted also, but the flavor you like so much probably comes from the smoke. Hickory wood is often used for the fire. Some kinds of smoked fish and game are much liked. Sometimes meat is treated with the chemicals found in the smoke, such as creosote, and is never really smoked at all.



Courtesy, Swift and Company

Frankfurters being inspected while they are smoked.



Courtesy, Gibbes Memorial Art Library

A volunteer fire company of 1840 painted by C. Meyr.

WHEN THE FIRE ALARM RINGS

FIRE cooks our food, keeps us warm in winter and makes the steam which turns the wheels of our industries. Nature gives us no more useful servant. But let the master turn his back for a moment and the slave leaps up in rebellion, hungry to devour and to destroy.

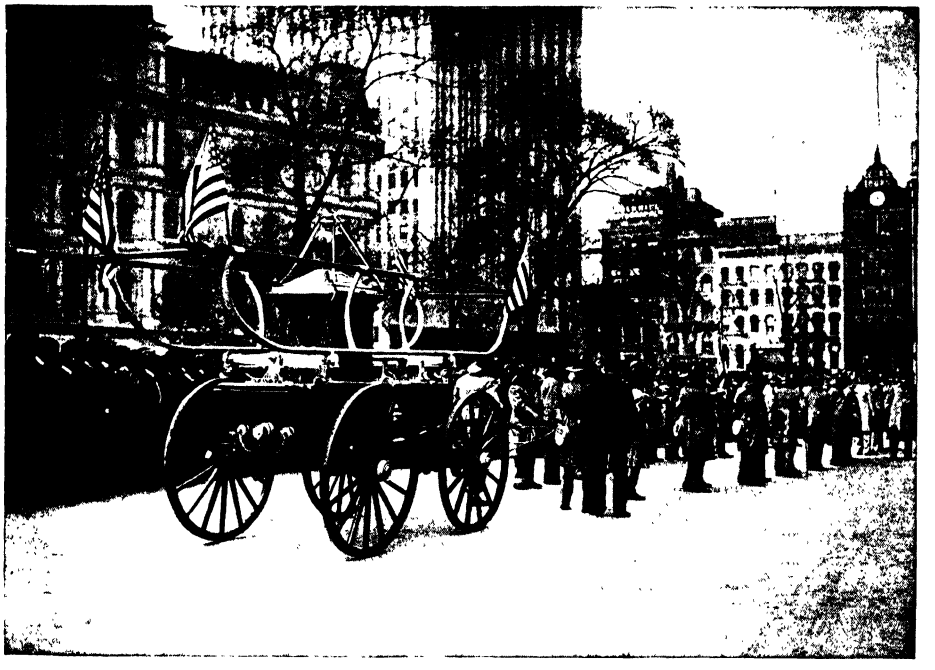
The danger was not so great until man began to live in wooden houses and began grouping them together into towns and cities. All through history we find accounts of conflagrations that wiped out cities. When fire had gained a foothold the people were helpless; all they could do was gather together as much of their valuables as they could carry and flee to the open country.

The Romans first attempted to offer resistance to these terrible raids. Rome was the first city to organize a regular fire department, which at one time numbered seven thousand. Could we have a moving picture of a great fire in Rome two thousand years ago, it would probably present a scene not very different from those we sometimes witness today. The houses in the poorer and more populous quarters were usually built of wood. Each family kept the fire burning on an open altar in honor of the domestic gods. No wonder fires often broke out.

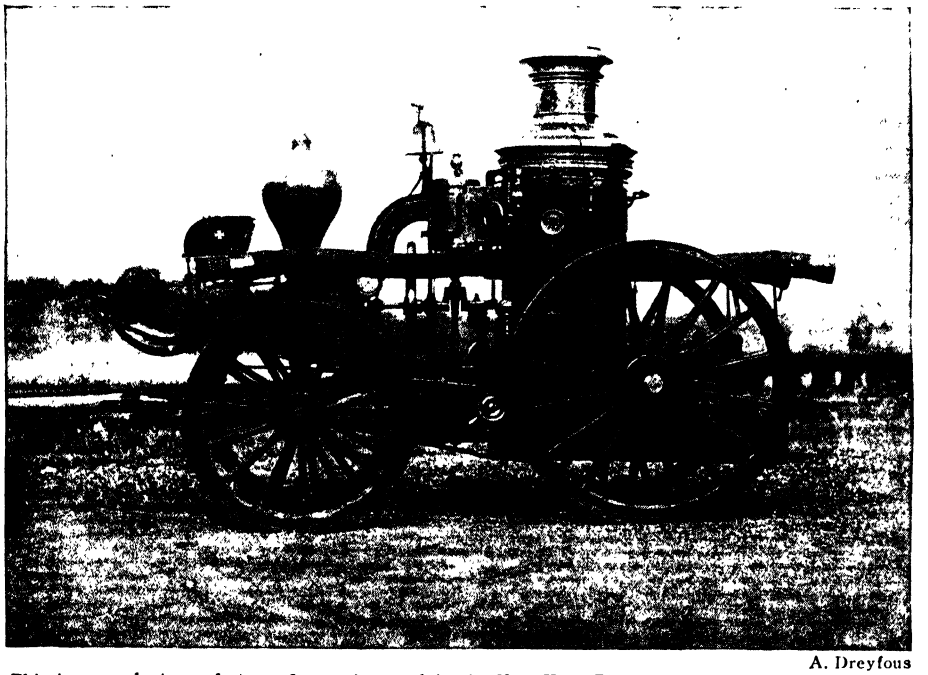
The householder would rush into the street shouting, but there were no alarm boxes to which he could turn. Instead there were men stationed along the streets known as *nocturnes*. From one nocturne to another the alarm would be shouted along the line until it reached the nearest *castra*, or fire-house. Then all the human alarm boxes within hearing would rush to the scene of the fire and become policemen, driving back the crowds and establishing strict fire-lines.

Not many minutes would pass; then, above the murmuring of the crowds would rise the distant sounds of shouts and the quick tramp of feet. The nocturnes would rapidly clear an opening through the crowds, and through the passage would charge a centurion heading a company of firemen in metal helmets and leather jackets and trousers. Some would be bearing *siphones*—wooden hand-pumps that worked like syringes; others would be armed with axes, hammers, saws and iron bars; while still other groups bore short ladders so made that their ends fitted and could be clamped together to form a means of

EARLIER DAYS IN FIRE-FIGHTING



Steam fire engines supplanted the old hand engines just as motor engines have supplanted steam. Here is shown one of the old hand engines, which was drawn by the firemen themselves, generally volunteers. The water was pumped by raising and lowering the bars at the sides.



A. Dreyfous

This is an early type of steam fire engine used in the New York Fire Department about 1865. It was called a "Harp Tank" from the shape of the space between the boiler and the front.

ascent to the tops of the highest buildings they had then. Firemen appointed for this task would clamber bravely up the ladders much as firemen do today.

After these would follow the main mass of the firemen, the *aquarii*, numbering hundreds, each carrying a light earthenware vase. The *aquarii* would immediately form into chains to the nearest cistern, supplied from the great aqueducts leading into the city, and presently the jars would begin emptying a stream of water into the pumps.



What sight could be more thrilling than a fire engine drawn by galloping horses, with sparks flying from under the horses' feet, bells clanging and smoke pouring from the engine? The motor engine of today is far less exciting to watch. The horses that drew the engines seemed to share in the excitement, and many a fire station had a pet Dalmatian dog as mascot that attended every fire.

THE FIRE CHIEF FINALLY REACHES THE SCENE

Suddenly a chariot would dash through the passageway bearing the *prefectus vigilum* —the fire chief—who would assume command. Surgeons, too, would be in attendance. The pillow-bearers, each four carrying a huge leather pillow at least four feet square and stuffed with feathers, were on hand. Should anybody appear in the upper windows of the burning building the pillow-bearers would drop their pillows below the windows. Upon them the imprisoned inmates of the building might leap. There are expert fire-fighters today who say that nothing has ever been invented that serves its purpose better than the life-saving pillow of the old Romans.

Last to arrive would be the *questionarius*, the most feared and respected of all the Roman fire officials. As his title indicates, even to those who do not know Latin, his business was to ask questions, but to many his questions were anything but comfortable. How did the fire start? Was it accident or carelessness? For the Roman laws demanded that responsibility must be fixed for every fire. It was the business of the *questionarius* to fix the responsibility. He established a court of inquiry even before the flames had been subdued. Only recently modern cities in this country have taken example of old Rome and appointed officials whose duties correspond to those of the *questionarius;* these officials are known as fire marshals.

When the Northern barbarians destroyed Rome many of her institutions were lost to the world. During the Middle Ages men thought more of war and destruction than of saving lives and property from the flames. Great fires were thought to show that God was angry. Berlin was destroyed in 1405;

Moscow, Lisbon, Venice, Vienna and Copenhagen suffered enormous and disastrous fires. Constantinople was entirely or partly wiped out a dozen times. London was again and again laid waste, notably in the years 798, 1087, 1132, 1212 and in 1666, the last being the "Great Fire," which burned for four days and destroyed 13,000 houses and public buildings covering 436 acres.

Immediately after the Great Fire officials were appointed whose business it was to devise some means to check future fires. The hand-pump was brought into use again. Volunteer fire companies, too, were organized, just as they are today in our villages and small towns.

FIRES HAVE ALWAYS BEEN DESTRUCTIVE IN AMERICA

In the colonies in America the problem of checking fires was even more serious than in the mother country, for here, because of the vast forests so close at hand, the houses were built almost entirely of wood. One of the first fire companies to be organized was founded in Philadelphia in 1736. Benjamin Franklin was one of the four chiefs. Each member was expected to furnish, at his own expense, six leather buckets and two stout linen bags. The buckets were intended for throwing water on the flames; the bags were used as receptacles for whatever valuables might be saved from the burning buildings. In New York similar fire brigades were organized, and it became quite the fashion for the young men of the city to join them.

SOME EARLY FIRE-FIGHTERS IN NEW YORK

The apparatus of these early fire brigades was very simple. Everybody has seen the old prints depicting fire scenes of that period: the eight or ten men working the old hand-pump; one or two men squirting a stream of water on the flames from a hose not much thicker than that used in a garden; and the two chains of firemen between the pump and the nearest source of water supply passing the buckets to and fro.

The invention of the steam engine brought about a change. With steam-driven machinery big pumps could be employed, capable of throwing powerful streams of water against burning buildings. The first steam fire pump was used in England in 1829. Its first appearance was ridiculed, and the name "steam squirt" was applied to it. Even so was the first steamship laughed at. Yet the "steam squirt" was the first of the modern apparatus used today.

STEAM ALSO INCREASES THE DANGER FROM FIRES

Steam has also increased the danger from fires. Railway locomotives shower sparks on shingled roofs, factories and warehouses; and cheap lumber encouraged more than ever the building of wooden houses. The invention of matches, one of the most common origins of fire, soon followed, and also the use of petroleum for lighting. Meanwhile smoking was becoming more common.

In Europe these changes did not increase the danger to the same extent as on this continent, for there the houses were built largely of stone and brick because of the scarcity of timber. On this side the risks multiplied tenfold. The white and yellow pine, the principal material used in the building of houses, was especially quick to burn. There were no laws about building.

Men said that the city had no right to tell a free-born citizen how he should build his home. And if John Smith & Company chose to erect a wooden warehouse in which to store cotton or barrels of petroleum, whose business was it but their own? It is only of late years that we are beginning to realize that personal liberties must not endanger the welfare of our neighbors.

GREAT FIRES IN THE HISTORY OF CANADA AND THE UNITED STATES

From early times this continent has been the scene of big fires. Quebec suffered in 1815, 1845 and 1866. New York had serious fires in 1835, 1845 and 1856. St. John, New Brunswick, was seriously damaged in 1837 and again in 1877; Pittsburgh was almost wiped out in 1845; Montreal had terrible fires in 1850 and 1852. The greatest fires of modern times have been the Chicago fire of 1871, the Boston fire of 1872, and the San Francisco fire of 1906. Charleston, Philadelphia, Savannah, Portland, Baltimore each has a fire history.

With the same energy that had been employed in building, the people set about organizing means of protection against the danger. Need calls forth invention. The pressing need of fire-fighting apparatus caused the improvement of European inventions and the development of new machines. Another fire danger peculiar to this continent was the tall buildings that were being erected in the cities. This called forth the invention of the water-tower.

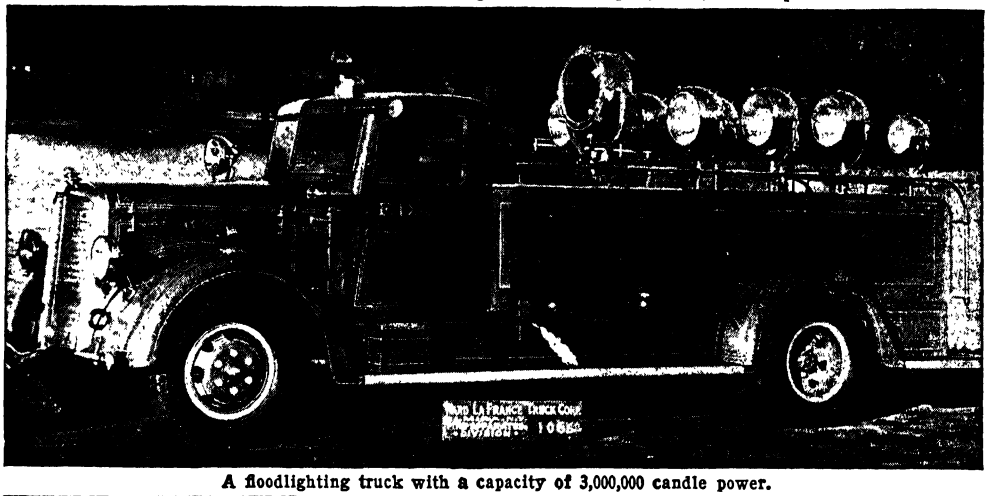
No wonder, then, that New York, with its skyscrapers, should have the biggest and most expensive fire department in the world.

FIRE-FIGHTING APPARATUS

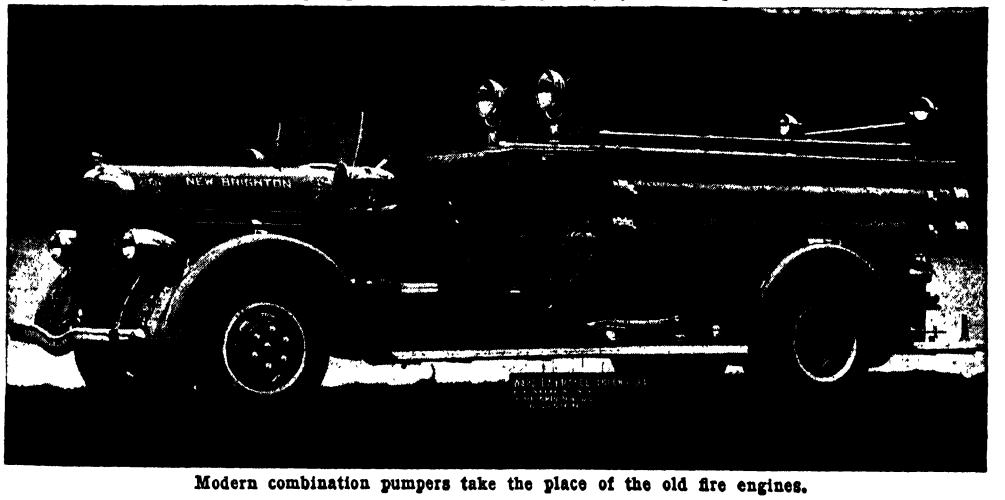


Universal Photo Service

This truck with tall aerial ladder belongs to the Davenport, Iowa, Fire Department.



A floodlighting truck with a capacity of 3,000,000 candle power.



Modern combination pumpers take the place of the old fire engines.



Crown Foto Features

The firemen are knee-deep in snow and slush, at this Philadelphia fire. Men on the aerial ladder have pulled a hose up and are directing a stream of water into the upper windows of the building.

While buildings were limited to three or four, or even five stories, it was comparatively easy to deal with fire. When they began shooting fifteen, twenty, and even forty stories into the air, it was another question. At first there was some talk of passing laws against the erection of such high buildings, but finally the engineers found a solution.

They got the idea of building pumphouses in which could be installed gigantic steam pumps so powerful that they could throw streams of water from the nozzles of hoses with almost the same force that a shell is fired from the mouth of a cannon. These pumps would be connected with the entire water system throughout the section of the city in which the skyscrapers were situated.

When the first test of the high-pressure system was made, the pump stations, five in number, each made a delivery of 18,000 gallons of water a minute. Some of the individual pumps discharged as much as 3,800 gallons a minute. So powerful is a stream of water from a high-pressure hose that it can make a brick wall crumble as though struck by an explosive shell. By raising the stream at an angle of about 80 degrees it would reach far up toward the top of towering city apartment houses.

Firemen are chosen very carefully. First, the applicant for the position must pass the mental test set by the Civil Service Commission. Then he must pass a strict physical examination. His body must strong and as nearly perfect as possible. Then he may be put on probation.

He must first attend the college training school for probationers; like the soldier, he must undergo a period of drill before he is sent out on the firing-line. He is taught to handle, raise and balance the ladders before he is allowed to use them. As the ladders weigh from twenty to sixty-five pounds, and range from fourteen to twenty feet in length, it can be seen that it takes experience to handle them. After the novice has mastered this he is made to climb to the first window, then to the second and, as his nervousness gradually leaves him, he mounts to the top.

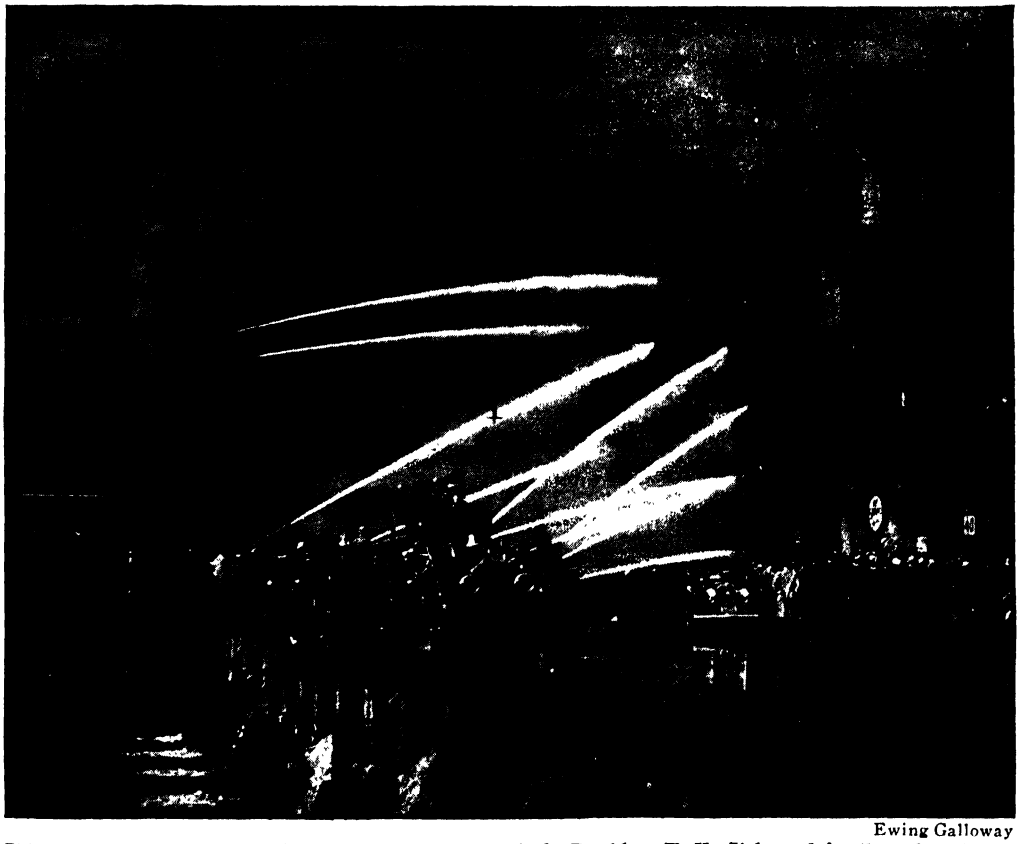
Next, the young fireman is taught how to

build a "chain" of ladders hanging from the windows, up to the top. A man is stationed at each window. In this drill, when the first man reaches the first window he fastens himself to his ladder by means of a large steel snap attached to a strong canvas belt about his waist. Then he reaches down and pulls up another ladder, passed to him by the man below. At the top of each ladder is a long hook which just fits over the sill of a window. The first man raises the second ladder and hooks it into the window above him, after which he climbs it, swinging like a monkey on the bough of a tree. And so the chain is built, each man coming up from below carrying one ladder for the chain.

It is not aways the fire that goes roaring through the roof of a building, lighting up the streets for a mile around, that presents the most danger. It is in the dull, smokey cellar fires that the fireman is most often overcome by smoke or gas. Then there is the awful "back draft," which every fireman soon learns to dread. Dashing up the stairway of a burning building, dragging the hose after them, the men come to a closed doorway. With axes they smash in the door. The smoldering fire within is exposed to view —and to the inrush of fresh air. For a moment there is an awful pause; then, as the oxygen strikes the fire the whole room explodes into a roaring flame. Out through the open doorway leap the fiery tongues as though flashed from the mouth of a cannon. The experienced fireman instinctively falls flat, his face in his hands, ducking the blow.

The falling wall is another common danger. Sometimes a brick wall will buckle in the middle and crumple, dropping like a curtain. The tumbling bricks are then easily dodged. But quite often the whole wall will fall straight out, reaching across the street and remain almost solid until it strikes the ground.

Broken glass and molten lead are other perils met with at almost every fire. All



Ewing Galloway

This spectacular fire broke out in a warehouse near a dock, in Brooklyn, N. Y. It burned for three days before the firemen, with the most modern apparatus, were able to put it out.



A picture of a fierce waterside fire, at Hoboken, N. J., in 1900. Fire boats helped to put out the flames.

through the department are found men bearing scars from wounds inflicted by glass splinters. And again they will enter large buildings not yet in full flame, encounter thick smoke and lose the way out. In such a case the experienced fireman immediately drops down beside his hose and follows it to the entrance.

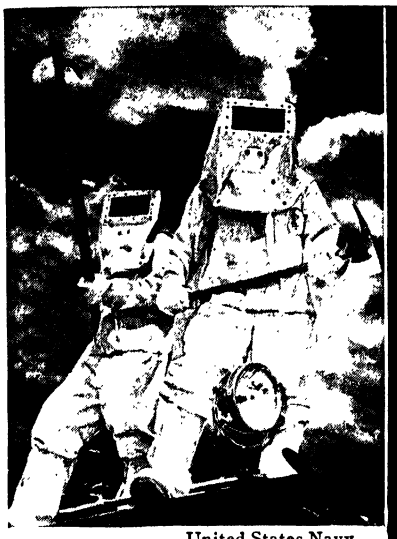
In all cities on the water, there are certain sections which can not be easily protected by fire-fighters on land. That is the shipping district. Docks reach out a fifth of a mile into the river or the bay, and on some of them are big warehouses filled with goods. Great ships lie beside them. On catching fire a ship may have its mooring lines burned through and then drift out of the reach of the streams from the fire hose. What adds to the danger of water-front fires is the fact that a fresh breeze is often blowing in from the water, ready to fan the flames inward. And a fire can be fought most effectively



Crown Foto Features

A fire tug in New York Harbor, giving a fine display. Modern fire boats, like this one, are swift and agile. They are always on the alert, able to throw gallons of water with tremendous force.

FIRE-FIGHTING DURING WORLD WAR II



United States Navy

Specialized equipment, such as this asbestos suit developed by the United States Navy, greatly aids fire control by protecting the fire-fighters.



British Information Service

During the London Blitz volunteer fire brigades worked continuously.



United States Navy

Fire-fighting parties battle flames on the Navy aircraft carrier Saratoga, set afire off Iwo Jima.

if it is approached from the windward side.

To protect its shipping, New York maintains a fleet of fire boats, really floating fire engines. Each of these marine fire-fighters is moored at a dock alongside a house erected especially for her crew. This building is fitted up like any other fire house; sleeping quarters upstairs, sliding-poles by which the men can descend quickly to the ground floor, and a full set of telegraphic instruments by which the company may be informed of all the alarms that are sounded throughout the city. The boat itself lies with steam up at all times, ready to speed away on business. All boats are able to keep in constant touch with headquarters by means of radio telephone equipment.

One of these fire boats, the John J. Harvey, can throw 16,000 gallons of water a minute at a blazing dock. The water, of course, is pumped up from over the side by four centrifugal pumps, each delivering 4,000 gallons per minute when working at full speed. At such times the pressure is about 150 pounds per square inch and can be doubled provided the entire 16,000 capacity is not needed at the same time. Certain outlets lead to mounted nozzles resembling machine guns, placed where they will be most effective. From these water can be thrown over three hundred feet. With all her power the John J. Harvey can bombard a burning ship or warehouse with a veritable cascade, which only the biggest blazes can withstand for long. One blow from her monitor nozzle stream can make a hole in a brick wall.

A TERRIBLE WATER-FRONT FIRE WHICH ONCE RAGED

Perhaps the most brilliant service of the fire fleet was during the disaster that occurred in 1900. A fire started on one of the piers on the New Jersey side of the Hudson River alongside which the passenger ship Saale was moored. In less than fifteen minutes the flames, fed by stores of cotton, turpentine and oil, swept from pier to pier. A strong breeze was blowing at the time. Before anybody realized the danger a quarter of a mile of docks and ships was ablaze. The Saale and four other big ships were crowded with visitors. Before the crowds aboard realized what was happening they were in the midst of roaring flames.

Whether they were cast loose by their crews or whether their mooring lines were burned through, the four big steamers, crowded with people, drifted out into the river. Hundreds jumped into the water. Some of these were rescued by tugboats and other craft, but most of those on board were forced down below. The portholes were too small to permit of their escape, and most of them perished. Over four hundred people, mostly women and children, were burned to death.

But it was the fire fleet that saved these drifting conflagrations from setting ablaze the whole shipping district on the New York side. One of the burning steamers, the Bremen, drifted across the river and set fire to a wharf, then to a lighter. One after the other the fire boats quenched these blazes. Finally they were able to give their whole attention to the four great steamers blazing in the river, pouring whole broadsides of water into them. Had it not been for their service there can be no doubt that one of the biggest fires in the history of any seaport would have swept the New Jersey and New York shores of the Hudson River.

SOME OF THE WAYS IN WHICH WE CAN AVOID FIRES

There are many ways by which the loss from fire can be prevented, some of them easy and some more difficult. One way is to build houses of brick or stone that will not burn so easily.

Another cause of many fires is bad workmanship. The mason who is building a chimney does not always take the trouble to be sure that the chimney is tight. Then some day when there is a hot fire in the furnace, stove or fireplace a spark goes through the crack and the house burns. Sometimes men who put in electric wires are careless, and when wires rub together a fire may begin. In some cities all electric wires must be placed in metal tubes.

Another reason why we have so many fires is that so many of us are careless. Matches are so cheap that we use more than any other people, and too often we throw one away without being entirely sure that the flame has gone out. Many people are careless enough to throw burnt match sticks into wastebaskets. Thousands of fires start in this way. People are often foolish enough to light matches where gasoline or kerosene is stored. The fumes of gasoline may catch fire though the flame is several feet from the liquid. That is the reason why smoking is forbidden in garages. Let us resolve to keep our wits about us in using matches, so that we may never have to blame ourselves for causing loss or tragedy from fire.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 2312.



British Information Services

An expertly laid fire for cooking in the open, which these British Boy Scouts have built and tend themselves.

WHY IS THE FIRE HOT?

WHEN we stand in front of a fire, we feel warm. The fire warms the air around us, and we feel this warmth on our skin and bodies. We are also warmed because fire gives out rays, like the rays of light that we can see. The rays from the fire, known as radiant heat, can not be seen, but we feel them and are warmed by them. It is possible to reflect these rays, just as rays of light can be reflected. Electric heaters, for instance, are so constructed that the rays of heat are reflected from a metal surface out into the room.

We have seen how the fire gives out heat, but perhaps your question is—why do you feel warm when you stand by the fire? It is believed today that matter is made up of tiny units, called molecules, which have some freedom to move. When an object—your hand held in front of the fire, for instance—begins to grow warm, it is because the molecules of matter of which it is composed begin to move more rapidly. As any object becomes hotter and hotter, its molecules move faster and faster and fly apart. When we boil water, the molecules of water move so rapidly that they finally escape from the water in the form of vapor, or steam. When you light a candle, the heat of the candle's flame causes the molecules of the wax to move more and more rapidly until the wax loses its shape and melts.

WHAT IS FIRE?

You already know what fire looks like and how it feels. You have seen fire burning in the fireplace; you have seen the gas fire over which your mother cooks the food; you have seen the fire that burns at the tip of the candle. But it is a little harder to say just what fire is.

Fire is the outward and visible sign of the chemical change that chemists call combustion. Usually we speak of combustion as burning. In burning, this is what happens: Some fuel—wood, coal, oil or something else —combines with oxygen. The fuel must be heated to what is known as the kindling point before it will burn. For that reason we use matches to light the material that we wish to burn—to raise its temperature to the kindling point.

Sometimes we see fire in the form of flames and sometimes in the form of a red glowing, as in a low coal fire. But whatever the form it takes, fire is the result of the combining of some substance with the oxygen in the air. This can occur only when heat is present.

WHAT MAKES FLAMES DANCE IN AN OPEN GRATE FIRE?

Flames often dance in an open grate fire because the draft of air is not steady. When a draft comes in through the window, for instance, the fire brightens up. When the air is still, the fire burns more steadily. If the wind direction above the chimney top changes, the flame may flicker and dance, or it may die down.

But that is not all. Imprisoned in coal there is a great quantity of gases of various kinds, all of which can be burned. As the coal breaks up, these gases escape. The same kind of gases are also freed from burning wood. The burning of these gases causes the beautiful flames of brilliant colors that flicker and throw a dancing light into the dark corners of the room. When we burn coke, coal from which the coal-gas has been removed, we get a very hot fire with very little flame, because we are burning practically nothing but solid carbon.

WHY CAN WE PUT OUT A CANDLE BY BLOWING ON IT?

When a candle is lighted, the flame heats the wax to a high enough temperature to make it combine with oxygen in the air. The heat changes the wax of the candle into gas and the hot gas burns with the oxygen. When we blow out the candle, we blow the flame away from the gases, and we also cool the wax. The temperature of the candle is then too low to allow the substance of which it is made to combine with the oxygen in the air.

WHY DOES OIL BURN MORE EASILY THAN SOME OTHER THINGS?

All oils contain a very large amount of the two elements, hydrogen and carbon. Many oils contain a certain amount of oxygen, but none of them contain nearly enough oxygen to satisfy the carbon and hydrogen atoms in them. If hydrogen is to be fully used up in a chemical change with oxygen, every two atoms of it need one atom of oxygen to combine with. In water this happens; two atoms of hydrogen combine with one atom of oxygen—H_2O. Carbon, to be fully used up, needs for every atom, two atoms of oxygen, as in carbon dioxide, which the chemists call CO_2.

Since no oils contain enough oxygen to satisfy completely the carbon and hydrogen atoms of which they are composed, those atoms are always ready to unite quickly with additional atoms of oxygen from the air. When we set fire to oil, the carbon and hydrogen atoms quickly unite with the oxygen of the air and are completely burned. Some oils burn more readily than others. This is because of the different proportions of carbon and hydrogen that different kinds of oils contain.

WHY DOES THE FIRE GO OUT?

We have already seen that the process of burning occurs only when a substance is heated to a high enough temperature to combine with the oxygen in the air. If the oxygen supply is cut off, the fire simply goes out. A fire will go out, too, when the material that is burning has all been burned up and there is nothing left to combine with the oxygen.

You have probably noticed that often a fire in the grate or in the stove will go out when there is still plenty of wood or coal left. This is probably because there is not enough draft—the air does not reach the coal or the wood quickly enough, and in large enough quantities. In this case, because the fire can not get air, it dies of suffocation. If we clear away the ashes or re-arrange the fuel, to let the air through, the fire will often burn brightly again.

A fire may also go out sometimes even



Fire Engineering

A sad sight to a farmer—the blaze in this barn may have been started by tiny microbes in stored hay.

when there is plenty of fuel and plenty of oxygen. If the draft—the current of air—blows the flames away from the fuel, the gases coming from the wood or coal do not get hot enough to burn. It is for this reason that you can blow out a candle or a match—you simply blow the fire away from the gases that would make the flame. Your breath also cools the material that is burning, below the kindling point.

CAN A FIRE LIGHT ITSELF?

Yes, many fires are caused by materials that set themselves on fire—a process known as spontaneous combustion. In order to set itself on fire, a material must have a very low kindling point. In other words, it must burn at a very low temperature. In addition, the process of oxidation—combining with the oxygen in the air—must already be going on.

Oily rags that are left around in closets or attics often start fires. The carbon and the hydrogen in the oil, as we have seen, are always ready to unite with the oxygen in the air. A certain amount of these elements in the oil on the rags is always uniting with the air, although this process goes on very slowly and does not at first produce any great amount of heat. Rags, however, are not good conductors of heat, and therefore they become hotter and hotter because the heat does not pass off into the air. Finally they become so hot that the kindling point is reached, and they burst into flame. For this reason, oily rags should never be left lying around. Spontaneous combustion also occurs at times in coal mines where great piles of coal are stacked.

Farmers take great care to see that their hay is thoroughly dry before they stack it. If the hay is moist, a tiny microbe known as *Bacillus subtilis,* which grows in hay and partly dried grass, multiplies rapidly in the hay stacks. This causes heat to be formed which may in time become so intense that the whole haystack will burst into flame. Farmers, therefore, try not to stack the hay too tightly, and to allow passages for the air to pass through in order to carry off some of the heat.

Some fires are started in dried grass by bottles left on the ground by picnic parties. The curved glass is believed to act like a burning-glass, and to concentrate the sun's rays on the dry grass, setting it on fire. This is, however, not real spontaneous combustion. The dried grass has not set itself on fire, but an outside means, the burning or magnifying glass, has acted very much as a lighted match would, and raised the temperature of the grass to the kindling point.

WHY DOES A LIGHT GO OUT IN WATER BUT FLARE UP IN GASOLINE?

As we have seen, water is composed of oxygen and hydrogen. The hydrogen in water has already combined with oxygen, and is not free to combine with anything else. Therefore, water does not burn. Because of this, a candle flame, or any other flaming light, will go out in water. The water not only can not be burned, but it also puts the light out by cooling the material that is burning.

Gasoline is a compound of carbon and hydrogen. Each of these elements burns very quickly—that is, easily combines with oxygen—in the presence of heat. Therefore, a fire burns more fiercely when gasoline is added to it.

WHY DOES WATER QUENCH FIRE?

The water puts out fire in two ways. If a fire is suddenly covered with water, the fire is smothered and can not get enough oxygen to continue burning. Water also cools the material that is burning—cools it below the kindling point. Water does this by taking much of the heat of the fire into itself, then becoming steam. This lowers the hotness, the temperature, of the thing that is burning.

WHY IS A FIRE PAIL FILLED WITH SAND?

There are two ways of putting out fires. We can cool the burning material below the kindling point—the point where it will burn—or we can smother the fire. We smother a fire when we cover it with some material that will cut off the supply of oxygen. There are some kinds of fire that can not be put out with water—a fire of flaming oil, for instance. The oil simply spreads out on top of the water and burns on. This is because oil is lighter than water. In such a case, sand is much more useful, because it will smother the fire. For this reason, fire pails are often filled with sand.

In the same way, a small fire in a house can often be smothered by covering it with a rug.

THE NEXT WONDER QUESTIONS ARE ON PAGE 2247.



United Mutual Fire Insurance Company

Gallons of water stream from firehoses to quench a fire that has started on the upper floor of this building.



Culver Service

This picture shows a group of pioneers sculptured on a monument in the Pioneer Memorial State Park at Harrodsburg, Kentucky. Harrodsburg was founded in 1775 and is the oldest permanent settlement in Kentucky. The old log fort has been reconstructed as a museum of pioneer life and is included in the Pioneer Memorial State Park.

MEN OF THE FRONTIER

DANIEL BOONE, JAMES ROBERTSON, JOHN SEVIER

WHEN we speak of the pioneers in the history of North America we mean particularly those men who left the older settlements and struck out into the forest, across rivers and mountains, plains and deserts, to make new homes in the wilderness. They were brave, hardy men, filled with great courage. Sometimes on a hunting expedition they wandered into a more than usually fertile or beautiful spot, of which they made haste to tell their friends. A few of them, like Cooper's Pathfinder, grew to love the quiet and loneliness of the woods. The sound of the wind in the trees and the song of the river were more to them than the voices of men, and they fled at the approach of civilization. Some of them were men to whom any kind of settled life was hateful. Others set out in search of gold, like the miners of California, or of Alaska. Where they went others followed, and we owe it to the pioneers that the vast prairies of the West, over which the buffalo roamed, have become a granary for millions, and the busy hum of cities is heard where once the howl of the wolf broke the silence. Many of the picturesque band of early pioneers are nameless to us now. Others' names will be handed down through history. Perhaps the best known of all is Daniel Boone.

Throughout Daniel Boone's long life the frontier was his home, and from his early childhood to his old age his days were full of adventure. It is strange to us now to think of the Schuylkill Valley as being on the frontier, but when he was born there, in 1734, not fifty years before the Declaration of Independence, it was just on the edge of civilization. He was born in a log cabin, and until late in his life he did not live in a less primitive dwelling. Some years before the time our story begins a Devonshire weaver came to settle in the Quaker colony of Pennsylvania, bringing with him his wife and a large family of boys and girls. Squire Boone, one of these boys, married Sarah Morgan, a Welsh girl, a Quaker like the Boones. Daniel Boone was one of their sons. Both father and mother taught their children self-reliance, self-control, great patience and loyalty.

Squire Boone, the father of Daniel, had been brought up to the weaver's craft like his father before him, but he did not make his entire living by it. He raised cattle on his land and, in addition to this, he operated a blacksmith's forge. The children helped their parents, as soon as they were big enough to take a hand.

There were few schools in the country in

those days, and not until the boy was fourteen did he get a chance to learn to read and write. Then his brother's marriage gave the boy a sister-in-law who gladly taught him all she knew—reading, writing and a little arithmetic. But though he was able to gain little knowledge from books, he learned many things from nature. He knew well the trees and plants in the forest, and was familiar with the haunts and habits of the wild things that made the woods their home.

About five or six miles away from the clearing, Daniel's father owned some good pasture land to which the cows were sent to graze every summer. There the boy's mother took him every year from the time that he was ten years old, and there they stayed until the cold weather forced them to go home again. He had to keep the cattle from straying away through the day, and in the evening to drive them back to the log inclosure round the cabin, where he helped his mother to fasten them up for the night, safe from wild beasts and thieving Indians.

DANIEL LEARNED THE WAYS OF THE WOODS FROM THE INDIANS

For themselves they had no fear of the Indians, who were generally friendly to the Pennsylvanians. From his infancy Daniel was familiar with the silent red men who came to trade their furs for the cloth and blankets that his father wove, or stood to watch the sparks that flew from the anvil in his blacksmith shop. Or perhaps two or three Indians would come on a cold winter's night to ask for shelter from the storm and, wrapping themselves in their deerskins, would lie down to sleep on the cabin floor. Daniel soon learned to glide through the forest as silently as they did, and it was in these early days that he gained the knowledge of their ways which helped him out of many a difficulty in later years.

AS HE GREW UP HE BECAME A GREAT HUNTER

In spite of hard work he had time for play, and during his summer days in the woods he laid the foundation for his fame as a hunter. At first his only weapon was a sapling torn up by the roots and trimmed down until it was just such a weapon as the staff which David used to kill the lion and the bear. His father was very proud of Daniel's skill in bringing down game by flinging this light club, and when the boy was twelve years old gave him a rifle of his own. With this he soon became an unerring marksman and a provider of game.

When he was about sixteen the family left Pennsylvania and traveled down through the Shenandoah Valley into North Carolina. It was a long journey for a large family to take, with their horses, cattle, implements and household goods, but they traveled slowly, and Daniel had plenty of time to go on long hunts and explore the country through which they passed. At length they reached their destination, and settled down at Blue Lick in the Yadkin Valley.

SPRINGS THAT GAVE SALT TO MEN AND TO ANIMALS

These "licks," of which we read so much, were interesting places. In many parts of our country there are salt springs, and from time immemorial these springs were haunted by wild animals which came to lick the salt left by the water as it flowed away. They kept the ground around the spring licked bare, and so the place was called a "lick."

For the next three years Daniel lived at home, helping his father and brothers in the blacksmith shop in the winter, and in the summer going off on long hunting trips. But when he was twenty-one war broke out with the French and Indians. The war, which is called the French and Indian, or the Seven Years' War, was a struggle between the French and British for the possession of the country west of the mountains. The French built forts in territory which was claimed by Virginia, and under their leadership the hostile Indians became very daring. In 1756 General Braddock with a small army was sent from England to drive back the intruding Frenchmen and teach their Indian allies a lesson. The expedition fell into an ambush, and although Braddock and his men fought bravely, they were defeated, and the General himself was killed. Daniel Boone was with the army.

THE INDIAN WARS MADE LIFE ON THE FRONTIER HAZARDOUS

Daniel was married shortly after this to Rebecca Bryan, the daughter of a near neighbor, and settled down to a life of hunting, trapping, blacksmithing and farming. But though he lived for many years in the little log house that he built, his days were not peaceful. Once the Indian wars had begun, they did not cease until after Canada was taken from the French in 1763, and at one time there was so much danger that Daniel thought it best to take his wife and little ones to Virginia for a while.

But he soon came back, and we know that he was present at some of the battles, and

THE WILDERNESS SCOUT



From an old print

This picture of Daniel Boone shows the great Wilderness Scout in his later years, after he had become famous for his deeds in exploring, settling and defending the lands west of the Appalachian mountain wall. He is wearing the deerskin clothing and moccasins of the frontiersman; he carries his long rifle, "Old Betsy."

once he went away down into Tennessee—it is thought on a scouting expedition. Up to half a century ago, a tree stood on the banks of Boone Creek, in Tennessee, on which was cut an inscription reading:

D. Boon
cilled a BAR
on this tree
year
1760.

After peace came he devoted more and more time to hunting. Very soon he began to think of changing his abode, for there were now many families in the valley, and it is said that he liked his nearest neighbors to be so far away that he could not see their chimney smoke as it curled in the breeze. In 1765 he set out on horseback with seven other men to find his way to Florida. They had a difficult journey through the swamps, and once nearly died of hunger, for the hunting was very poor. So he gave up the idea of moving to Florida.

BOONE SEARCHES FOR THE LAND BEYOND THE MOUNTAINS

On his return he turned his thoughts westward to the land beyond the mountains —Kentucky, the "dark and bloody ground" of the Indians, of which he had heard many wonderful tales. He made an attempt to find it in 1767, and with one companion actually spent the winter there without knowing that he had reached it.

In 1769 he set out on the expedition that made him one of the founders of the state. This time he and his companions climbed up over the Blue Ridge Mountains, the Stone and Iron mountains, through Moccasin Gap of Clinch Mountain, through Powell's Valley, up a hunter's trail through Cumberland Gap until they struck the "Warrior's Path," beaten by the feet of generations of Indian war parties, and so down into the forests of Kentucky.

BOONE SPENDS TWO YEARS EXPLORING KENTUCKY

Daniel did not leave Kentucky for two years, and twice was left alone for months, without even a dog as companion. He wandered all over the country, exploring it in every direction, noting its beauties, its well-watered plains and valleys, and storing up in his active mind knowledge that was of great value to the settlers who followed him into this fertile region. His brother Squire, who had been his companion during the year, came back in December, and they spent another winter in the woods. But this time they fell in with another party of hunters, who met them in a curious way. One evening when these men were making camp they heard what in that place was a most extraordinary noise. Motioning his companions to be silent, the leader crept cautiously forward and presently came on Daniel Boone, lying flat on his back and happily singing at the top of his voice as he waited for his brother.

INDIAN WARS DELAY SETTLEMENT OF THE NEW LAND

Boone was delighted with the Kentucky country, and in 1773 persuaded a number of families to join in attempting to make a settlement there. But one night, when they were on the way, his eldest son and some companions were surprised and killed by Indians, and overcome with sorrow and fright, the little party decided not to go on.

A new war now broke out with the Indians, who had been greatly angered by the treatment they had received from the white men. Boone did good service in this war, which is known in history as Lord Dunmore's War, and received great praise for his work. During the war he was sent to warn some scattered parties of their danger, and traveled through woods which were alive with Indians.

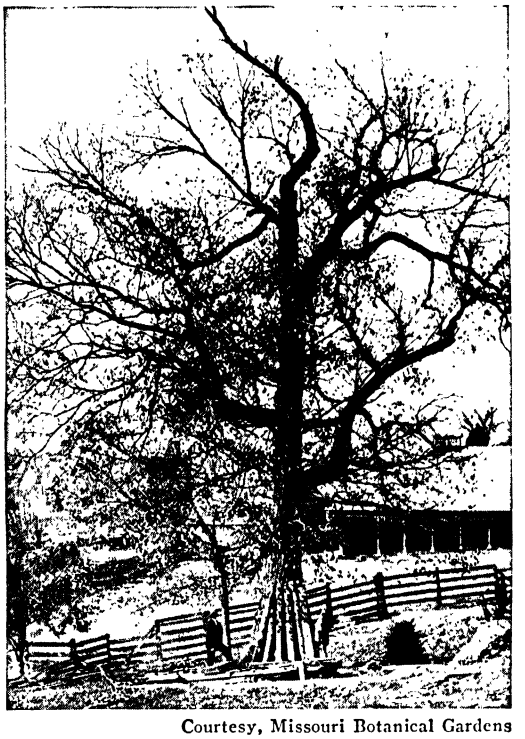
BOONESBOROUGH IS BEGUN IN THE YEAR 1775

The Indians were soon subdued, and when peace came the settlement of Kentucky was seriously begun. The new effort was made, on a much larger scale than before, by the Transylvania Company, with Colonel Richard Henderson at its head and Daniel Boone for one of the leaders. Early in 1775 the first party of settlers reached Big Lick on the Kentucky, by the path which has since been marked out by the Daughters of the Revolution. They began to build a fort, and Boone turned surveyor, laid out the site of a town, later called Boonesborough, and planned the fort. Outside this fort there was a great elm tree, and under its shade the first assembly ever held in Kentucky met to make laws to govern the little community.

In spite of drawbacks the little colony grew steadily. Boone and a number of the other settlers brought their wives and families, and prosperity seemed in sight. But the Revolution broke out, and the Indians commenced to raid the weak settlements. The first warning that the Boonesborough settlers had of their peril was the kid-

naping of Boone's daughter Jemima and her two friends, Betsey and Fanny Calloway. The three girls were paddling on the Kentucky River one Sunday afternoon when their canoe was carried by the current to the opposite bank, and they were captured by five Indians who had been watching the fort from the bushes. Colonel Calloway, the father of Betsey and Fanny, followed in hot pursuit with a party of mounted men. Boone, leading a party on foot, followed the trail and, guided by the scraps of clothing and bruised twigs which the brave girls contrived to leave in the path, caught up with them and rescued them.

The war times were gloomy days for Kentucky. The fort was attacked and once Boone barely escaped with his life. Another time, when he had gone into camp at Blue Lick, he was captured by a war party of Indians who were on their way to attack Boonesborough. He knew that the fort was not ready for defense, and in desperation promised the Indians that if they would put off the attack until spring, he would persuade his companions to surrender to them. The other members of his party listened to his persuasions, and these brave men, to save their families and friends, voluntarily went into what they knew would be a hard and bitter captivity. All through the winter they were dragged about the country from place to place, going even as far as Detroit.



Courtesy, Missouri Botanical Gardens

The elm near Defiance, Missouri, where Boone held court when he was made a judge by the Spanish governor.

In the spring, when the Indians were gathering for the attack on the settlements, Boone managed to escape and, without food, traveled steadily on toward the fort. He found it unprepared for an attack, but set the people vigorously to work. This was in June, 1778. However, the Indians did not reach the fort until August, when they appeared in large force. The siege of Boonesborough is famous in the annals of Kentucky. At times the settlers almost despaired; but at last, to their joy, the noise of shouting and fighting suddenly quieted down, and the Indians silently disappeared in the forest.

For years the settlers in Kentucky endured hardships and suffered many things from the Indians, even after the War for Independence came to an end. In spite of sorrow and hardships, however, the country continued to fill up, and Boone was in great demand as a surveyor. His knowledge of the Indians and his calm bravery and patience made him a tower of strength. He was made lieutenant of his county, town trustee, and was sent as representative to the legislature at Richmond. Kentucky was then a district of Virginia.

He does not appear to have been a good business man, and in spite of the fact that he was a surveyor and must have known the regulations, he failed to file his own land claims. As a consequence, new settlers registered claims against his property. As he had failed to comply with the law, the courts could do nothing for him, and he found himself without an acre of ground in his beloved Kentucky. Sadly disappointed, he left it and went back to what is now West Virginia, where he lived in the little village of Point Pleasant for a number of years. He was held in great esteem by the people, who again sent him to the assembly at Richmond, though he can not be said to have been a brilliant success as a legislator.

The Indians were at last defeated by General Anthony Wayne, a famous general of the Revolution. After the land had been made safe more people began to arrive in Kanawha Valley, and again Boone felt that

INDIAN-FIGHTING ON THE FRONTIER



American Historical Scenes, University of Pennsylvania Press

This painting by Stanley M. Arthurs shows an incident during a savage attack on Boonesborough by the Indians.

he must move so that he might have "elbow room," as he expressed it. Some members of his family had gone to Missouri—then under Spanish rule—and there he followed them, about 1799 with his wife and family and all his possessions.

He was very happy for a few years in Missouri. He received a large tract of land from the government, had plenty of room, good hunting, and was made magistrate of his district, an office in which he was very popular.

In 1813 Boone was greatly saddened by the loss of his wife. After her death he left the little house in which they had lived for years, and for the remainder of his life was tenderly cared for by his sons. He lived until 1820, always happy and active, going off sometimes on a hunting trip, sometimes working a little on the farm.

A monument was built to Boone's memory at Frankfort, the capital of Kentucky. He was not the first man to explore the region, nor even the first to settle in it, but the people realized that he was the best type of pioneer, and that in honoring him they honored what was the greatest in all the men who had taken their lives in their hands and gone out into the wilderness to build a nation.

JAMES ROBERTSON OF TENNESSEE

WHILE Daniel Boone was helping to build the state of Kentucky the same work was being done in Tennessee by James Robertson (1742-1814). Robertson, who was a few years younger than Boone, was born in Virginia. We know little of his early years, except that when he was only a child his family moved to North Carolina. Of course he learned to hunt and shoot, and knew all the trees and plants, and the birds and animals of the woods, how they lived and where they made their homes. No boy of the frontier who did not learn these things was counted of much use to his community. When he was about twenty-six Robertson married.

About two years after his marriage he decided to go in search of a place where he could make a new settlement. With nothing but his horse and his rifle for company, he crossed the mountains and found himself in the lovely Watauga Valley, where there were already a few settlers as adventurous as himself. He stayed long enough to prove the fertility of the land by growing a field of corn, and then went back across the mountains for his family.

On the long journey back through the mountains he lost his way and his horse, and if he had not been rescued by hunters, he would have lost his life; but he reached home safely, and was so full of enthusiasm that sixteen other families determined to join him when he set out in the spring.

Can you imagine the moving of those seventeen families who set out to make the Watauga settlement? Early in the spring everything that could be carried on the backs of horses was packed; the things that could not be taken were sold or given to neighbors; the doors of the old homes were closed, and each family set out for the meeting-place. There the sadness felt at leaving the old home was forgotten in the feeling of adventure. With the leader at the head of the column, the women and children on horseback, the men trudging at the horses' heads and keeping careful watch, and the boys ranging the forest on either side, or driving the cattle that they brought with them, the little party went forward with high hopes. At night they camped, and you can imagine the delicious feeling of safety with which a little boy went to sleep under the starlight in his father's strong arms, or a little girl nestled close beside her mother, near the fire, sure that any prowling Indians or bears or wolves would fall before the aim of the men on watch.

Robertson's party arrived safely at the Watauga, and the men soon built the log cabins that were to be their homes, and gradually made the simple furniture that had to fill their needs in the early years of the settlement. Trees were cut down to clear the fields, and the land was tilled. The next year John Sevier, also a native of Virginia, joined the settlement, and he and Robertson became the leaders of the little community.

The Watauga Valley, in which the new settlement was made, was far from the older settlements and the towns where the courts of law were held. So the men decided to form a government of their own. They drew up a written constitution known as the Articles of the Watauga Association and elected a little assembly of thirteen representatives to govern them. From among the

representatives five were chosen as a court to try all cases of wrong-doing.

That same year (1772) Robertson and another man made a treaty with the Cherokee Indians who lived near by. To celebrate the treaty, sports were held, to which the Indians were invited, and a feast was made. But some bad men who were prowling around in the woods killed an Indian, and all the red men left the settlement vowing vengeance upon it. Not a moment was to be lost. Leaving Sevier and the other men to build a fort as a place of refuge, Robertson set out alone to make peace with the Indians. Although he knew that they might torture him to death, he followed them through the forest, and when he came up with them, apologized for the action of the wrong-doer and won them over completely by his fearlessness and courtesy.



Colonel James Robertson.

Robertson prospered in Watauga, but about eight years after he settled there he determined to go farther afield. This time he made up his mind that before the moving began there should be some houses for the people to move into. So, in the spring he and eight other men climbed the Cumberland Mountains and went down the other side into the land that lies between the Cumberland and the Tennessee. They traveled as far as French Lick, which they decided was a good place for a settlement, and there they planted a large field of corn and built log cabins. When the work was done, three men stayed to guard the crop and the houses, and the others went back to Watauga to show the way to the men and women who were to make the new settlement.

Most of the younger men of Robertson's party followed him through the mountains to the Cumberland Valley. It was a toilsome road, however. It was thought that the river would be an easier way for the women and children to take, and with a few men they went round by boat. On your map you can easily follow the adventurous voyage taken in the winter of 1780 by so many boys and girls, some of them perhaps the ancestors of some of our readers. The party, we are told, left Cloud Creek, on February 27, 1780, under command of John Donelson, a friend of Robertson. They floated down the Tennessee until they reached the Ohio, rowed and paddled up the Ohio to the Cumberland, and up the Cumberland to Big Salt Lick, where Robertson met them. Two months had been spent on the way, and much of the time they had been in peril from Indians, and toward the end they were sometimes hungry. This was a very roundabout way, as you can see by the map in your geography, for the Tennessee River flows almost twice across the state, and even then the journey was not over.

No sooner were the people settled down than Robertson and Colonel Richard Henderson, who had been associated with Boone, helped to organize a government. Representatives were chosen by each of the little villages in the settlement, and the representatives met in Nashborough, the central fort, which was built where Nashville now stands. Robertson was made chairman of the court and colonel of the militia, and was looked upon as the leader of the community.

Before long the Indians attacked the new settlement, and the settlers were kept constantly on the alert. Some families deserted their clearings and went back to their old homes. Others wanted to go, but Robertson persuaded them that to face the dangers was the braver part, and, heartened by his strength, they stayed and were able to fight off their attackers. As winter came on, the powder and bullets began to run short, and the dauntless Robertson went alone through the woods to Kentucky, where he got a supply and brought it back just in time to beat off two attacks made by the Indians.

Robertson suffered much hardship during the years of Indian warfare which came after the Revolution. One of his sons was killed, and he himself was wounded and almost captured. But the great-hearted man was a tower of strength to the people of the Cumberland region. We find him promising that a road should be built and seeing that it should be done, organizing armed forces and leading an expedition against the Indians, and persuading new settlers to come into the district, for he knew that the only way to quiet the Indians was to overawe them by filling the country with white people. Many strong men and women did come

in. By degrees the country filled up with comfortable farms, and, except on the border, the warfare died out.

All this time the country which is now Tennessee had been part of North Carolina. In 1791, however, North Carolina ceded it to the nation, and it was made the territory of Tennessee. Robertson was put in command of the militia in the western part of the territory, and a few years after the state of Tennessee was admitted to the Union (1796) he was made a state senator. During the War of 1812 he did much to prevent the Indians from joining the British. He died in 1814 and his memory is honored to the present day.

JOHN SEVIER OF TENNESSEE

THREE years younger than James Robertson was the pioneer John Sevier (1745-1815), who grew up to become the first governor of Tennessee. He was born in Virginia, in a small community in the Shenandoah Valley, where his father, Valentine, traded in furs and rum with Indians and white settlers. Friendly Indians bringing in their furs were a familiar sight to young John.

He was the eldest of seven children, who played about their father's tavern and helped with the work on their father's farm. Although he did not have the opportunity to learn very much from books, he came to know a great deal about Indians and listened to the tales of travel which his father had to tell. John's grandfather had sailed from France to make his home in England. Later, his father had sailed to the New World and settled at last in the Shenandoah Valley.

At the age of sixteen, John married Sarah Hawkins, who was one of his neighbors. The young couple set up a tavern at a near-by crossroads (which is now the town of New Market) and raised a fine family.



Governor John Sevier.

In the story of Robertson you have read of the Watauga settlement in Tennessee. The first settler built his cabin there in 1769. News of this adventure must soon have reached John's ears and made him long to seek new places and a new home. It is believed that he made the journey southwest to Watauga twice before he decided to take his family with him. Then, in 1773, he moved with his family and his household goods to the Holston River settlement, near Watauga. Soon, throughout the Watauga country, Sevier and Robertson stood out as trusted leaders of the frontiersmen.

After the outbreak of the Revolution, Sevier led his men, 240 strong, across the Smokies to fight the British at King's Mountain, and his victory brought him great fame. That was in 1780, the year in which Robertson left Watauga, and Sevier became the most important leader in the region. In these times of peril, sorrow came to Sevier in the death of his wife. The name of his second wife was Catherine Sherrill. Sevier was soon called on to cross the mountains once more to help in another battle against the British. Now his knowledge of Indians came to his aid. The Indians had grown increasingly dangerous, but in three brilliant raids, Sevier helped to put an end to their menace.

The settlers were very grateful to their leader and never forgot his great services. A few years after the Revolution they tried to organize a new state. This was to be called the state of Franklin, after Benjamin Franklin. John Sevier was to be the first governor. This plan did not work out as they had hoped; but in 1796, when Tennessee was admitted to the Union, the people elected Sevier as its first governor. He served for three terms, and spent the rest of his days in high office, first as a senator and later as a congressman; and he died as he had lived, in the service of his state and his country.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 2494.



Napoleon watching the progress of the Battle of Wagram, where he defeated the Austrians. He liked to stand on high ground, where he could see the whole field, and send messengers with orders to the different commanders.

FRANCE AND ENGLAND IN TUG OF WAR

NAPOLEON AND HIS CONQUERORS

THERE was born in a little room in Ajaccio, on the island of Corsica, on August 15, 1769, Napoleon, the second surviving son of Carlo Buonaparte and Maria Letizia Buonaparte, whose maiden name was Ramolino.

The Buonapartes were of Italian origin, 240 years before Napoleon, but they had become so Corsican that they were neither Italian nor French in sentiment until Corsica became a part of France. Then they became wholeheartedly French, even changing their name to the French form, Bonaparte; though the family character retained many Italian traits.

Young Napoleon left Corsica at the age of nine to be educated in France as a soldier. At sixteen he was a sub-lieutenant of artillery, poor and not very popular, for his appearance did not recommend him to his officer comrades. He was small, slight and had a dark-skinned Italian appearance. But his comrades, however critical they might feel of his appearance, could not deny that he was a diligent student of his profession. Military science, history, geography, travel and the lives of men of action made up the chief substance of his reading.

Seven years passed between the time when this young officer began his training and the time when he was given responsible work. During that period he saw the outbreak of the French Revolution and approved of it; he also approved of the wild Reign of Terror, of which we tell you elsewhere. But he formed the opinion that the mob ought never to be allowed to rule.

After the execution by the revolutionists of the king and queen of France, England joined in the war against the French Republic, and her fleet occupied Toulon harbor on behalf of the Royalists, who held the town. But from the landward side the Republicans began a siege of the city. The only hope of driving the English fleet out of the harbor was by artillery fire, and the command of the artillery was given to young Bonaparte. So skillful were his plans of

attack that the English ships had to withdraw, Toulon was recaptured, and at the age of twenty-four Napoleon became a brigadier general.

A NEW MILITARY LEADER RISES TO THE DEFENSE OF FRANCE

Bonaparte had now become a man from whom great deeds were expected. France needed defenders badly. The Government in Paris was weak; many people were dissatisfied; and the French armies on the frontiers, holding back the enemies who wished to crush the Republic, were being hard pressed, though the war minister, Carnot, was proving a tower of strength.

The most vital point for France was the north of Italy, then held to a large extent by Austria, her most dangerous continental enemy. The young general sketched out a plan by which the Austrians were to be driven from Italy. The fierce cruelties of the Revolution had caused France to be honeycombed with jealousy and distrust, in the army as elsewhere; Napoleon was arrested on suspicion of treachery, after he had been appointed to command the artillery of the French army marching to invade Italy. The influence of Carnot secured his release.

Such success as was gained in Italy was due to the plans of Napoleon; but he felt that he must have a free hand, and he aspired to the chief command of the French army on that frontier. He would not accept lesser commands that would put him at the mercy of the political parties now cutting off each other's heads in Paris.

He failed to be made commander-in-chief on the Italian front. Instead, he was struck off the list of fighting French officers and was thinking of offering his services to Turkey's army. But before he made this move conditions in Paris grew very bad. There was so much dissatisfaction with the Government that another revolution seemed at hand. Someone was needed to keep order in the distracted capital; and the job was given to Napoleon Bonaparte.

When the uprising came, so well did he manage his artillery that with comparatively little loss of life the rebellion against the Government was suppressed, and the people of Paris were able to judge the cleverness of the young general who seemed to perform brilliantly whatever needed doing.

He had an immediate reward. When he was five months short of twenty-seven he was appointed, on the motion of Carnot, commander-in-chief of the French army in Italy, and thus reached the full height of his immediate ambition. He had won the chance for which he had been working. Moreau, the chief commander on the Rhine front, was eight years older. The best general on the Italian front, Masséna, was eleven years older than the new commander, and Augereau, who was to serve with Napoleon through nearly twenty years of carnage, was twelve years older. None of these generals knew Napoleon when, small in stature and haggard in face, he appeared among them. But, as Masséna remarked of him, "the moment after he had put on his general's hat he seemed to have grown two feet."

Two days after his appointment to the command in Italy he married Josephine Beauharnais, a widow six years older than himself.

NAPOLEON'S BRILLIANT VICTORIES ASTOUND THE WORLD

Napoleon acted with a swiftness that electrified France and Europe. The Austrians were in possession of Lombardy in northern Italy, with Milan as their Italian capital and the great fortress of Mantua as their base. As allies, they had the Piedmontese Italians, with Turin as their capital. Napoleon's whole army was less than two-thirds of the united armies of his opponents.

Striking at the junction of the two enemy armies, he rolled up the Austrian center, then swung round and defeated the Piedmontese. Turning again with the bulk of his army, he next defeated the Austrians and headed their retreat away from the Piedmontese. He was now free to deal separately with the Piedmontese, whom he twice more defeated, and they asked for an armistice.

There was only one enemy left. The beaten Austrians were followed up swiftly; battle after battle was won; and two months after Napoleon had received his appointment as commander-in-chief in Italy he made his entry into Milan, amid applauding crowds who believed him when he said he was bringing them freedom from the Austrians.

France was in ecstasies of delight. Instead of being crushed by her enemies, six of whom were hemming her in by land and sea, she was turning the tables on them on the landward side. What would this wonderful general do next? The French Government, at that time called the Directory, sent him word that he must turn southward to Rome and deal out punishment for the opposition which the Church had offered to the French Revolution.



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Napoleon leads his men to victory at Arcole in 1796.

Not the least notice was taken of these orders by Napoleon. "Do you think," he asked, "that I triumph in Italy to make the greatness of the lawyers of the Directory?" He proceeded to use his victories as he thought best and won a peace according to his own liking. In the meantime he sent General Augereau to Paris to look after his interests.

He followed up the Austrians, defeated them repeatedly in the neighborhood of Mantua, forced the surrender of that fortress, crossed the Austrian Alps and arrived within one hundred miles of Vienna. Then Austria accepted his terms of peace.

These terms were the surrender of Belgium to France, the extension of the French frontier to the Rhine and the founding of an Italian republic in the north of Italy. In return Austria received Venice from Napoleon, which before had been independent and was not his to give away. At the same time he made friendly proposals to the Pope to relieve the religious difficulties that were hampering France. He also poured wealth and treasures from Italy into France.

Here, then, at the end of his first campaign, we see the true Napoleon. He had found France a nation struggling desperately to maintain the freedom she had won through her blood-stained Revolution. He blinded her eyes by saying he was carrying that freedom beyond the Alps into Italy, and beyond the Rhine, to make free nations there. But really he was making France an aggressive nation, for wherever he carried the French eagles France became the mistress and he the master of the conquered lands, though he might give each region the name of a republic. The so-called republics he made in the name of freedom had to pay handsomely into his treasury and provide him with soldiers. His devotion to freedom was illustrated by his betrayal of free Venice to Austria, the worst tyrant in Europe.

The other nations now decided to drop the fight and to accept the Republic of France as a sister-nation. Only England remained unbeaten and unterrified. And France bestowed upon Napoleon a new honor; she made him commander of an army called "the Army of England," that is, the army raised to fight England.

NAPOLEON TRIES TO STRIKE AT ENGLAND THROUGH THE EAST

Where could he best strike a deadly blow at England while she held command of the seas? He decided that her vulnerable point was India, where she had now become the predominant power. "Europe," he said to his secretary, "is too small a field. Great fame can be won only in the East." And so toward the East and India he set his face, beginning his enterprise with the landing of an army in Egypt, to hold it as a halfway house, while he proposed to dig a canal across the Isthmus of Suez and thus join the waters of the Mediterranean with the Red Sea.

Here we see the fateful converging of the lives of the four greatest men of action of that age—Napoleon and three Englishmen who, from this time forward, by their deeds while they lived and by their influence after they were dead, finally overthrew him.

Those three Englishmen were William Pitt, the organizer of opposition to the man who had begun to "bestride the narrow world like a Colossus"; Lord Nelson, the guardian of Britain's safety behind her girdling seas; and the Duke of Wellington, who year by year wore down the strength of France and finally overthrew the man who "left a name at which the world grew pale."

As early as 1793 Pitt, as prime minister, had engineered the coalition partnership of Great Britain, Russia, Austria, Spain and Piedmont against France, but, as we have

seen, it was broken up by Napoleon's Italian victories. Still Pitt went on with his schemes, continuing the war at sea, shattering the French naval strength, seizing France's West Indian islands and the colonial possessions of any other state, such as Holland, that sided with France as the French frontier was extended. It was Pitt's mind, using England's money, that steadfastly continued the struggle, with or without friends, always scheming to form fresh combinations hostile to France.

Out of the constant warfare on the sea emerged the heroic figure of Horatio Nelson (1758-1805), one of the greatest captains that ever sailed the seas on fighting bent. The son of a Norfolk clergyman, Nelson went to sea at the age of twelve, a year before Napoleon was born. He, too, was small and slight, but, unlike Napoleon, he was delicate.

No boy seemed less suited to a sailor's life, but in him burned the fire of dauntless bravery. The first proof of it came when he was a middy serving in the Arctic seas. Sighting a polar bear on the ice, he went after it with a musket, fired at it and wounded it; whereupon the bear, fiercest of fighting animals when hurt, turned to chase him. Anybody else would have "made tracks" to save his life, but not so young Nelson. He clubbed his musket, which there was not time to reload, and advanced to meet the bear. Luckily for him and for England, a shot from one of his comrades laid the bear low just as it was clawing for Nelson and he was clouting it with his musket.

That encounter was a forecast of Nelson's seafaring life. Whatever the odds, he advanced to the attack, and not only did he know no fear, but he had the power of inspiring others with his own bravery.

But Nelson was far more than fearless; he became a master of every form of seamanship. At the age of twenty he was captain of a ship.

Wherever active service was possible, there Nelson was found and always in the most dangerous place. While Napoleon was winning his first military honors at the siege of Toulon, Nelson was engaged in the blockading of the port outside; and after the withdrawal of the English ships from the harbor, he commanded a landing party in



Culver Service

Nelson boarding the Spanish ship San Josef during the battle off Cape St. Vincent. It was the quick thinking and heroic action of Nelson in this battle that kept the enemy fleet from escaping and gave England the victory.

Corsica and lost the sight of his right eye from a shower of gravel flung up by a cannon shot. Later he lost his right arm, shattered by a grapeshot when he was trying, on a dark night, to cut out a Spanish treasure ship in the harbor of Santa Cruz de Tenerife.

NELSON'S NAVAL VICTORIES CHECK NAPOLEON'S PROGRESS

Five months earlier another exploit won for him the rank of rear admiral. This exploit was performed in the course of the battle off Cape St. Vincent. Nelson, who was in command of the Captain, detected a maneuver which might have allowed the Spaniards to escape. He placed his ship across the line of the Spanish advance without orders from his admiral, and so took the fire of all the foremost ships for half an hour. His ship was disabled, but she had barred the way till the other British ships came up and won a great victory. When they returned from the pursuit they found that Nelson had managed to drift his battered ship alongside a Spanish ship, boarding and capturing her, and then passing from her to capture a second Spanish ship.

After Pitt's coalition against France had broken up, the Dutch, Spanish and French fleets were all against England, and the ports of Italy were closed to her. So the British fleet had been withdrawn from the Mediterranean. Napoleon decided that he was free to transport his army to Egypt. But Pitt knew that an army was gathering around Toulon and felt that it must be watched. He selected Nelson, just made a rear admiral, to re-enter the Mediterranean with a British fleet and checkmate, as far as possible, any plan Napoleon might have formed.

Napoleon left Toulon for Egypt on May 19, 1798, with 13 battleships, 12 frigates and 200 transports. Nelson's fleet of 14 battleships assembled and started in pursuit June 7. Nelson had no small ships to act as scouts and could only guess where Napoleon had gone, but he decided it must be Egypt. Napoleon had delayed in order to capture Malta, and in the night of June 22 the fleets were close to each other unawares. Nelson reached Egypt first, and, finding that Napoleon was not there, he scouted back along the coast of Asia Minor. On reaching Alexandria Napoleon heard that Nelson was searching for him, so he hastily landed his army, leaving 13 battleships anchored in a line in the Aboukir roadstead, near the mouth of the Nile, and there they were on August 1, when Nelson returned.

Instantly Nelson attacked; half his ships passed inshore of the French line and half outside, with the French between the two fires. The battle lasted till midnight, and the whole French fleet was sunk or taken except two battleships and two frigates which escaped in the night but were captured later. Nelson himself received a severe wound across the forehead during the engagement.

Nelson's name now resounded through Europe. He was made an English baron and an Italian duke. Never had there been such a complete victory at sea. It left Napoleon's army stranded in Egypt, without support and unable to return to France. It enabled Pitt to form another coalition against France in which Russia, Austria, Portugal, Naples and Turkey joined Great Britain. The fruits of Napoleon's great Italian campaign were lost, while France at home was thrown into a state of confusion that threatened reaction and disaster.

NAPOLEON BECOMES THE MOST IMPORTANT MAN IN FRANCE

Once more it seemed as if France was overthrown, and as if Europe, united, might wipe out the effects of the French Revolution. France's only hope was in Napoleon. He had lost her Mediterranean fleet, but she was accustomed to defeat by England at sea, and as Napoleon had conquered Egypt and annihilated a Turkish army sent against him, some glory still shone around him. In October, 1799, he arrived in France, having quietly slipped away from Egypt by sea. He was received with exultation. When he asked what had been done with his conquests during his absence, France had no answer to give. They were lost. Masséna, bravely but with difficulty, was holding back the enemy who had advanced to the borders of France in the south. Moreau was doing the same in the north.

The return of this remarkable man altered everything. The Directory was swept away, and a new constitution was formed which the country approved of, in January, 1800. It placed three Consuls at the head of the French Government, Napoleon being the First Consul and the other two men of no importance, so that he possessed all the real power.

Then, crossing the Alps by the St. Bernard Pass, Napoleon fell on the Austrians and in the battle of Marengo defeated them. Moreau, to the north, won the decisive battle of Hohenlinden. This led to the collapse of

all France's enemies and the regaining of the territories won in Napoleon's first Italian campaign.

The great aim of Napoleon's life now was to isolate and ruin England by closing all the Continent against her. Aided by the Tsar of Russia, he tried to form against her a northern coalition of Russia, Prussia, Sweden and Denmark.

The most dangerous element was the fleet of Denmark, and England met the danger by bombarding Copenhagen and seizing the Danish fleet. Here, again, Nelson was retary genius. They had risen from a state of national misery into comparative prosperity by the Revolution, which gave the peasants rights in the soil they tilled, and they saw in Napoleon the defender of those newly won rights.

It should never be forgotten that Napoleon undoubtedly reigned in France by the will of her people, again and again renewed; and he showed during the first four or five years of the nineteenth century that he had as great capacities for good government in times of peace as he had aggressive power in war.



Greeting Napoleon as First Consul. Josephine is seated beside him; behind her stand her daughter and son.

sponsible for the victory, though to win he was obliged to disobey the orders issued to him by a stupid admiral who had been placed in command because he was older than Nelson.

The Battle of Copenhagen and the death of the mad Tsar Paul of Russia broke up the northern coalition, and then, for a short time, there was peace. Now Napoleon mounted rapidly toward the summit of his ambition. In May, 1802, France voted that he should be Consul for life. In May, 1804, she voted that he should be Emperor of the French. Was it not enough to turn the head of one who from the first had been working steadily for his own glory?

Yet the French were not without reason in taking full advantage of Napoleon's mili-

The work he did at home in France was great and lasting. He brought order to a nation that was confused by changes made by weaker men. He gave France a code of laws that has been a model for many nations, and established a system of government that remained unchanged in many respects for a century or more. He reorganized education, was tolerant of different forms of religion, promoted scientific study and opened careers, in the army and elsewhere, to every Frenchman, rich or poor. Most steadying of all, he accepted firmly the position left by the Revolution in the country districts, so that the peasantry looked upon him as the defender of their fields and vineyards.

If only now he had been able to stay his hand from war and live at peace, Napoleon

would have been by far the greatest man in history. But he was not able to remain quiet. He meant to overthrow England, if possible, directly by invading her, or indirectly by conquering all her friends and then starving her into submission by destroying her trade.

First came his attempt at invasion. On the French shore he collected at Boulogne a great army with which he felt sure he could march triumphantly through England and capture London—if only he could get the army across the Channel. So sure was he of victory that he had medals cut beforehand in France celebrating the victory and saying, in the inscription on them, that they had been cast in London!

All England was in a state of excitement. The most frequent way of keeping English children quiet in those days was to say "Boney is coming!" All except the bravest of grown-up people trembled, while they prepared to defend their native land. But there was no invasion. Nelson, with his fleet, was keeping watch, and he was as great a terror to the battleships afloat as Napoleon was to the nations of Europe ashore.



Napoleon I, Emperor of the French, wearing the coronation robes of crimson velvet, gold and ermine.

Napoleon ordered the French fleet to put to sea, but it would not, and finally he withdrew his army from the coast in order to attack Austria and Russia, who, influenced by Pitt, had made another alliance.

Even the friends of Napoleon in England —for he had friends there—began to see that he was engaged in the pursuit of personal glory when he formed northern Italy into a kingdom and crowned himself as its king. Advancing rapidly against Austria, he captured one of her armies at Ulm and routed the combined Austrian and Russian armies at Austerlitz.

On the day before the Austrian disaster occurred at Ulm (October 21, 1805) the French and Spanish fleet of 33 ships of the line ventured to put out to sea, and were met off Cape Trafalgar by Nelson with 27 British ships of the line. Flying the signal, "England expects every man will do his duty," Nelson at once attacked the larger fleet before him, and a great sea fight followed. At its close 18 of the enemy ships were captured and the rest dispersed, but the heroic Nelson lay dead on his ship, the Victory, with the words, "Thank God I have done my duty," on his dying lips. He had utterly crushed the sea power of his country's enemies and left Napoleon with no hope of conquests except on land.

But the great Corsican's land conquests prospered more and more. When Pitt, six weeks after Trafalgar, heard of the great defeat at Austerlitz, he became completely disheartened, not withstanding Trafalgar, and died with the despairing words, "My country! How I leave my country!" on his lips. But though the great statesman who had opposed Napoleon from the first and the sailor-hero who had saved England on the seas were dead, their spirits lived on in the men whom they had inspired, and England never again relaxed her efforts to save the world from the man whose definite aim it was to be a universal conqueror.

The one European country that had kept out of the strife was Prussia; and when Austria had again made peace, Napoleon forced war on Prussia, routed her armies in the two great battles of Jena and Auerstadt, fought on one day, and entered Berlin in triumph. Afterward, through dreadful carnage at Eylau and Friedland, he forced Russia into peace and close alliance.

All Europe north of the Pyrenees was now at his feet, and everywhere trade with England was forbidden. This was the high-water mark of Napoleon's power. Again he had the opportunity of pausing; but still he went on. His brother Louis was made king of Holland; his brother Jerome, king of

Westphalia; his brother Joseph, king of southern Italy; while he himself was king of northern Italy. Later, when Joseph was made king of Spain, Murat, Napoleon's brother-in-law, succeeded him as king of southern Italy. All southern Germany was in alliance with the French Empire. Only England was free.

To complete the ring of enemies of England, Napoleon invaded Portugal to make her refuse to trade with England. He invaded Spain to put Joseph Bonaparte on its throne. This crossing of the Pyrenees was the fatal step that led to the conqueror's downfall, for here, in the peninsula, he met his third great English opponent, who at last became his conqueror.

At the time when Napoleon began his widely planned attack on England by occupying Egypt he had found an ally in Tippoo, the sultan of Mysore, a turbulent Indian ruler. But Tippoo was attacked by the English and defeated and slain in a battle in which a young English general, Sir Arthur Wellesley, greatly distinguished himself. Later, when the French invasion of Portugal began, Wellesley was chosen to take command of an English army that went to the help of the Portuguese, and he swiftly defeated the French army. Had it not been that Wellesley was superseded by an older general after his second victory, he would probably have captured the whole of the French army in Portugal. As it was, he proved himself the general that England needed to oppose Napoleon on land as Nelson had opposed him on the sea.

Later, when Napoleon sent a force into Spain to put his brother Joseph on the throne, the English sent into Spain an army commanded by Sir John Moore. The people of Spain resented the French invasion; and though the French could beat the Spaniards in pitched battles, the Spaniards harassed their armies by attacks on their lines of communication.

At last the outlook for the French became so bad in Spain that Napoleon himself crossed the Pyrenees. His army was so great that the British, under Sir John Moore, were obliged to retreat to the coast. Seeing Napoleon's difficulties in Spain, the Austrians once more declared war against him in 1809, whereupon he returned from Spain and left the pursuit of Moore to Marshal Soult, who caught up with the British army as it was about to embark for England. The Battle of Corunna followed, when the English faced about and drove back the pursuing French army under Soult. Sir John Moore was killed during the battle and was buried by his men in the night before they embarked. The Spaniards erected a monument over his lonely grave.



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The charge of the Mamelukes at Austerlitz. In this battle Napoleon defeated the Russian and Austrian armies.

The next time an army was sent to Spain to help the still unconquered Spaniards Wellesley was its commander, and he never left the field until Napoleon was beaten.

When Napoleon reached Austria he defeated the Austrians in terrible battles at Essling and Wagram. After entering Vienna he again compelled them to make peace.

Napoleon now divorced his wife Josephine and married the young Archduchess Marie Louise of Austria, thus hoping to raise himself socially into the circle of the hereditary European monarchs. He had made some inquiries respecting marriage with the sister of the Tsar of Russia, and when these fell through, the Tsar was offended. In 1812 Napoleon began an invasion of Russia, taking a huge army for the purpose.

But the best of his soldiers were in Spain, where Wellesley, who had now become Lord Wellington, was winning battle after battle against the best of Napoleon's generals—Masséna, Marmont, Victor and Soult—and driving their forces back toward France.

The campaign against Russia proved a disastrous failure. Though Napoleon won great battles there and reached Moscow, the Russians burned the city so that it should not give him shelter, and at last, with the terrible winter cold freezing and starving his army, he had to retreat.

As he retreated his enemies rose against him on all sides, the Prussians and other Germans, and Austrians and Swedes joining in, while Wellington forced the French in Spain to retreat through the Pyrenees. Wellington finally invaded the south of France, with Soult offering a desperate but unavailing resistance to the onward march of the British.

At last Napoleon's career of aggression had roused the people of every country to unite. Though he fought to the last with skill and bravery, the day came—it was April 11, 1814—when he was compelled to resign his crown and was sent into retire-



After the terrible experience in Russia, Napoleon's broken army straggled across Europe and back to France again. The sick, half-starved soldiers on their return were greeted by their dear ones with love and sorrow.



This picture shows Napoleon signing the abdication in a room of the palace of Fontainebleau. After all the years of glory and power, Napoleon had to give up his throne and his empire and become an exile on a small island.

ment as ruler of the little Isle of Elba in the Mediterranean. In France the brother of the last king, Louis XVI, reigned for a short time.

For ten months Napoleon remained quiet in Elba. Then he crossed quietly to France to appeal to his old army to make him once more Emperor of the French. Once more his spell over his soldiers worked. The army sent to arrest him went over to his side.

The response of the army was wonderful. His journey from the coast to Paris was a triumph. But his enemies were not to be caught. The nearest of his opponents were the British and the Prussians, and their best meeting-place was Belgium. Into Belgium the British army went, under the command of Wellington, while the Prussians, under Marshal Blücher, lined up alongside them. Less than half of Wellington's army were British; the rest were Germans and Belgians.

Napoleon's plan was to hold the English in check while he crushed the Prussians, and then to turn on the English and crush them. But Wellington and Blücher agreed that whichever of them should be forced to retreat, the other should fall back also, so that they should not be divided.

On June 16, 1815, Napoleon sprang on the Prussians at Ligny while more lightly attacking the English at Quatre Bras. The Prussians were driven back, while the English held their ground, but at night they too retreated, keeping touch with the Prussians, and next day Wellington took up his chosen ground at Waterloo to meet the attack he knew was coming. The two great generals, Napoleon and Wellington, whose armies had been fighting each other for six years, had never met. "Now I go to measure my strength with Wellington," said Napoleon.

On June 18, a Sunday, the final fight began. Against the English line the whole force of the French—foot, horse and artillery—was flung hour after hour, and still the line held; there was not a yard's retreat. Five times the French Marshal Ney, the bravest of the brave, led the charges. Gradually, as the afternoon wore on, the Prussians began to arrive, rallied after their beating of two days before. Then Napoleon, knowing that the decisive hour had come, sent forward his Old Guard, whose motto was "The Old Guard dies but never surrenders," and Wellington, knowing that the end was at hand, ordered the English to meet charge with charge. Napoleon himself should have been in that charge, but he was not there.



Courtesy, Frick Art Reference Library

The Duke of Wellington (left) and Marshal Blücher, commander of the Prussian army at Waterloo, meet at Belle-Alliance. Waterloo was one of the most important battles in history, for it decided the fate of many nations.

He did not meet his conqueror in the field. But he joined his men as they fled from the field, fugitives.

As Wellington rode back over the battlefield that night, while the Prussians pressed on the pursuit, he murmured repeatedly to himself, "Thank God." It was the end of a mighty struggle between great men and great nations. A long and dramatic chapter of history was closed.

On arriving in Paris, three days after Waterloo, Napoleon still clung to the hope of rousing national feeling in his favor, but the temper of the people was now against him. On June 22 he abdicated in favor of his son, although this was a mere form, as his son was in Austria and not in the least likely to be brought back by the French. Then he was told he must leave Paris, and for four days he took refuge in Malmaison, the former home of Josephine. (She had died shortly after his first abdication.)

The Prussians, with orders to take him dead or alive, now advanced, and Napoleon retreated westward. He was hoping to sail for the United States, but could get no passports, and when he reached Rochefort he found that British cruisers cut off his hope of escape. Given only a day to leave France, he decided to cast himself upon the generosity of the British Government. Dictating a letter to the prince regent, then ruling for King George III, he compared himself to Themistocles seating himself at the hearth of his enemy. His friend and counselor, Las Cases, who accompanied him, made overtures to the captain of H. M. S. Bellerophon. This captain carried Napoleon to Plymouth. The British Government decided to send him to St. Helena, a lonely island some five hundred miles off the coast of Africa, where he could have a certain freedom of movement without endangering the safety of the world at large. To St. Helena he proceeded. His title of emperor had now been forfeited, and he was treated officially as a general.

Arriving in St. Helena in October, he resided first at The Briars and later at Longwood, a residence specially prepared for him. His chief interest during his captivity was the dictation of his memoirs and the writing of essays on military and political subjects. He died in 1821.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 2292.

NAPOLEON AND HIS CONQUERORS



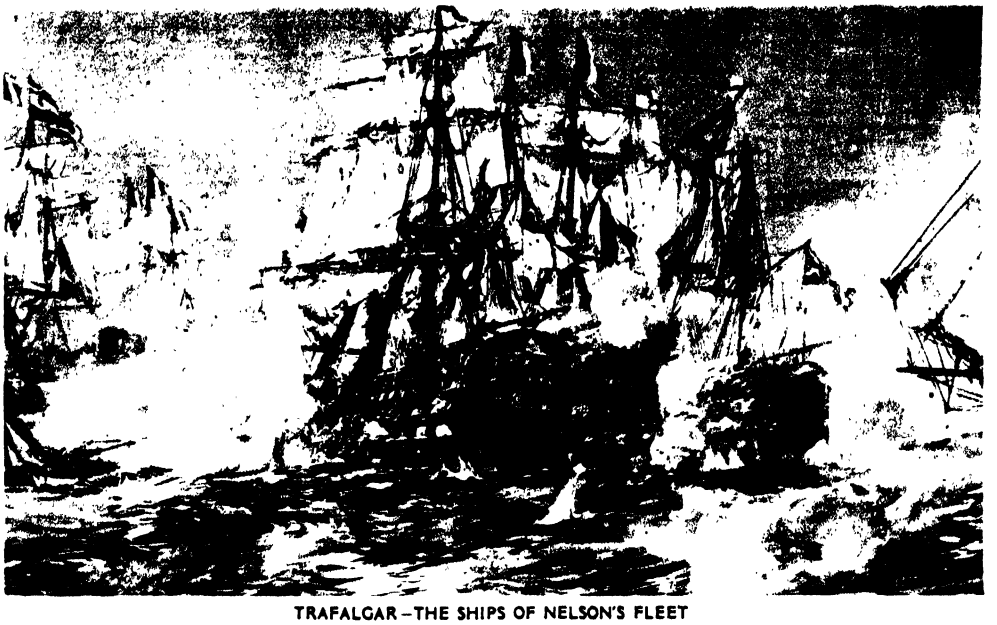
NAPOLEON AS A BOY AT THE MILITARY SCHOOL AT BRIENNE, BY REALIER DUMAS



NELSON'S GOOD-BYE TO HIS GRANDMOTHER BEFORE GOING TO SEA, BY GEORGE W. JOY



PROUD YOUNG WELLINGTON SHOWS HIS MOTHER HIS NEW UNIFORM



TRAFALGAR – THE SHIPS OF NELSON'S FLEET



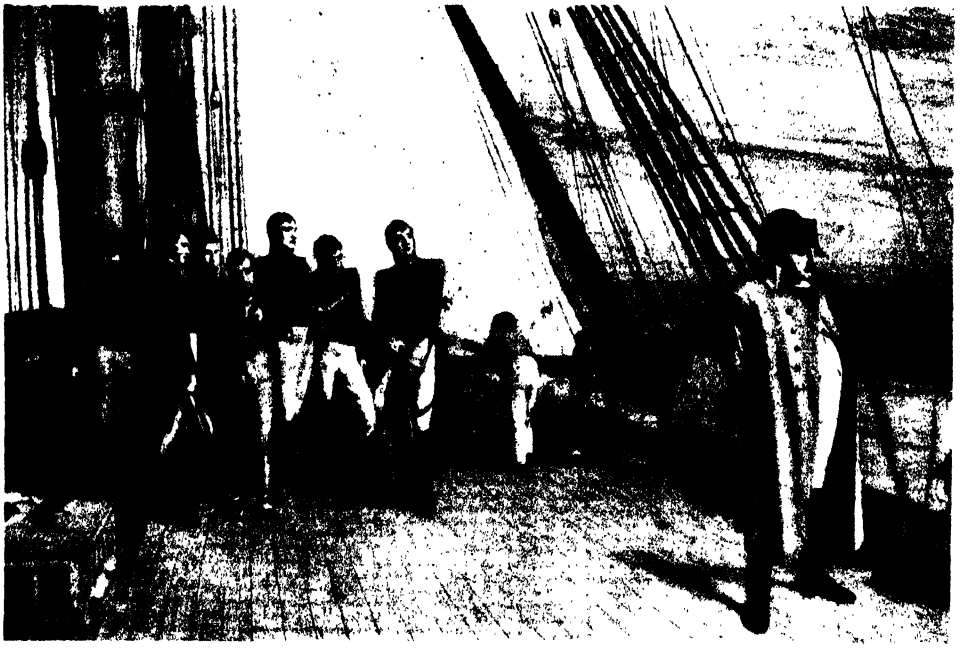
NELSON ON HIS FLAGSHIP THE VICTORY



WELLINGTON ON HIS MARCH FROM QUATRE BRAS TO WATERLOO. FROM THE PAINTING BY ERNEST CROFTS, R A.



THE EVENING OF WATERLOO NAPOLEON ON THE FIELD OF BATTLE, BY ERNEST CROFTS, R A.



THE CAPTIVE NAPOLEON ON BOARD THE BELLEROPHON. FROM THE PAINTING BY W. Q. ORCHARDSON, R.A.



MEISSONIER'S PICTURE OF NAPOLEON AT THE HEAD OF HIS TROOPS

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The King of the Golden River

BY JOHN RUSKIN

In a secluded and mountainous part of Styria there was, in old time, a valley of the most surprising and luxuriant fertility. It was surrounded on all sides by steep and rocky mountains rising into peaks which were always covered with snow, and from which a number of torrents descended in constant cataracts. One of these fell westward, over the face of a crag so high that when the sun had set to everything else, and all below was darkness, his beams still shone upon this waterfall, so that it looked like a shower of gold. It was therefore called by the people of the neighborhood the "Golden River."

It was strange that none of these streams fell into the valley itself. They all descended on the other side of the mountains and wound away through broad plains and by populous cities. But the clouds were drawn so constantly to the snowy hills, and rested so softly in the circular hollow, that in time of drought and heat, when all the country round was



Little Gluck turned and turned, and the roast got nice and brown.

burned up, there was still rain in the little valley; and its crops were so heavy, and its hay so high, and its apples so red, and its grapes so blue, and its wine so rich, and its honey so sweet, that it was a marvel to everyone who beheld it, and was commonly called the "Treasure Valley."

The whole of this little valley belonged to three brothers called Schwartz, Hans and Gluck. Schwartz and Hans, the two elder brothers, were very ugly men, with overhanging eyebrows and small, dull eyes, which were always half shut, so that you couldn't see into *them,* and always fancied they saw very far into *you.*

They lived by farming the Treasure Valley, and very good farmers they were. They killed everything that did not pay for its eating. They shot the blackbirds, because they pecked the fruit; and killed the hedgehogs, lest they should suck the cows; they poisoned the crickets for eating the crumbs in the kitchen; and smothered the cicadas which used to sing all summer in the lime trees. They worked their servants without any wages, till they would not work any more, and then quarreled with them and turned them out of doors without paying them.

It would have been very odd if, with such a farm and such a system of farming, they hadn't got very rich; and very rich they *did* get. They generally contrived to keep their corn by them till it was very dear and then sell it for twice its value; they had heaps of gold lying about on their floors, yet it was never known that they had given so much as a penny or a crust in charity; they were of so cruel and grinding a temper as to receive, from all those with whom they had any dealings, the nickname of the "Black Brothers."

The youngest brother, Gluck, was as completely opposed, in both appearance and character, to his seniors as could possibly be imagined or desired. He was not above twelve years old, fair, blue-eyed, and kind in temper to every living thing. He did not, of course, agree particularly well with his brothers, or rather they did not agree with him. He was usually appointed to the honorable office of turnspit, when there was anything to roast, which was not often, for to do the brothers justice they were hardly less sparing upon themselves than upon other people. At other times he used to clean the shoes, the floors, and sometimes the plates, occasionally getting what was left on them, by way of encouragement, and a wholesome quantity of dry blows, by way of education.

Things went on in this manner for a long time. At last came a very wet summer, and everything went wrong in the country around. The hay had hardly been got in when the haystacks were floated bodily down to the sea by a flood; the vines were cut to pieces with the hail; the corn was all killed by a black blight; only in the Treasure Valley, as usual, all was safe. As it had rain when there was rain nowhere else, so it had sun when there was sun nowhere else. Everybody came to buy corn at the farm, and went away pouring maledictions on the Black Brothers. They asked what prices they liked, and got them, except from the poor people, who could only beg, and several of whom were starved at their very door, without the slightest regard or notice.

It was drawing towards winter, and very cold weather, when one day the two elder brothers had gone out, with their usual warning to little Gluck, who was left to mind the roast, that he was to let nobody in and give nothing out. Gluck sat down quite close to the fire, for it was raining very hard, and the kitchen walls were by no means dry or comfortable-looking. He turned and turned, and the roast got nice and brown.

"What a pity," thought Gluck, "my brothers never ask anybody to dinner! I'm sure, when they've got such a nice piece of mutton as this and nobody else has got so much as a piece of dry bread, it would do their hearts good to have somebody to eat it with them."

Just as he spoke there came a double knock at the house door, yet heavy and dull, as though the knocker had been tied up—more like a puff than a knock.

"It must be the wind," said Gluck; "nobody else would venture to knock double knocks at our door."

No; it wasn't the wind: there it came again very hard, and, what was particularly astounding, the knocker seemed to be in a hurry, and not to be in the least afraid of the consequences. Gluck went to the window, opened it, and put his head out to see who it was.

It was the most extraordinary-looking little gentleman he had ever seen in his life. He had a very large nose, slightly brass-colored; his cheeks were very round and very red, and might have warranted a supposition that he had been blowing a fire for the last eight-and-



Little Gluck was so perfectly paralyzed by the singular appearance of his visitor that he remained fixed.

forty hours; his eyes twinkled merrily through long silky eyelashes, his mustaches curled twice round like a corkscrew on each side of his mouth; and his hair, of a curious mixed pepper-and-salt color, descended far over his shoulders. He was about four feet six in height, and wore a pointed cap of nearly the same height decorated with a black feather some three feet long. His doublet was prolonged behind into something resembling a violent exaggeration of what is now termed a "swallow tail," but was much obscured by the swelling folds of an enormous black, glossy-looking cloak, which must have been very much too long in calm weather.

Gluck was so perfectly paralyzed by the singular appearance of his visitor that he remained fixed without uttering a word until the old gentleman turned round to look after his fly-away cloak. In so doing he caught sight of Gluck's little yellow head jammed in the window.

"Hello!" said the little gentleman. "That's not the way to answer the door; I'm wet, let me in!"

To do the little gentleman justice, he *was* wet. His feather hung down between his legs like a beaten puppy's tail, dripping like an umbrella; and from the ends of his mustaches the water was running into his waistcoat pockets and out again like a mill-stream.

"I beg pardon, sir," said Gluck; "I'm very sorry, but I really can't."

"Can't what?" said the old gentleman.

"I can't let you in, sir—I can't indeed; my brothers would beat me to death, sir, if I thought of such a thing. What do you want, sir?"

"Want?" said the old gentleman petulantly. "I want fire and shelter; and there's your great fire there blazing, crackling and dancing on the walls with nobody to feel it. Let me in, I say; I only want to warm myself."

Gluck had had his head, by this time, so long out of the window that he began to feel it was really unpleasantly cold, and when he turned and saw the beautiful fire rustling and roaring and throwing long, bright tongues up the chimney, as if it were licking its chops at the savory smell of the leg of mutton, his heart melted within him that it should be burning away for nothing.



"He does look very wet," said little Gluck; "I'll just let him in for a quarter of an hour."

Round he went to the door and opened it; and as the little gentleman walked in, there came a gust of wind through the house that made the old chimneys totter.

"That's a good boy!" said the little gentleman. "Never mind your brothers. I'll talk to them."

"Pray, sir, don't do any such thing," said Gluck. "I can't let you stay till they come; they'd be the death of me."

"Dear me," said the old gentleman, "I'm very sorry to hear that. How long may I stay?"

"Only till the mutton's done, sir," replied Gluck, "and it's very brown."

Then the old gentleman walked into the kitchen and sat himself down on the hob, with the top of his cap accommodated up the chimney, for it was a great deal too high for the roof.

"You'll soon dry there, sir," said Gluck, and sat down again to turn the mutton. But the old gentleman did not dry there, but went on drip, drip, dripping among the cinders, and the fire fizzed and spluttered, and began to look very black and uncomfortable; never was such a cloak: every fold in it ran like a gutter.

"I beg your pardon, sir," said Gluck at length, after watching the water spreading in long, quicksilver-like streams over the floor for a quarter of an hour; "mayn't I take your cloak?"

"No, thank you," said the old gentleman.

"Your cap, sir?"

"No, I am all right, thank you," said the old gentleman rather gruffly.

"But, sir, I'm very sorry," said Gluck hesitatingly; "but really, sir, you're putting the fire out."

"It'll take longer to do the mutton, then," replied his visitor dryly.

Gluck was very much puzzled by the behavior of his guest: it was such a strange mixture of coolness and humility. He turned away at the string meditatively for another five minutes.

"That mutton looks very nice," said the old gentleman at length. "Can't you give me a little bit?"

"Impossible, sir," said Gluck.

"I'm very hungry," continued the old gentleman. "I've had nothing to eat yesterday nor to-day. They surely couldn't miss a bit from the knuckle."

He spoke in so very melancholy a tone that it quite melted Gluck's heart. "They promised me one slice to-day, sir," said he; "I can give you that, but not a bit more."

"That's a good boy!" said the old gentleman again.

Then Gluck warmed a plate, and sharpened a knife.

"I don't care if I do get beaten for it," thought he. Just as he had cut a large slice out of the mutton, there came a tremendous rap at the door. The old gentleman jumped off the hob, as if it had suddenly become inconveniently warm. Gluck fitted the slice into the mutton again, with desperate efforts at exactitude, and ran to open the door.

"What did you keep us waiting in the rain for?" said Schwartz, as he walked in, throwing his umbrella in Gluck's face. "Ay! what for, indeed, you little vagabond?" said Hans, giving Gluck a box on the ear.

"Bless my soul!" said Schwartz.

"Amen," said the little gentleman, who had taken his cap off, and was standing in the middle of the kitchen, bowing with the utmost possible velocity.

"Who's that?" said Schwartz, catching up a rolling-pin and turning to Gluck with a fierce frown.

"I don't know, indeed, brother," said Gluck, in great terror.

"How did he get in?" roared Schwartz.

"My dear brother," said Gluck deprecatingly, "he was so *very* wet!"

The rolling-pin was descending on Gluck's head; but, at the instant, the old gentleman interposed his conical cap, on which it crashed with a shock that shook the water out of it all over the room. What was very odd, the rolling-pin no sooner touched the cap than it flew out of Schwartz's hand, spinning like a straw in a high wind, and fell into the corner at the farther end of the room.

"Who are you, sir?" demanded Schwartz, turning upon him.

"What's your business?" snarled Hans.

"I'm a poor old man, sir," the little gentleman began very modestly, "and I saw your fire through the window and begged shelter for a quarter of an hour."

"Have the goodness to walk out again, then," said Schwartz. "We've quite enough water in our kitchen without making it a drying house."

"It is a cold day to turn an old man out in.



The old gentleman sat himself down on the hob, with the top of his hat accommodated up the chimney.

Look at my gray hairs."

"Ay!" said Hans, "there are enough of them to keep you warm. Walk!"

"I'm very hungry, sir; couldn't you spare me a bit of bread before I go?"

"Bread, indeed!" said Schwartz. "Do you suppose we've nothing to do with our bread but to give it to such red-nosed fellows as you?"

"Why don't you sell your feather?" said Hans sneeringly. "Out with you!"

"A little bit," said the old gentleman.

"Be off!" said Schwartz.



Schwartz hit his head against the wall.



A ragged cloud rolled away down the valley in all manner of shapes.

"Pray, gentlemen."

"Off, and be hanged!" cried Hans, seizing him by the collar. But he had no sooner touched the old gentleman's collar than away he went after the rolling-pin, spinning round and round, till he fell into the corner on the top of it. Then Schwartz was very angry and ran at the old gentleman to turn him out; but he also had hardly touched him when away he went after Hans and the rolling pin, and hit his head against the wall as he tumbled into the corner. And so there they lay, all three. Then the old gentleman spun himself round in the opposite direction; continued to spin until his long cloak was all wound neatly about him; clapped his cap on his head, very much on one side (for it could not stand upright without going through the ceiling), gave an additional twist to his corkscrew mustaches, and replied with perfect coolness: "Gentlemen, I wish you a very good morning. At twelve o'clock tonight I'll call again; after such a refusal of hospitality as I have just experienced, you will not be surprised if that visit is the last I ever pay you."

"If ever I catch you here again," muttered Schwartz, coming, half frightened, out of the corner—but before he could finish his sentence the old gentleman had shut the house door behind him with a great bang; and there drove past the window, at the same instant, a wreath of ragged cloud that whirled and rolled away down the valley in all manner of shapes, melting away at last in a gush of rain.

"A very pretty business, indeed, Mr. Gluck!" said Schwartz. "Dish the mutton, sir. If ever I catch you at such a trick again —— Bless me, why, the mutton's been cut!"

"You promised me one slice, brother, you know," said Gluck.

"Oh, and you were cutting it hot, I suppose, and going to catch all the gravy. It'll be long



An enormous foam globe, on which reclined the little old gentleman.

before I promise you it again. Leave the room, sir."

Gluck left the room melancholy enough. The brothers ate as much mutton as they could, locked the rest in the cupboard, and proceeded to get very drunk after dinner.

Such a night as it was! Howling wind and rushing rain, without intermission. The brothers had just sense enough left to put up all the shutters and double-bar the door before they went to bed. As the clock struck twelve they were both awakened by a tremendous crash. Their door burst open with a violence that shook the house from top to bottom.

"What's that?" cried Schwartz, starting up.

"Only I," said the little gentleman.

The brothers sat up and stared into the darkness. The room was full of water, and by a misty moonbeam which found its way through a hole in the shutter, they could see in the midst of it an enormous foam globe spinning round and bobbing up and down like a cork, on which reclined the little old gentleman, cap and all. There was plenty of room for him now, for the roof was off.

"Sorry to incommode you," said their visitor ironically. "I'm afraid your beds are dampish. Perhaps you had better go to your brother's room. I've left the ceiling on there."

They required no second admonition, but rushed into Gluck's room, wet through, and in an agony of terror.

"You'll find my card on the kitchen table," the old gentleman called after them. "Remember, the last visit."

"Pray Heaven it may be!" said Schwartz, shuddering. And the foam globe disappeared.

Dawn came at last, and the two brothers looked out of Gluck's little window in the morning. The Treasure Valley was one mass of ruin and desolation. The flood had swept away trees, crops and cattle, and left in their stead a waste of red sand and gray mud. The two brothers crept, shivering and horror-struck, into the kitchen.

The water had gutted the whole first floor—corn, money, almost every movable thing had been swept away, and there was left only a small white card on the kitchen table. On it, in large, breezy, long-legged letters, were engraved the words:

Southwest Wind, Esquire

II

Southwest Wind, Esquire, was as good as his word. He entered the Treasure Valley no more; and, what was worse, he had so much influence with his relations, the West Winds in general, and used it so effectually, that they all adopted a similar line of conduct.

So no rain fell in the valley from one year's end to another. Though everything remained green and flourishing in the plains below, the inheritance of the three brothers was a desert. The brothers in despair abandoned their valueless patrimony to seek some means of gaining a livelihood among the cities and people of the plains. All their money was gone, and they had nothing left but some curious old-fashioned pieces of gold plate, the last remains of their ill-gotten wealth.

"Suppose we turn goldsmiths!" said Schwartz to Hans. "It is a good knave's trade. We can put a great deal of copper into the gold without anyone's finding it out."

The thought was agreed to be a very good one; they hired a furnace, and turned goldsmiths. But two slight circumstances affected their trade: the first, that people did not approve of the coppered gold; the second, that the two elder brothers, whenever they had sold anything, used to leave little Gluck to mind the furnace, and go and drink out the money in the ale-house next door.

So they melted all their gold without making money enough to buy more, and were at last reduced to one large drinking-mug which an uncle of his had given to little Gluck, and of which he was very fond and would not have parted with for the world, though he never drank anything out of it but milk and water. The mug was a very odd mug to look at. The handle was formed of two wreaths of flowing golden hair so finely spun that it looked more like silk than metal; and these wreaths descended into, and mixed with, a beard and whiskers of the same exquisite workmanship, which surrounded and decorated a very fierce little face, of the reddest gold imaginable, right in the front of the mug, with a pair of eyes in it which seemed to command its whole circumference. When it came to the mug's turn to be made into spoons, it half broke poor little Gluck's heart; but the brothers only laughed at him, tossed the mug into the melting-pot, and staggered out to the ale-house, leaving him to pour the gold into bars when it was all ready.



The mug was a very odd mug to look at.

When they were gone, Gluck took a farewell look at his old friend in the melting-pot. The flowing hair was all gone; nothing remained but the red nose, and the sparkling eyes, which looked more malicious than ever. "And no wonder," thought Gluck, "after being treated in that way." He sauntered disconsolately to the window, and sat himself down to catch the fresh evening air, and escape the hot breath of the furnace. Now this window commanded a direct view of the range of mountains, which, as I told you before, overhung the Treasure Valley, and more especially of the peak from which fell the Golden River. It was just at the close of the day, and, when Gluck sat down at the window, he saw the rocks of the mountain tops, all crimson and purple with the sunset; and there were bright tongues of the fiery cloud burning and quivering about them; and the river,

brighter than all, fell, in a wavering column of pure gold, from precipice to precipice, with the double arch of a broad purple rainbow stretched across it, flushing and fading alternately in the wreaths of spray.

"Ah," said Gluck aloud, after he had looked at it for a while, "if that river were really all gold, what a nice thing it would be!"

"No, it wouldn't, Gluck," said a clear voice, close at his ear.

"Bless me, what's that?" exclaimed Gluck, jumping up.

There was nobody there.

He looked into all the corners and cupboards, and then began turning round and round as fast as he could in the middle of the room, thinking there was somebody behind him, when the same voice struck again on his ear.

It was singing now very merrily, "Lala-lira-la"; no words, only a soft melody, something like that of a kettle on the boil. All at once it struck Gluck that it sounded louder near the furnace. He ran to the opening and looked in. Yes, he saw right; it seemed to be coming not only out of the furnace but out of the pot. He uncovered it, and ran back in a great fright, for the pot was certainly singing! He stood in the farthest corner of the room, with his hands up and his mouth open, for a minute or two, when the singing stopped, and the voice became clear.

"Hollo!" said the voice.

Gluck made no answer.

"Hollo! Gluck, my boy," said the pot again.

Gluck summoned all his energies, walked straight up to the crucible, drew it out of the furnace, and looked in. The gold was all melted, and its surface as smooth and polished as a river; but instead of reflecting little Gluck's head as he looked in, he saw, meeting his glance from beneath the gold, the red nose and sharp eyes of his old friend the mug, a thousand times redder and sharper than ever he had seen them in his life.

"Come, Gluck, my boy," said the voice out of the pot again; "I'm all right; pour me out."

But Gluck was too much astonished to do anything of the kind.

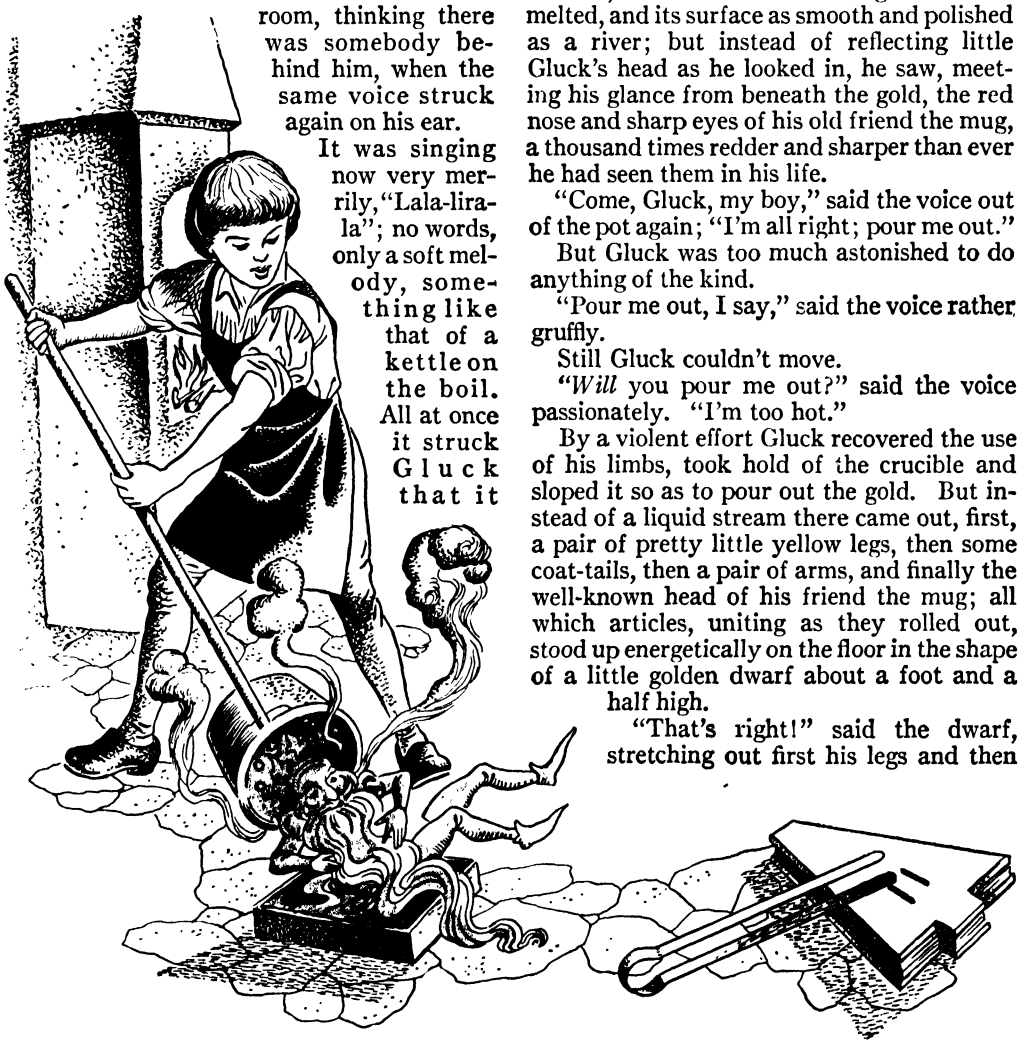
"Pour me out, I say," said the voice rather gruffly.

Still Gluck couldn't move.

"*Will* you pour me out?" said the voice passionately. "I'm too hot."

By a violent effort Gluck recovered the use of his limbs, took hold of the crucible and sloped it so as to pour out the gold. But instead of a liquid stream there came out, first, a pair of pretty little yellow legs, then some coat-tails, then a pair of arms, and finally the well-known head of his friend the mug; all which articles, uniting as they rolled out, stood up energetically on the floor in the shape of a little golden dwarf about a foot and a half high.

"That's right!" said the dwarf, stretching out first his legs and then



Instead of a liquid golden stream, there came out a little golden dwarf about a foot and a half high.

his arms, and then shaking his head up and down and as far round as it would go for five minutes without stopping; apparently with the view of ascertaining if he were quite correctly put together, while Gluck stood contemplating him in speechless amazement.

He was dressed in a slashed doublet of spun gold, so fine in its texture that the colors gleamed over it as if on a surface of mother-of-pearl; and over this brilliant doublet his hair and beard fell full halfway to the ground in waving curls, so exquisitely delicate, that Gluck could hardly tell where they ended; they seemed to melt into air. The features of the face, however, were by no means finished with the same delicacy; they were rather coarse, slightly inclining to coppery in complexion, and indicative, in expression, of a very pertinacious and intractable disposition. When the dwarf had finished his self-examination, he turned his small sharp eyes full on Gluck, and stared at him deliberately for a minute or two. "No, it wouldn't, Gluck, my boy," said the little man.

"Wouldn't it, sir?" said Gluck, very mildly, and submissively indeed.

"No," said the dwarf, conclusively, "no, it wouldn't." And with that the dwarf pulled his cap hard over his brows, and took two turns, of three feet long, up and down the room, lifting his legs up very high, and setting them down very hard. This pause gave time for Gluck to collect his thoughts a little, and, seeing no great reason to view his diminutive visitor with dread, and feeling his curiosity overcome his amazement, he ventured on a question of peculiar delicacy.

"Pray, sir," said Gluck, "were you my mug?"

On which the little man turned sharply round, walked straight up to Gluck, and drew himself up to his full height.

"I am the King of what you mortals call the Golden River. The shape you saw me in was owing to the malice of a stronger king, from whose enchantments you have freed me. What I have seen of you and your conduct to your wicked brothers renders me willing to serve you; therefore attend to what I tell you. Whoever shall climb to the top of that mountain from which you see the Golden River issue, and shall cast into the stream at its source three drops of holy water, for him, and for him only, the river shall turn to gold. But no one failing in his first can succeed in a second attempt; and if anyone shall cast unholy water into the river, it will overwhelm him and he will become a black stone."

So saying, the King of the Golden River turned away and deliberately walked into the center of the hottest flame of the furnace. His figure became red, white, transparent, dazzling, a blaze of intense light—rose, trembled and disappeared. The King of the Golden River had evaporated.

"Oh!" cried poor Gluck, running to look up the chimney after him. "Oh, dear, dear, dear me! My mug! my mug! my mug!"

III

The King of the Golden River had hardly made his extraordinary exit before Hans and Schwartz came roaring into the house, very savagely drunk.

The discovery of the total loss of their last piece of plate had the effect of sobering them just enough to enable them to stand over Gluck beating him very steadily for a quarter of an hour; at the expiration of which period they dropped into a couple of chairs, and requested to know what he had got to say for himself. Gluck told them his story, of which, of course, they did not believe a word. They beat him again till their arms were tired, and staggered to bed. In the morning, however, the steadiness with which he adhered to his story obtained him some degree of credence; then the two brothers, after wrangling a long time on the knotty question which of them should try his fortune first, drew their swords and began fighting. The noise of the fray alarmed the neighbors, who sent for the constable.

Hans, on hearing this, contrived to escape, and hid himself; but Schwartz was taken before the magistrate, fined for breaking the peace, and, having drunk out his last penny the evening before, was thrown into prison till he should pay.

When Hans heard this, he was much delighted and determined to set out immediately for the Golden River. How to get the holy water was the question. He went to the priest, but the priest could not give any holy water to so abandoned a character. So Hans stole a cupful and returned home in triumph.

Next morning he got up before the sun rose, put the holy water into a strong flask, and two bottles of wine and some meat in a basket, slung them over his back, took his staff in his hands, and set out for the mountains.



Hans strode over the body of the old man and darted on.

It was, indeed, a morning that might have made anyone happy, even with no Golden River to seek for. Level lines of dewy mist lay stretched along the valley, out of which rose the massy mountains—their lower cliffs in pale gray shadow, hardly distinguishable from the floating vapor, but gradually ascending till they caught the sunlight, which ran in sharp touches of ruddy color along the angular crags, and pierced, in long level rays, through their fringes of spear-like pine. Far beyond, fainter than the morning cloud, but purer and changeless, slept, in the blue sky, the utmost peaks of eternal snow.

The Golden River was now nearly in shadow; all but the uppermost jets of spray, which rose like slow smoke above the undulating line of the cataract and floated away in feeble wreaths upon the morning wind.

On this object, and on this alone, Hans' eyes and thoughts were fixed; forgetting the distance he had to traverse, he set off at an imprudent rate of walking, which greatly exhausted him before he had scaled the first range of the green and low hills. He was, moreover, surprised, on surmounting them, to find that a large glacier, of whose existence he had been absolutely ignorant, lay between him and the source of the Golden River.

He entered on it with the boldness of a practiced mountaineer; yet he thought he had never traversed so strange or so dangerous a glacier in his life. The ice was excessively slippery, and out of all its chasms came wild sounds of gushing water. The ice crashed and yawned into fresh chasms at his feet, and tottering spires nodded around him and fell thundering across his path; and it was with terror that he leaped the last chasm, and flung himself, exhausted and shuddering, on the firm turf of the mountain. He had been compelled to abandon his basket of food.

His way now lay straight up a ridge of bare red rocks, without a blade of grass to ease the foot, or a projecting angle to afford an inch of shade from the south sun. It was past noon, and the rays beat intensely upon the steep path, while the whole atmosphere was motionless and penetrated with heat. Intense thirst was soon added to the bodily fatigue with which Hans was now afflicted; glance after glance he cast on the flask of water which hung at his belt.

"Three drops are enough," at last thought he; "I may at least cool my lips."

He opened the flask, and was raising it to his lips when his eye fell on an object lying on the rock beside him; he thought it moved. It was a small dog, apparently in the last agony of death from thirst. Its tongue was out, its jaws dry, and a swarm of black ants were crawling about its lips and throat. Its eye moved to the bottle which Hans held in his hand. He raised it, drank, spurned the animal with his foot, and passed on. And he did not know how it was, but he thought that a strange shadow had suddenly come across the blue sky.

The path became steeper and more rugged

every moment; and the high hill air, instead of refreshing him, seemed to throw him into a fever. The noise of the hill cataracts sounded like mockery in his ears; they were all distant, and his thirst increased every moment.

Another hour passed, and he again looked down to the flask at his side; it was half empty; but there was much more than three drops in it. He stopped to open it, and again, as he did so, something moved in the path above him. It was a fair child stretched nearly lifeless on the rock, its breast heaving with thirst, its eyes closed, and its lips parched and burning. Hans eyed it deliberately, drank, and passed on. And a dark, gray cloud came over the sun, and long, snake-like shadows crept up along the mountainsides.



Hans struggled on. The sun was sinking, but its descent seemed to bring no coolness; the leaden weight of the dead air pressed upon his brow and heart, but the goal was now near. He saw the cataract of the Golden River springing down from the hillside scarcely five hundred feet above him. He paused for a moment to breathe, and sprang on to complete his task.

At this instant a faint cry fell on his ear. He turned and saw a gray-haired old man extended on the rocks. His eyes were sunk, his features deadly pale and gathered into an expression of despair.

"Water!" He stretched his arms to Hans, and cried feebly: "Water! I am dying!"

"I have none," replied Hans. "Thou hast had thy share of life."

He strode over the prostrate body and darted on. And a flash of blue lightning rose out of the East shaped like a sword; it shook thrice over the whole heaven, and left it dark with one heavy, impenetrable shade. The sun was setting; it plunged toward the horizon like a red-hot ball.

The roar of the Golden River rose on Hans' ear. He stood at the brink of the chasm through which it ran. Its waves were filled with the red glory of the sunset; they shook their crests like tongues of fire, and flashes of bloody light gleamed along their foam. Their sound came mightier and mightier on his senses; his brain grew giddy with the prolonged thunder. Shuddering, he drew the flask from his girdle and hurled it into the centre of the torrent. As he did so, an icy chill shot through his limbs; he staggered, shrieked and fell. The waters closed over his cry. And the moaning of the river rose wildly into the night, as it gushed over

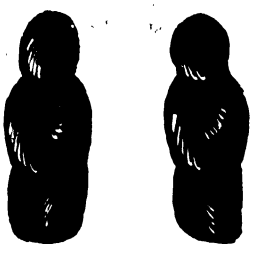
THE BLACK STONE.

IV

Poor little Gluck waited very anxiously alone in the house for Hans' return. Finding he did not come back, he was terribly frightened and went and told Schwartz in the prison all that had happened. Schwartz was pleased, and said that Hans must certainly have been turned into a black stone, and he should have all the gold to himself.

But Gluck was very sorry, and cried all night. When he got up in the morning, there was no bread in the house nor any money; so Gluck went and hired himself to another goldsmith, and he worked so hard, and so neatly,

and so long every day, that he soon got money enough together to pay his brother's fine, and he gave it all to Schwartz, and Schwartz got out of prison. Then Schwartz was quite pleased and said he should have some of the gold of the river. But Gluck only begged he would go and see what had become of Hans.



Now when Schwartz had heard that Hans had stolen the holy water, he thought to himself that such a proceeding might not be considered altogether correct by the King of the Golden River, and determined to manage matters better. So he took some more of Gluck's money and went to a bad priest, who gave him some holy water very readily for it. Then Schwartz was sure it was all quite right. So Schwartz got up early in the morning before the sun rose, and took some bread and wine in a basket, and put his holy water in a flask, and set off for the mountains.

Like his brother, he was much surprised at the sight of the glacier, and had great difficulty in crossing it even after leaving his basket behind him. The day was cloudless, but not bright; there was a heavy purple haze hanging over the sky, and the hills looked lowering and gloomy. And as Schwartz climbed the steep rock path, the thirst came upon him until he lifted his flask to his lips to drink. Then he saw the fair child lying near him on the rocks, and it cried to him and moaned for water.

"Water, indeed!" said Schwartz. "I haven't half enough for myself," and passed on. And as he went he thought the sunbeams grew more dim, and he saw a low bank of black cloud rising out of the west; and, when he had climbed for another hour, the thirst overcame him again, and he would have drunk. Then he saw the old man lying before him on the path, and heard him cry out for water.

"Water, indeed!" said Schwartz. "I haven't half enough for myself." And on he went.

Then, again, the light seemed to fade from before his eyes, and he looked up, and, behold, a mist, of the color of blood, had come over the sun; and the bank of black cloud had risen very high and its edges were tossing and tumbling like the waves of the angry sea. And they cast long shadows, which flickered over Schwartz's path.

A sudden horror came over Schwartz, he knew not why; but the thirst for gold prevailed over his fear, and he rushed on. And when Schwartz stood by the brink of the Golden River, its waves were black like thunder-clouds, but the foam was like fire; and the roar of the waters below and the thunder above met as he cast the flask into the stream.

And, as he did so, the lightning glared in his eyes, and the earth gave way beneath him, and the waters closed over his cry. And the moaning of the river rose wildly into the night, as it gushed over the

TWO BLACK STONES.

V

When Gluck found that Schwartz did not come back, he was very sorry and did not know what to do. He had no money and was obliged to go and hire himself again to the



Gluck made up his mind to go and try his fortune with the Golden River.

goldsmith, who worked him very hard and gave him very little money.

So, after a month or two, Gluck grew tired, and made up his mind to go and try his fortune with the Golden River.

"The little king looked very kind," thought he. "I don't think he will turn me into a black stone."

So he went to the priest, and the priest gave him some holy water as soon as he asked for it. Then Gluck took some bread in his basket and the bottle of water, and set off very early for the mountains.

If the glacier had occasioned a great deal of fatigue to his brothers, it was twenty times worse for him, who was neither so strong nor so practiced on the mountains. He had several very bad falls, lost his basket and bread, and was very much frightened at the strange noises under the ice. He lay a long time to rest on the grass after he had got over, and began to climb the hill just in the hottest part of the day. When he had climbed for an hour, he got dreadfully thirsty and was going to drink, like his brothers, when he saw an old man coming down the path above him looking very feeble and leaning on a staff.

"My son," said the old man, "I am faint with thirst; give me some of that water."

Then Gluck looked at him, and when he saw that he was pale and weary, he gave him the water. "Only, pray, don't drink it all!" said Gluck. But the old man drank a great deal, and gave him back the bottle two-thirds empty. Then he bade him good speed, and Gluck went on again merrily. And the path became easier to his feet, and two or three blades of grass appeared upon it, and some grasshoppers began singing on the bank beside it; and Gluck thought he had never heard such merry singing.

Then he went on for another hour, and the thirst increased on him so that he thought he should be forced to drink. But, as he raised the flask, he saw a little child lying panting by the roadside, and it cried out piteously for water. Then Gluck struggled with himself and determined to bear the thirst a little longer; and he put the bottle to the child's lips, and it drank it all but a few drops.

Then it smiled on him, and got up, and ran down the hill; and Gluck looked after it till it became as small as a little star, and then turned and began climbing again. And then there were all kinds of sweet flowers growing on the rocks, bright green moss with pale pink starry flowers, and soft belled gentians more blue than the sky at its deepest, and pure white transparent lilies. And crimson and purple butterflies darted hither and thither, and the sky sent down such a pure light that Gluck had never felt so happy in his life.

Yet, when he had climbed for another hour, his thirst became intolerable again, and when he looked at his bottle he saw that there were only five or six drops left in it, and he could not venture to drink. And, as he was hanging the flask to his belt again, he saw a little dog lying on the rocks gasping for breath—just as Hans had seen it on the day of his ascent. And Gluck stopped and looked at it, and then at the Golden River not five hundred yards above him; and he thought of the dwarf's words, "that no one could succeed except in his first attempt"; and he tried to pass the dog, but it whined piteously, and Gluck stopped again.

"Poor beastie," said Gluck, "it'll be dead when I come down again if I don't help it." Then he looked closer and closer at it, and its eye turned on him so mournfully that he could not stand it. "Confound the King and his

gold, too!" said Gluck; and he opened his flask, and poured all the water into the dog's mouth.

The dog sprang up and stood on its hind legs. Its tail disappeared; its ears became long, longer, silky, golden; its nose became very red; its eyes became very twinkling. In three seconds the dog was gone and before Gluck stood his old acquaintance the King of the Golden River.

"Thank you," said the monarch; "but don't be frightened, it's all right." For Gluck showed manifest symptoms of consternation at this unlooked-for reply to his last observation.

"Why didn't you come before," continued the dwarf, "instead of sending me those rascally brothers of yours for me to have the trouble of turning into stones? Very hard stones they make, too!"

"Oh, dear me!" said Gluck, "have you really been so cruel?"

"Cruel!" said the dwarf. "They poured unholy water into my stream; do you suppose I'm going to allow that?"

"Why," said Gluck, "I'm sure, sir—your Majesty, I mean—they got the water out of the church font."

"Very probably," replied the dwarf, "but" —and his countenance grew stern as he spoke —"the water which has been refused to the cry of the weary and dying is unholy, though it had been blessed by every saint in heaven; and the water which is found in the vessel of mercy is holy, though it had been defiled with corpses."

So saying, the dwarf stooped and plucked a lily that grew at his feet. On its white leaves there hung three drops of clear dew. And the dwarf shook them into the flask which Gluck held in his hand. "Cast these into the river," he said, "and descend on the other side of the mountains into the Treasure Valley. And so good speed!"

As he spoke, the figure of the dwarf became indistinct. The playing colors of his robe formed themselves into a mist of dewy light: he stood for an instant veiled with them as with the belt of a broad rainbow. The colors grew faint, the mist rose into the air; the monarch had evaporated.

And Gluck climbed to the brink of the Golden River, and its waves were as clear as crystal and as brilliant as the sun. And when he cast the three drops of dew into the stream, there opened where they fell a small circular



He put the bottle to the child's lips . . . then there were all kinds of sweet flowers growing on the rocks.

whirlpool, into which the water descended with a musical noise.

Gluck stood watching it for some time, very much disappointed, because not only was the river not turned into gold, but its waters seemed much diminished in quantity. Yet he obeyed his friend the dwarf and descended the other side of the mountains, toward the Treasure Valley; and as he went he thought he heard the noise of water working its way under the ground. And when he came in sight of the Treasure Valley, behold, a river, like the Golden River, was springing from a new cleft of the rocks above it and was flowing in innumerable streams among the dry heaps of red sand.

And as Gluck gazed, fresh grass sprang beside the new streams, and creeping plants grew and climbed among the moistened soil. Young flowers opened suddenly along the riversides, as stars leap out when twilight is deepening, and thickets of myrtle and tendrils of vine cast lengthening shadows over the valley as they grew. And thus the Treasure Valley became a garden again, and the inheritance which had been lost by cruelty was regained by love.

And Gluck went and dwelt in the valley, and the poor were never driven from his door; so that his barns became full of corn; and his house, of treasure. And, for him, the river had, according to the promise, become a River of Gold.



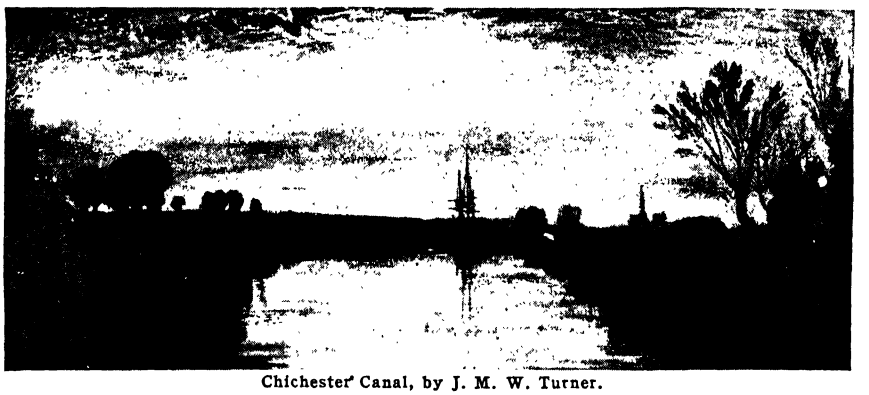
Gluck climbed to the brink of the Golden River, and cast the three drops of dew into the stream.

And to this day the inhabitants of the valley point out the place where the three drops of holy dew were cast into the stream by little Gluck, and trace the course of the Golden River under the ground, until it emerges in the Treasure Valley.

And at the top of the cataract of the Golden River are still to be seen two black stones round which the waters howl mournfully every day at sunset; and these stones are still called by the people of the valley

THE BLACK BROTHERS.

THE NEXT STORIES ARE ON PAGE 2454.



Chichester Canal, by J. M. W. Turner.

A CENTURY OF CHANGE IN ART

CONSTABLE, TURNER AND THE PRE-RAPHAELITES

CLIMATE has more influence on art than we may at first realize. Our feeling for the beautiful is partly born in us and partly created by the unconscious daily use of our eyes and ears. So, that which any race calls beautiful and tries to immortalize in art is influenced by the sun and the weather.

Conceptions of form and color in an artist who has spent his life in a climate of changing days of mist and sun and rain and long twilights, amid soft outlines of trees and hills, will be very different from those of another artist whose experience has belonged to a land of hot, clear sunshine and brilliant effects where "sharp as a sickle is the edge of shade and shine." Southern eyes—in Greece and Italy, for instance—open morning after morning on distinct contours near and far: the sharp lines of a white town against a sapphire sea, the gray-black of olives cut out in bleached sandy spaces. Northern eyes, on the contrary, are accustomed to indefinite and changing contours, to shapes which at a little distance may be muffled and indistinct. Landscape paintings in England and Holland, then, to be natural must show blurred outlines and gradual-toned color.

Until the English painters began to make pictures of simple green fields and trees, there was a feeling in Europe that a landscape, to have any merit at all, must look as if it had been painted in Italy, and give the impression that just round the corner were some classical figures, and not far away was a ruined temple. Poussin and Claude Lorrain, the seventeenth-century French artists, who worked in Italy, were responsible for this tradition. Europe paid much more heed to them than to the sturdy Dutch masters who were establishing another kind of tradition in the Netherlands.

The forerunner of English landscape painting, Richard Wilson (1713–82), was strongly influenced by the classic tradition as represented in Claude Lorrain and Joseph Vernet. After he had realized his greatest ambition and had managed to go to Italy to study, he always recalled the look of Italian skies; and in his mind no pictured landscape was quite satisfactory without some classic building, some ruin or piece of statuary. But he had sincerity and a gift for composition, and he kept his own original method of presenting effects of light and air. His paintings have a tender golden tone.

They are "beautiful unrealities." Unhappily they were not received well in his lifetime, and his later years were clouded with discouragement and bitterness.

Wilson was a forerunner, rather than a leader, in the march of English landscape art. Next came Gainsborough, a true pioneer. He, as we have seen, in his tender affection for the green countryside of his home district transcribed its scenes truly and faithfully. "His landscapes are like windows opening on the country," rather than mere compositions. They are dignified, reposeful, and painted in the vibrating, loose way which was the secret of his technique. He did not feel the need of any far-fetched grandeur, or indeed of anything artificial. He painted things as he saw them, and so did the men who followed where he and Wilson had opened the way, and who gave their full attention to landscape.

BRITISH LANDSCAPE PAINTING, A LASTING INFLUENCE IN ART

Foremost among these were Constable, Crome and Morland. They had more in common with Ruisdael and Hobbema and the other Dutch landscape-painters than with the French and Italian schools. But, once they were known, they immediately influenced the French artists and became a lasting inspiration to foreign landscape art. These Englishmen were the first artists to "set up an easel in the fields."

George Morland (1763–1804), highly gifted, but sadly uncontrolled in his life and habits, has left several thousand paintings. He worked very fast and confidently, sometimes producing two pictures a day, paying his debts with pictures, and even occasionally sending a canvas to the dealer while the paint was still wet. There was a great demand for his work. Familiarity with stable-yards and racecourses and inn yards had helped to make him thoroughly acquainted with the figures and ways of domestic animals. His painting of them was masterly, and they are an important factor in his landscapes. No other has surpassed him in the presentation of pigs. His scenes of humble life, faithful to nature, are given in fine, harmonious color and with delicate treatment. His masterpiece, The Interior of a Stable, is in the National Gallery, London.

John Crome (1768–1821) is better known as "Old Crome," since he had a son John, also an artist. Starting as a house- and signboard-painter, Old Crome —a young man, then—rented a garret for a studio and spent all the time he could in sketching out of doors. The Dutch artists became his masters, through their pictures which he saw and studied in the homes of wealthy gentlemen, after he had changed his occupation to that of drawing-teacher. Later, in Paris, he made broader acquaintance with them. But he painted chiefly English landscape—familiar and beloved—and his manner was his own. The touch of his brush was light and true; he gave careful attention to detail (sometimes, perhaps, too much); and his color is mellow and golden, yet delicate. Light and air play over his scenes. Trees he represented with unusual force and understanding, making them individual living things, as you can see if you look at The Old Oak, in the Metropolitan Museum, New York, or The Poringland Oak, in the National Gallery, London (shown on page 2231). Mousehold Heath and The Willow are others of his masterpieces.

Crome spent his life at Norwich and is remembered as the founder of the Norwich school of painters. He was not widely known during his lifetime, and his works did not bring high prices then; but his importance has increased until he has come to hold a high place among painters of landscape.

Among the followers of Crome the best were George Vincent and John Cotman. The latter, who in gift and achievement stands next to Crome himself, painted harbor scenes and quiet country landscapes. He is noted, besides, for etching and water-color work.

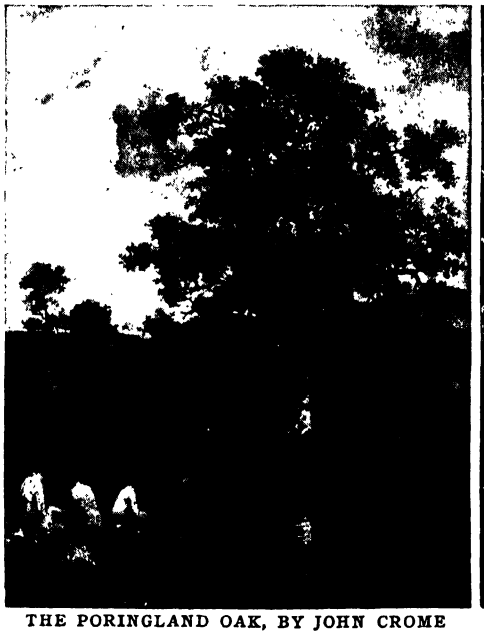
JOHN CONSTABLE, THE "FATHER OF MODERN LANDSCAPE"

In John Constable (1776–1837) we see the real "father of modern landscape." Behind his paintings is the story of a young miller who could not help being an artist, and whose mill at Flatford, by the river Stour in Suffolk, has in our day been presented by a member of Parliament to the British nation to be held in trust by the Royal Academy as a centre for a landscape school. For along the banks of this stream Constable wandered and mused and sketched, his whole spirit given in devoted companionship to the spirit of beauty in the country around him. "I love every stile and stump and lane in the village," he wrote, when he

LANDSCAPES BY CONSTABLE AND CROME



CONSTABLE'S FAMOUS PICTURE OF THE HAY WAIN

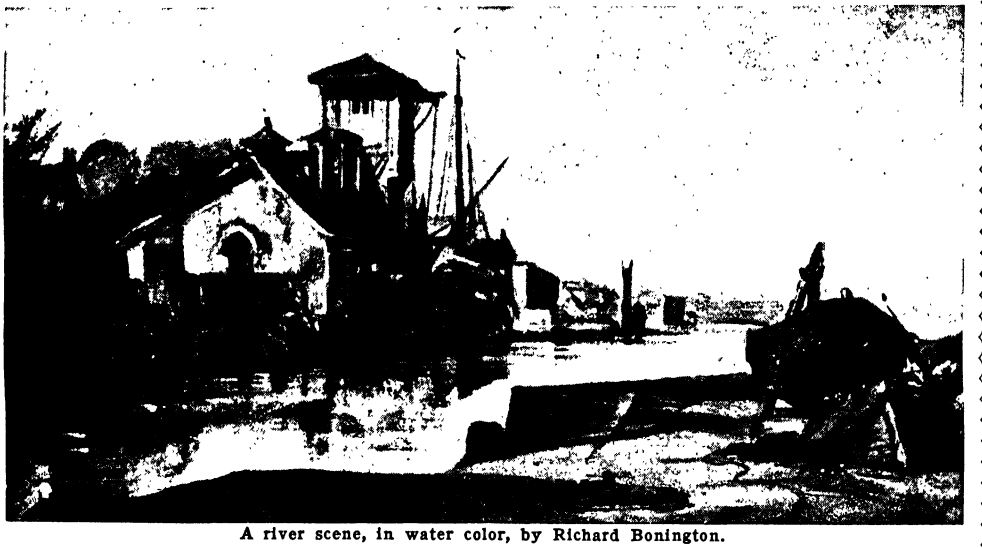


THE PORINGLAND OAK, BY JOHN CROME



THE CORNFIELD, BY CONSTABLE

was away in London. The landscapes that he painted recording this intercourse with nature, are of the kind that picture what the French call *paysage intime* (the intimate countryside). It is a sort very familiar to us in modern painting, but Constable and his contemporaries were adventuring upon new paths when they started to paint green and blue landscapes that were bathed in light and air. "Do you not find it difficult to determine where to place your brown tree?" asked one of Constable's patrons who had in mind the pictures of earlier painters. "Not in the least," answered the artist, without an instant's hesitation, "for I never put such a thing into a picture."



A river scene, in water color, by Richard Bonington.

When we remember that he was doing something comparatively new and unfamiliar, it is not surprising that he was harshly criticized by many and that his landscapes were not in great demand. Because they were not sold and widely scattered it is possible now to see a number of them together in the National Gallery and in the South Kensington Museum, London. "Here," says one writer, "you may see him at every stage of his career, and there was hardly a moment in it when he was not inspired, and never a moment when he was not either actually or mentally recording the beauty of the visible world."

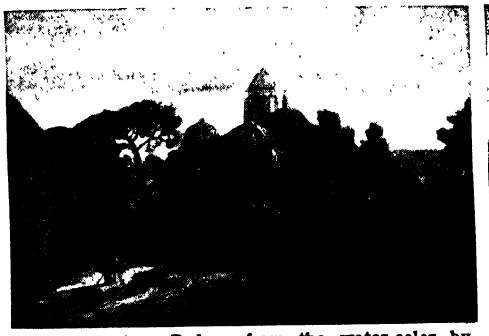
When in 1824 The Hay Wain and another of his canvases were exhibited in France, they made so great a sensation that they were given a place of honor, and the king of France sent the artist a gold medal. The painters of France were the first to recognize the excellence and charm of Constable's work and to respond to its challenge, and all of French landscape painting since has been different because of his influence.

The Hay Wain, with the two other greatest examples of Constable's art, The Valley Farm and The Cornfield, show bits of country close by his old home beside the Stour. The ten years between 1816 and 1826 cover the period of the artist's best work. On his later canvases he used the palette knife freely to press on spots and splashes of color —a custom very familiar in later art.

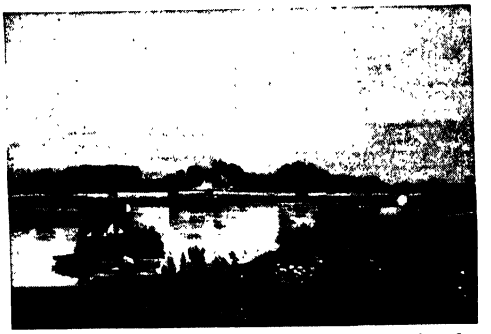
Constable saw landscape in large masses of form and color. He showed the gradations of the atmosphere. Bursts of sunlight coming between rolling clouds, restless or stormy skies give life to his scenes. The quiet streams, cultivated fields and stately trees are not exciting in themselves, but the feeling of reality and of movement is so strong that we can almost imagine a stir among the leaves and can almost hear the rippling of the water.

A name associated with Constable's as of one who helped to bring about the open-air school of landscape painting in France is that of Richard Bonington, for the works of the two Englishmen were exhibited at the same time in Paris. Bonington had been trained in France and had studied in Venice, but his painting showed something of the broad style of

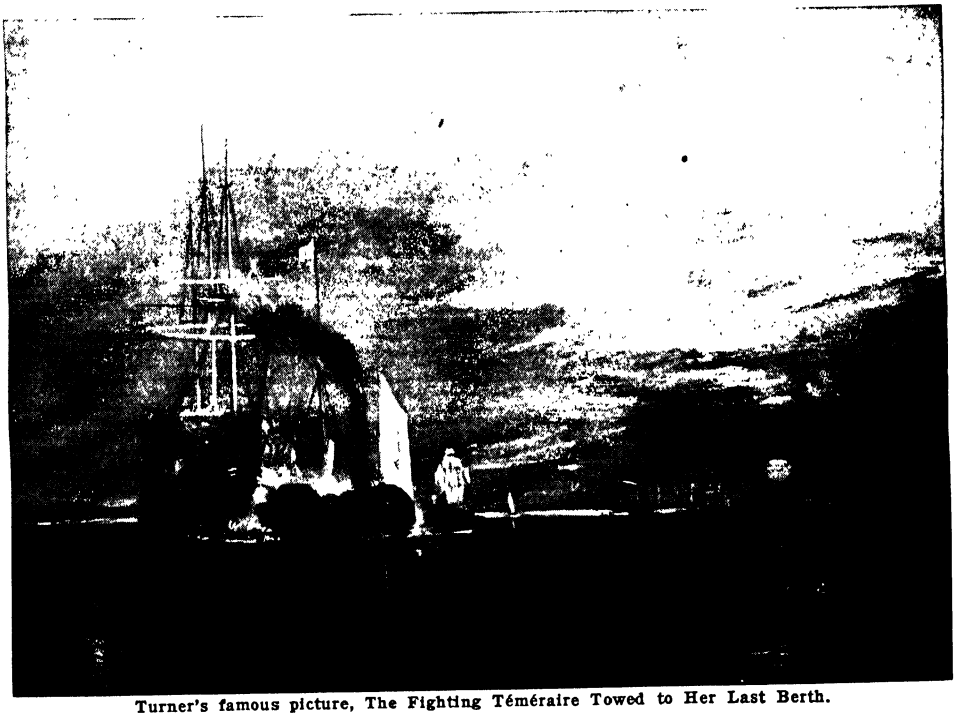
TURNER AND THE WATER-COLORISTS



Santa Giustina, Padua—from the water-color by J. R. Cozens.



Bray on the Thames—from the water-color by Peter de Wint.



Turner's famous picture, The Fighting Téméraire Towed to Her Last Berth.



Fishing Boats—from the water-color by Richard Donington.



Hindu Devotions—a beautiful landscape by J. M. W. Turner.

Constable's. His subjects were principally seashore and street scenes.

Side by side with these painters of pure nature there lived one who, though he adored nature and lived, it would seem, only for the purpose of presenting to the world many aspects of her beauty, saw the natural world in a sort of dream glory of light. This was Joseph Mallord William Turner (1775–1851)—a man whose outer physical life had little relation to the splendors of imagery that must have brightened his inner existence. Son of a barber, unlovely in appearance, poorly educated, shrinking from society, he was still keenly alive to beauty.

TURNER, WHO SAW NATURE IN A GLORY OF LIGHT

But who can guess what visions may have flashed within the mind of the odd little man and compelled him to paint? He painted light as no other had done. It seems as if the liquids he used were living substances saturated with the light and color of the earth. Here are strangeness, wonder and mystery mingled with the beauty of known things. Indeed, as time went on he became more concerned with producing magic effects by means of his colors than with trying to picture any real forms of nature. His experimenting was more than bold: it was sometimes reckless and almost meaningless; the colors he used on some of the later canvases have lost so much of their life and character that we can only guess his intention.

Resolved always to outdo others, Turner in his earlier years worked unwearyingly in water color, aiming to surpass Girtin, then the leader of the water-color school which he and an artist named Cozens had founded. Some of Turner's choicest pictures are in this medium—exquisite in coloring and true in their light effects. In his hands, after Girtin's death in 1802, water-color painting was lifted to a higher plane than it had ever before reached.

Through rivalry after rivalry with painters both British and foreign, whether they were living or dead, the ambitious Turner advanced—tramping, sketching, studying and painting, painting, painting—striving always to excel. His chief contest was with the famous paintings of Claude Lorrain of France, whose classic style and rich color he emulated. Among the pictures he bequeathed to England are two: The Sun Rising through Vapor, and Dido Building Carthage, which he directed should be hung between two Claudes in the National Gallery. These, with The Fighting Téméraire Towed to her Last Berth (shown on page 2233), are perhaps more familiarly known and more popular than his other oil paintings. The sea and shipping were favorite themes for his skill and fancy, appearing under many variations of light and atmosphere—sunset or sunrise, mist or golden floods of full sunlight.

It has been said that "no artist in the world was so steadily and unwearyingly and copiously productive as Turner." His best period lay in the years between 1829 and 1839, during which time he made several visits to Venice, leaving the world a brilliant record of his impressions there, both in water colors and oils. Of the latter a beautiful example is The Grand Canal, now in the Metropolitan Museum, New York, where several of his works in both mediums may be studied. Other collections, too, in Europe and America hold treasured canvases from his store. The great mass of his busy life's production, however, he kept together to bestow, at his death, upon his country. The extravagant praise of John Ruskin, the art critic, led to a prompt appreciation of Turner—even to overestimation of his importance; then revolt against this excessive praise brought about a swing in the other direction, when the pictures were less esteemed than they deserved; but time is steadying opinion to a more just view.

MANY SUCCESSFUL WORKERS IN THE MEDIUM OF WATER COLOR

The best of the water-color men besides Cozens, Girtin and Turner, Cotman and Bonington, were Thomas Stothard, Peter de Wint (of Dutch ancestry), David Cox and Copley Fielding. If Turner's genius had not glowed so brilliantly, these and others might have shone more conspicuously bright; for an astonishingly large number of British artists have done excellent work in this field.

Toward the middle of the nineteenth century art had fallen into a very different line from the straightforward portraiture and landscape of the best period. An era of pictures that tell stories and appeal to the feelings was making art more popular, particularly since many of the paintings were reproduced in engrav-

ing and in this form were distributed far and wide in the homes of the people.

It is unfortunate that the animal pictures of Sir Edwin Landseer, who lived from 1802 to 1873, have been known very largely through prints made from steel plates engraved by his brother Thomas. They were skillfully and sympathetically reproduced; but the engraver's technique is very different in feeling from the painter's, and this difference, together with the story-interest suggested by the title, makes a wide gap between the person who looks at the prints and Landseer who painted the originals. A view of the canvases themselves brings spectator and painter much closer together.

While the pictures are true animal portraits, they set before us the sentiments and qualities that belong to human beings. Pertness, pathos or fine courage are some of the impressions we catch from the pictures of dogs; dignity, annoyance or exhausted strength are suggested by some of his lions and deer. From small boyhood Landseer had unusual skill in drawing animals, and he studied them alive and dead until he was altogether acquainted with their anatomies and their habits; but his stag is called the "Monarch of the Glen"; his dogs are presented as "Dignity and Impudence," "Jack in Office," or the "Highland Shepherd's Chief Mourner." Quite different from the naturally placed, unposed animals in Morland's country scenes, Landseer's familiar company, like trained actors, take their parts in comic or tragic situations or ordinary episodes of daily life.

While the artist's method had more surface cleverness than depth of quality, he was a painter of ability and was made an Associate of the Royal Academy at twenty-four, the earliest age accepted. He was knighted in 1850.

REFORMS SOUGHT BY THE PRE-RAPHAELITE BROTHERHOOD

At just about this time a group of very young men with high ideals set themselves the task of lifting standards of art in Great Britain from the trivial taste and formal style into which it had dropped. They called themselves the Pre-Raphaelite Brotherhood because they felt that to get utter sincerity and exact truthfulness in art it was necessary to turn back for models to the work of the Italian painters before Raphael, such as Botticelli and Mantegna. In making an earnest and honest attempt to secure the true, the good and the beautiful they reached a studied simplicity, different from the natural simplicity of the early Italians, but of real value in its influence upon the taste of their own day and upon painting since. They wished to restore a more spiritual attitude, a more poetic feeling; and in their use of mystical and symbolical figures they sometimes went over the line into affectation. Their idealism was an idealism of the mind rather than of impulse.

At their best, however, the Pre-Raphaelite Brothers were simple and sincere, and gave their pictures a reverent spiritual quality. Yet it is not so much what they themselves painted that counts, as the influence of their ideas on what has been painted since. That can hardly be calculated.

CHARM IN ART DEPENDS ON INDIVIDUALITY AND PERSONALITY

While Gainsborough, Constable, Turner and others we have been studying had turned aside from the conventions which painters had long accepted, they had not made any statement of principles for themselves or for others. This was to be the work of the Pre-Raphaelites, who made it clear that the true secret of charm in works of art is due to each artist's seeing things for himself and expressing them in the way that is natural to him; in other words, that there should be individual "observation filtered through personality." To this they added the requirement that every picture must be built around some worth-while idea.

In technique they put emphasis upon great carefulness and attention to detail, while with regard to color they made startlingly new effects. Painters of the time, trying to get the secret of mellow, dim coloring in the pictures of Rembrandt and other masters of the past, had believed in the necessity of using a dark mineral background for their oil paints. To break away from this custom was thought almost as shocking as to turn from some well-founded religious belief. Yet some of the Pre-Raphaelites began to use a wet white ground on which to lay their colors, declaring that this was the true secret of producing high lights and of giving the canvases fine and lasting coloring. Sometimes their colors were more than bright—even crude—and there

was not always an attempt at harmonizing them. Pre-Raphaelite pictures could not be overlooked when they were exhibited; therefore they were loudly attacked or as heartily praised. Charles Dickens was one of those who savagely criticized them. John Ruskin was their most eloquent and influential defender and supporter.

THE SEVEN YOUNG MEN OF THE PRE-RAPHAELITE BROTHERHOOD

The actual union of the Pre-Raphaelite Brotherhood lasted only from 1848 to 1853. It was made up of seven very young men, the leading members being William Holman Hunt, John Everett Millais (afterward Sir John) and Dante Gabriel Rossetti. Of these, Rossetti, a poet, had the greatest fund of literary knowledge and the most romantic turn of mind. He supplied novel plans and intellectual impulse. In his painting he was chiefly interested in working out ideas, treating of beauty in form, expression or color. He was more writer than painter, exhibiting few pictures.

Holman Hunt was a vigorous leader against the old conventions and traditions. He was in "grim earnest," ready to fight for his faith in this return to nature as the only salvation for art. As soon as he had money enough he went to Palestine to see and feel the actual conditions of light and setting in which Bible characters lived, so as to present them exactly in his scenes from scriptural narratives. His eager pains to get all details in his pictures perfect often led to a lack of unity in his compositions; for, looking so intently at things one by one, he lost the important effect of the whole.

Millais was the most gifted painter of the group, facile and bold and at times brilliant. He had the "pictorial eye and hand," though his mind was less imaginative and able than Rossetti's. While he worked with Holman Hunt in a comradely spirit, he had not the same determined rebellious intention to overthrow the old methods. His connection with the Brotherhood has been likened to the progress of a "swallow flitting through a great hall, in and out and done with it." He went on painting pleasant story-telling pictures that quickly won him the favor of the public.

The four other Pre-Raphaelite Brothers were Thomas Woolner, a sculptor; James Collinson, a painter; Frederic George Stephens, who became an art critic; and William Michael Rossetti, brother of Dante Gabriel, who also became well known as a critical writer on art subjects.

An older man than any of these, and a more experienced artist when the movement began, was Ford Madox Brown, once Rossetti's teacher. He was closely associated with the Brothers, influenced their work somewhat and "gave them his blessing," but never formally joined them. The name of Sir Edward Burne-Jones is another that is frequently mentioned in connection with the Pre-Raphaelites, for he was a pupil of Rossetti and painted in the same romantic, idealistic spirit. He did not, however, continue to use the same methods. His works are graceful and decorative in composition, this quality taking precedence of the thought in the picture.

All of these painters chose subjects from literature or from religious story and gave them romantic or mystical expression with the brush upon the canvas.

OTHER PAINTERS WHO CHOSE ROMANTIC AND SYMBOLIC THEMES

Albert Moore, a contemporary of Burne-Jones, like him produced pleasing decorative effects in mass and color. His treatment of draperies is particularly skillful. Frederick, Lord Leighton, devoted to Italy and to subjects taken from classic myth and from history, was a good draftsman whose work shows the results of study and of cultivated taste. Born earlier than this whole group and outliving them all, George Frederick Watts gave his long life to the pursuit of art—both painting and sculpture. Aiming to make his works valuable as lessons for uplifting mankind, he sometimes reached heights of grandeur. Usually his pictures are full of symbolism, serving as sermons in color. Among the best-known are: Love and Life, Love and Death, and Hope. Watts made some superb portraits —Gladstone, Browning, Tennyson, Rossetti and many other distinguished men counting among his sitters. These portraits have double value: as historical records and as works of art.

Another who excelled in portraiture is the Scottish artist Sir William Orchardson, who painted, besides, historical scenes like Napoleon on Board the Bellerophon, and genre pictures, chiefly of life in the early part of the nineteenth century.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 2327.

ART OF THE PRE-RAPHAELITE PERIOD



BEATA BEATRIX, BY DANTE GABRIEL ROSSETTI



CARDINAL MANNING, BY G. F. WATTS



CHRIST WASHING PETER'S FEET. FROM THE PAINTING BY FORD MADOX BROWN, IN THE TATE GALLERY



THE HIRELING SHEPHERD. BY HOLMAN HUNT, IN THE MANCHESTER ART GALLERY



LORENZO AND ISABELLA. FROM THE PAINTING BY SIR J. E. MILLAIS, IN THE WALKER ART GALLERY, LIVERPOOL



THE KNIGHT AT THE FORD BY SIR J. E MILLAIS



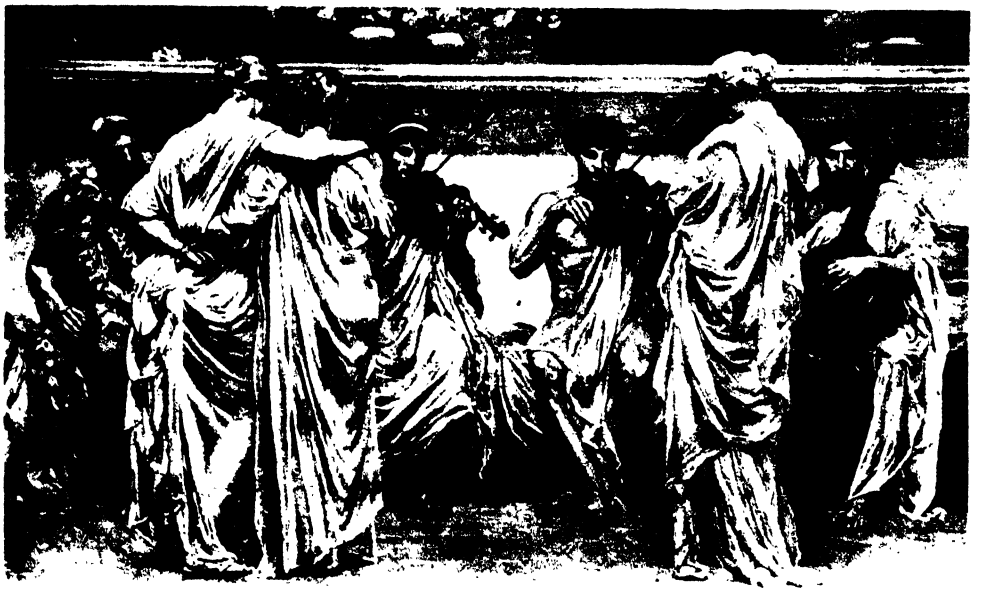
THE SONG OF LOVE. FROM THE PAINTING BY SIR EDWARD BURNE-JONES



THE ANNUNCIATION, BY D. G. ROSSETTI



AT THE GOLDEN GATE, BY VAL PRINSEP



THE QUARTETTE, FROM THE PAINTING BY ALBERT MOORE

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STREAMS AND FLOWING WATERS

Illustrated by Graham Bernbach

The Tide River

By CHARLES KINGSLEY (1819-1875)

CLEAR and cool, clear and cool,
By laughing shallow and dreaming pool;
Cool and clear, cool and clear,
By shining shingle and foaming weir;
Under the crag where the ouzel sings,
And the ivied wall where the church-bell rings,
Undefiled, for the undefiled;
Play by me, bathe in me, mother and child.

Dank and foul, dank and foul,
By the smoky town in its murky cowl;
Foul and dank, foul and dank,
By wharf and sewer and slimy bank;
Darker and darker the farther I go,
Baser and baser the richer I grow;
Who dare sport with the sin-defiled?
Shrink from me, turn from me, mother and child.

Strong and free, strong and free,
The flood-gates are open, away to the sea.
Free and strong, free and strong,
Cleansing my streams as I hurry along,
To the golden sands, and the leaping bar,
And the taintless tide that awaits me afar.
As I lose myself in the infinite main,
Like a soul that has sinned and is pardoned again,
Undefiled, for the undefiled;
Play by me, bathe in me, mother and child.

The Song My Paddle Sings*

By E. PAULINE JOHNSON (1862-1913)

WEST wind, blow from your prairie nest,
Blow from the mountains, blow from the west.
The sail is idle, the sailor too;
O wind of the west, we wait for you.
Blow, blow!
I have wooed you so,
But never a favor you bestow;
You rock your cradle the hills between,
But scorn to notice my white lateen.
I stow the sail and unship the mast:
I wooed you long, but my wooing's past;
My paddle will lull you into rest:
O drowsy wind of the drowsy west,
Sleep, sleep!
By your mountains steep,
Or down where the prairie grasses sweep,
Now fold in slumber your laggard wings,
For soft is the song my paddle sings.

August is laughing across the sky,
Laughing while paddle, canoe, and I
Drift, drift,
Where the hills uplift
On either side of the current swift.
The river rolls in its rocky bed,
My paddle is plying its way ahead,
Dip, dip,
When the waters flip
In foam as over their breast we slip.

And oh, the river runs swifter now;
The eddies circle about my bow:
Swirl, swirl!
How the ripples curl
In many a dangerous pool awhirl!
And forward far the rapids roar,
Fretting their margin for evermore;
Dash, dash;
With a mighty crash,
They seethe and boil, and bound and splash

Be strong, O paddle! be brave, canoe!
The reckless waves you must plunge into.
Reel, reel,
On your trembling keel,
But never a fear my craft will feel.

We've raced the rapids, we're far ahead:
The river slips through its silent bed.
Sway, sway,
As the bubbles spray
And fall in tinkling tunes away.

And up on the hills against the sky,
A fir-tree rocking its lullaby
Swings, swings,
Its emerald wings,
Swelling the song that my paddle sings.

*This poem is reprinted by special permission of the author's executor, L. A. Makovski.



The Brook's Song

By ALFRED, LORD TENNYSON
(1809-1892)

I COME from haunts of coot and hern,
I make a sudden sally,
And sparkle out among the fern,
To bicker down a valley.

By thirty hills I hurry down,
Or slip between the ridges,
By twenty thorps, a little town,
And half a hundred bridges.

Till last by Philip's farm I flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

I chatter over stony ways,
In little sharps and trebles,
I bubble into eddying bays,
I babble on the pebbles.

With many a curve my banks I fret
By many a field and fallow,
And many a fairy foreland set
With willow-weed and mallow.

I chatter, chatter, as I flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

I wind about, and in and out,
With here a blossom sailing,
And here and there a lusty trout,
And here and there a grayling,

And here and there a foamy flake
Upon me, as I travel
With many a silvery water-break
Above the golden gravel,

And draw them all along, and flow
To join the brimming river,
For men may come and men may go
But I go on for ever.

I steal by lawns and grassy plots,
I slide by hazel covers;
I move the sweet forget-me-nots
That grow for happy lovers.

I slip, I slide, I gloom, I glance,
Among my skimming swallows;
I make the netted sunbeam dance
Against my sandy shallows.

I murmur under moon and stars
In brambly wildernesses;
I linger by my shingly bars;
I loiter round my cresses;

And out again I curve and flow
To join the brimming river,
For men may come and men may go
But I go on for ever.

The Unnamed Lake*

By FREDERICK GEORGE SCOTT (1861-)

IT SLEEPS among the thousand hills
Where no man ever trod,
And only Nature's music fills
The silences of God.

Great mountains tower above its shore,
Green rushes fringe its brim,
And o'er its breast for evermore
The wanton breezes skim.

Dark clouds that intercept the sun
Go there in spring to weep,
And there, when autumn days are done,
White mists lie down to sleep.

Sunrise and sunset crown with gold
The peaks of ageless stone,
Where winds have thundered from of old
And storms have set their throne.

No echoes of the world afar
Disturb it night or day,
But sun and shadow, moon and star,
Pass and repass for aye.

'Twas in the gray of early dawn,
When first the lake we spied,
And fragments of a cloud were drawn
Half down the mountain side.

Along the shore a heron flew,
And from a speck on high,
That hovered in the deepening blue,
We heard the fish-hawk's cry.

Among the cloud-capped solitudes,
No sound the silence broke,
Save when, in whispers down the woods,
The guardian mountains spoke.

Through tangled brush and dewy brake,
Returning whence we came,
We passed in silence, and the lake
We left without a name.

*By permission of the author, Frederick George Scott.

Where Go The Boats?

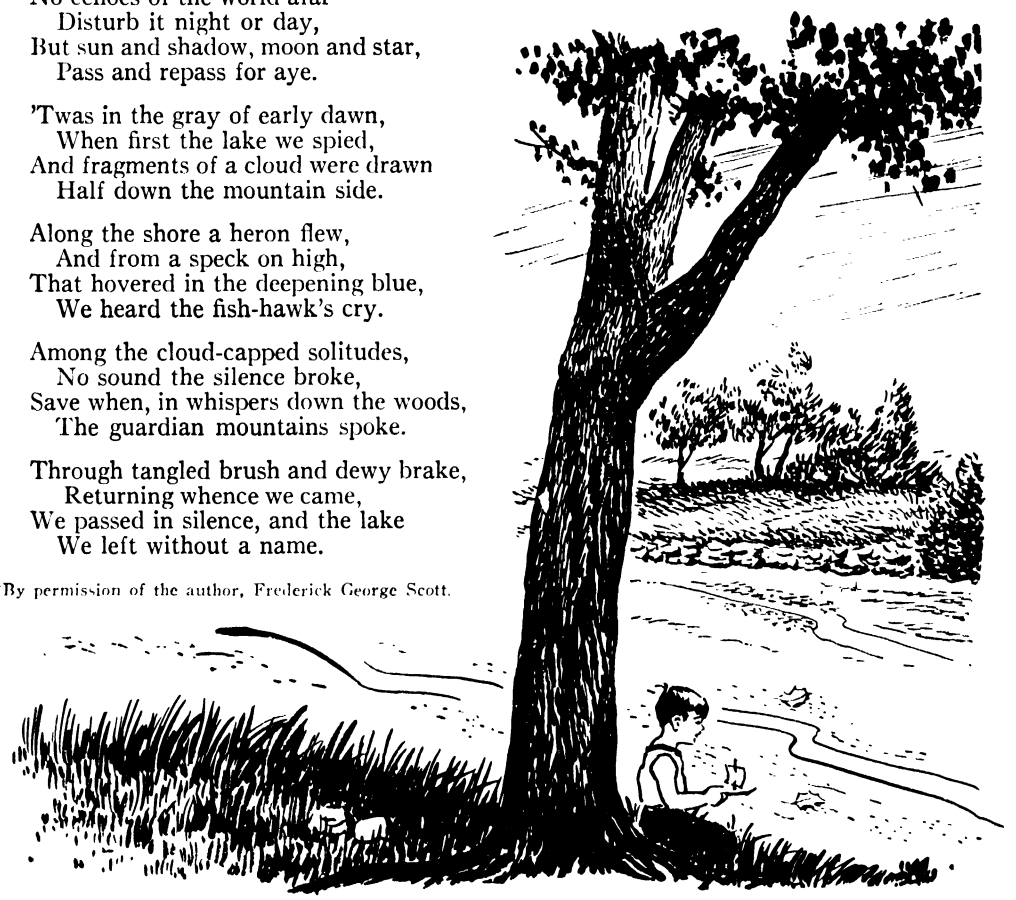
By ROBERT LOUIS STEVENSON
(1850-1894)

DARK brown is the river,
Golden is the sand,
It flows along forever,
With trees on either hand.

Green leaves a-floating,
Castles of the foam,
Boats of mine a-boating—
Where will all come home?

On goes the river
And out past the mill,
Away down the valley,
Away down the hill.

Away down the river,
A hundred miles or more,
Other little children
Shall bring my boats ashore.



The Isle Of Long Ago

By BENJAMIN FRANKLIN TAYLOR
(1819-1887)

O! A WONDERFUL stream is the River Time,
As it runs through the realm of Tears,
With a faultless rhythm and a musical rime,
And a broader sweep and a surge sublime,
As it blends with the Ocean of Years.

How the winters are drifting, like flakes of snow,
And the summers, like buds between,
And the year in the sheaf—so they come and they go,
On the river's breast, with its ebb and its flow,
As it glides in the shadow and sheen.

There's a magical isle up the River Time,
Where the softest of airs are playing;
There's a cloudless sky and a tropical clime,
And a song as sweet as a vesper chime,
And the Junes with the roses are staying.

And the name of this Isle is the Long Ago,
And we bury our treasures there;
There are brows of beauty and bosoms of snow—
They are heaps of dust, but we loved them so!
There are trinkets and tresses of hair.

There are fragments of song that nobody sings,
And a part of an infant's prayer,
There's a harp unswept and a lute without strings,
There are broken vows and pieces of rings,
And the garments that She used to wear.

There are hands that are waved when the fairy shore
By the mirage is lifted in air;
And we sometimes hear through the turbulent roar
Sweet voices we heard in the days gone before,
When the wind down the River is fair.

Oh, remembered for aye be the blessed Isle
All the day of our life till night,
And when evening comes with its beautiful smile,
And our eyes are closing in slumber awhile,
May that "Greenwood" of soul be in sight.

Canadian Boat-Song

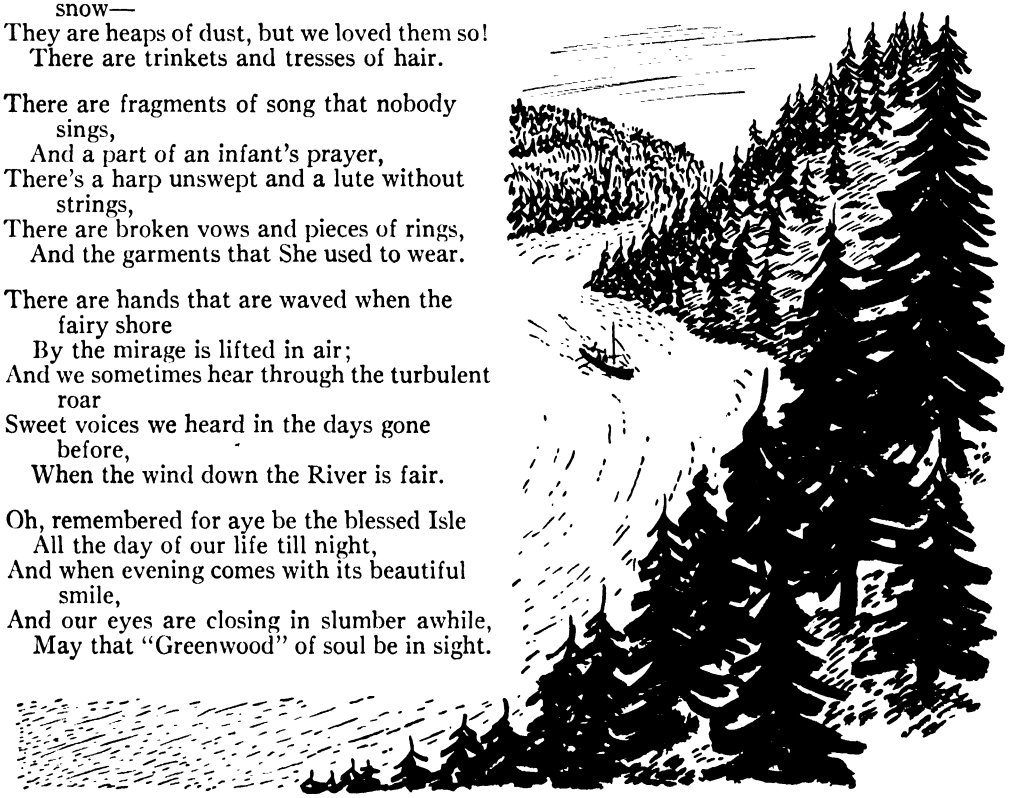
ON THE RIVER ST. LAWRENCE

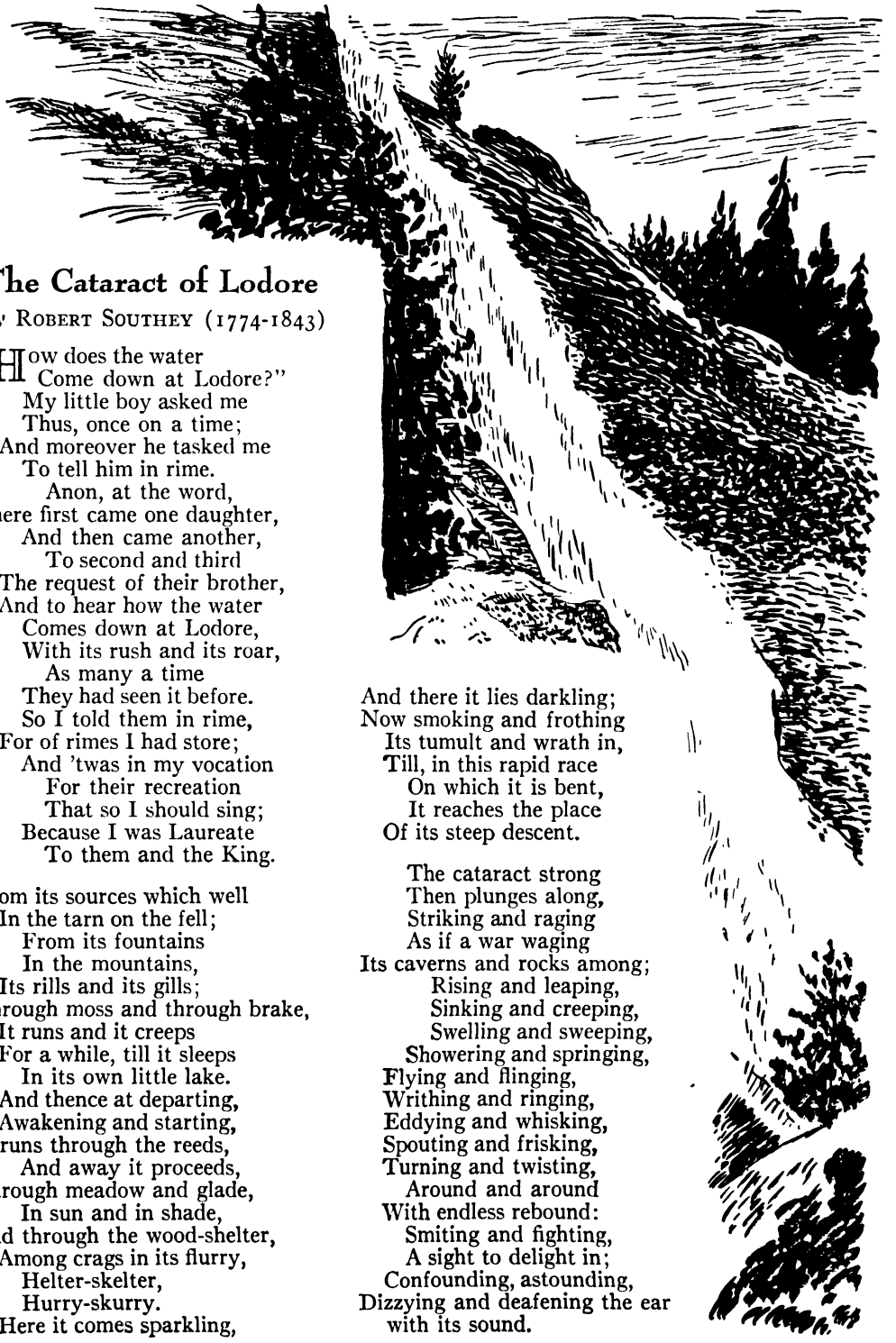
By THOMAS MOORE (1779-1852)

FAINTLY as tolls the evening chime
Our voices keep tune and our oars keep time.
Soon as the woods on the shore look dim,
We'll sing at St. Ann's our parting hymn.
Row, brothers, row, the stream runs fast,
The rapids are near and the daylight's past.

Why should we yet our sail unfurl?
There is not a breath the blue wave to curl,
But, when the wind blows off the shore,
Oh, sweetly we'll rest our weary oar.
Blow, breezes, blow, the stream runs fast,
The rapids are near and the daylight's past.

Utawas' tide! this trembling moon
Shall see us float over thy surges soon.
Saint of this green isle! hear our prayers,
Oh, grant us cool heavens and favoring airs.
Blow, breezes, blow, the stream runs fast,
The rapids are near and the daylight's past.





The Cataract of Lodore

By ROBERT SOUTHEY (1774-1843)

"How does the water
Come down at Lodore?"
My little boy asked me
Thus, once on a time;
And moreover he tasked me
To tell him in rime.
Anon, at the word,
There first came one daughter,
And then came another,
To second and third
The request of their brother,
And to hear how the water
Comes down at Lodore,
With its rush and its roar,
As many a time
They had seen it before.
So I told them in rime,
For of rimes I had store;
And 'twas in my vocation
For their recreation
That so I should sing;
Because I was Laureate
To them and the King.

From its sources which well
In the tarn on the fell;
From its fountains
In the mountains,
Its rills and its gills;
Through moss and through brake,
It runs and it creeps
For a while, till it sleeps
In its own little lake.
And thence at departing,
Awakening and starting,
It runs through the reeds,
And away it proceeds,
Through meadow and glade,
In sun and in shade,
And through the wood-shelter,
Among crags in its flurry,
Helter-skelter,
Hurry-skurry.
Here it comes sparkling,
And there it lies darkling;
Now smoking and frothing
Its tumult and wrath in,
Till, in this rapid race
On which it is bent,
It reaches the place
Of its steep descent.

The cataract strong
Then plunges along,
Striking and raging
As if a war waging
Its caverns and rocks among;
Rising and leaping,
Sinking and creeping,
Swelling and sweeping,
Showering and springing,
Flying and flinging,
Writhing and ringing,
Eddying and whisking,
Spouting and frisking,
Turning and twisting,
Around and around
With endless rebound:
Smiting and fighting,
A sight to delight in;
Confounding, astounding,
Dizzying and deafening the ear
with its sound.

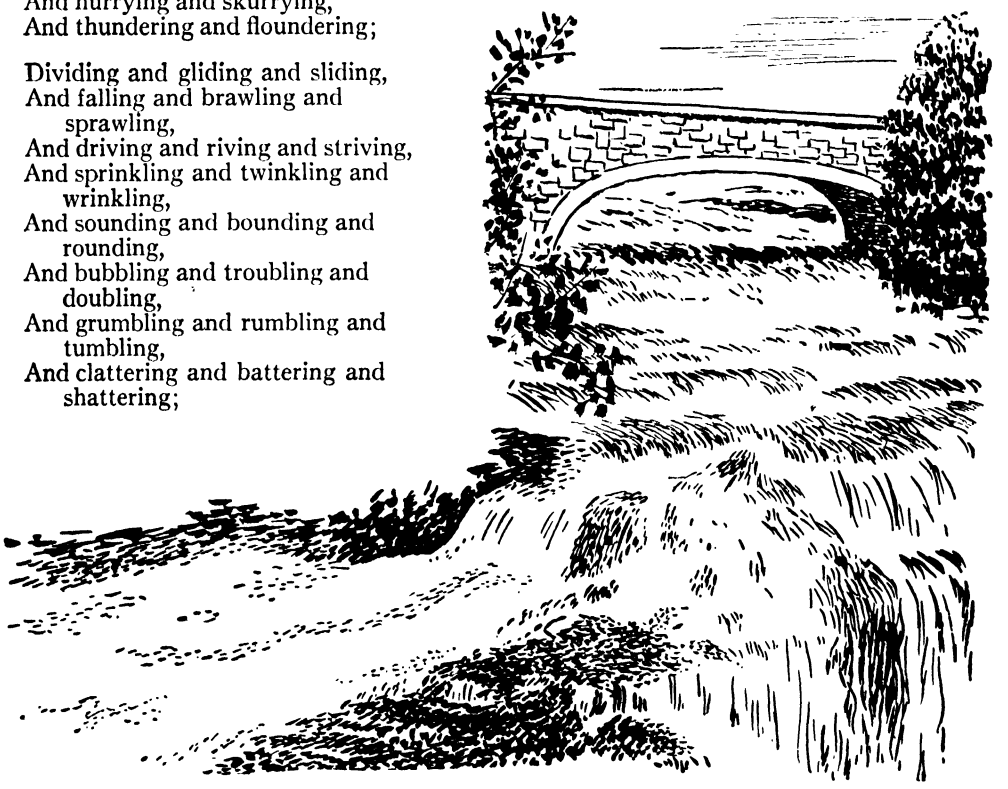
Collecting, projecting,
Receding and speeding,
And shocking and rocking,
And darting and parting,
And threading and spreading,
And whizzing and hissing,
And dripping and skipping,
And hitting and splitting,
And shining and twining,
And rattling and battling,
And shaking and quaking,
And pouring and roaring,
And waving and raving,
And tossing and crossing,
And flowing and going,
And running and stunning,
And foaming and roaming,
And dinning and spinning,
And dropping and hopping,
And working and jerking,
And guggling and struggling,
And heaving and cleaving,
And moaning and groaning;

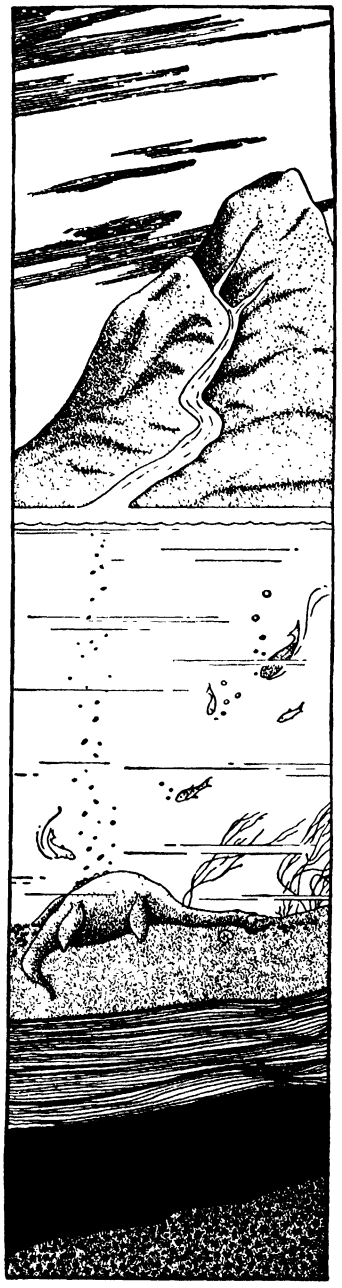
And glittering and frittering,
And gathering and feathering,
And whitening and brightening,
And quivering and shivering,
And hurrying and skurrying,
And thundering and floundering;

Dividing and gliding and sliding,
And falling and brawling and sprawling,
And driving and riving and striving,
And sprinkling and twinkling and wrinkling,
And sounding and bounding and rounding,
And bubbling and troubling and doubling,
And grumbling and rumbling and tumbling,
And clattering and battering and shattering;

Retreating and beating and meeting and sheeting,
Delaying and straying and playing and spraying,
Advancing and prancing and glancing and dancing,
Recoiling, turmoiling and toiling and boiling,
And gleaming and streaming and steaming and beaming,
And rushing and flushing and brushing and gushing,
And flapping and rapping and clapping and slapping,
And curling and whirling and purling and twirling,
And thumping and plumping and bumping and jumping,
And dashing and flashing and splashing and clashing;
And so never ending, but always descending,
Sounds and motions for ever and ever are blending
All at once and all o'er, with a mighty uproar,—
And this way the water comes down at Lodore.

THE NEXT POEMS ARE ON PAGE 2363.





These pictures show how the history of the earth is written in its rocks. A stream once ran down a mountain side, carrying sand and stone to the sea. In the sea swam a plesiosaurus (a huge reptile). When it died, its body fell to the bottom of the sea. Stones and sand borne by the stream kept on falling, covering the animal's body.

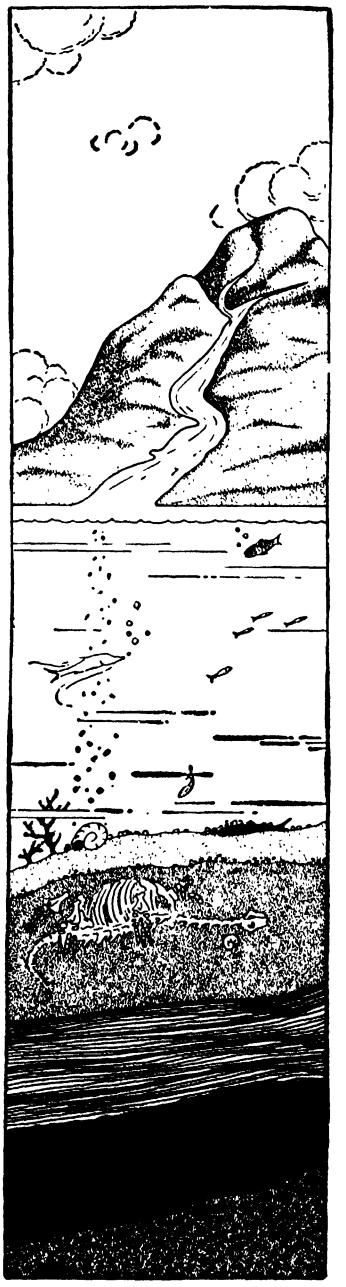
WHAT IS A FOSSIL?

ONCE upon a time, ages and ages ago, many strange animals lived upon the earth. Some of them were so big that they could eat off the top branches of tall trees; some flew and others swam. In the plant life that flourished in those days, there were plants quite unlike any that we have today.

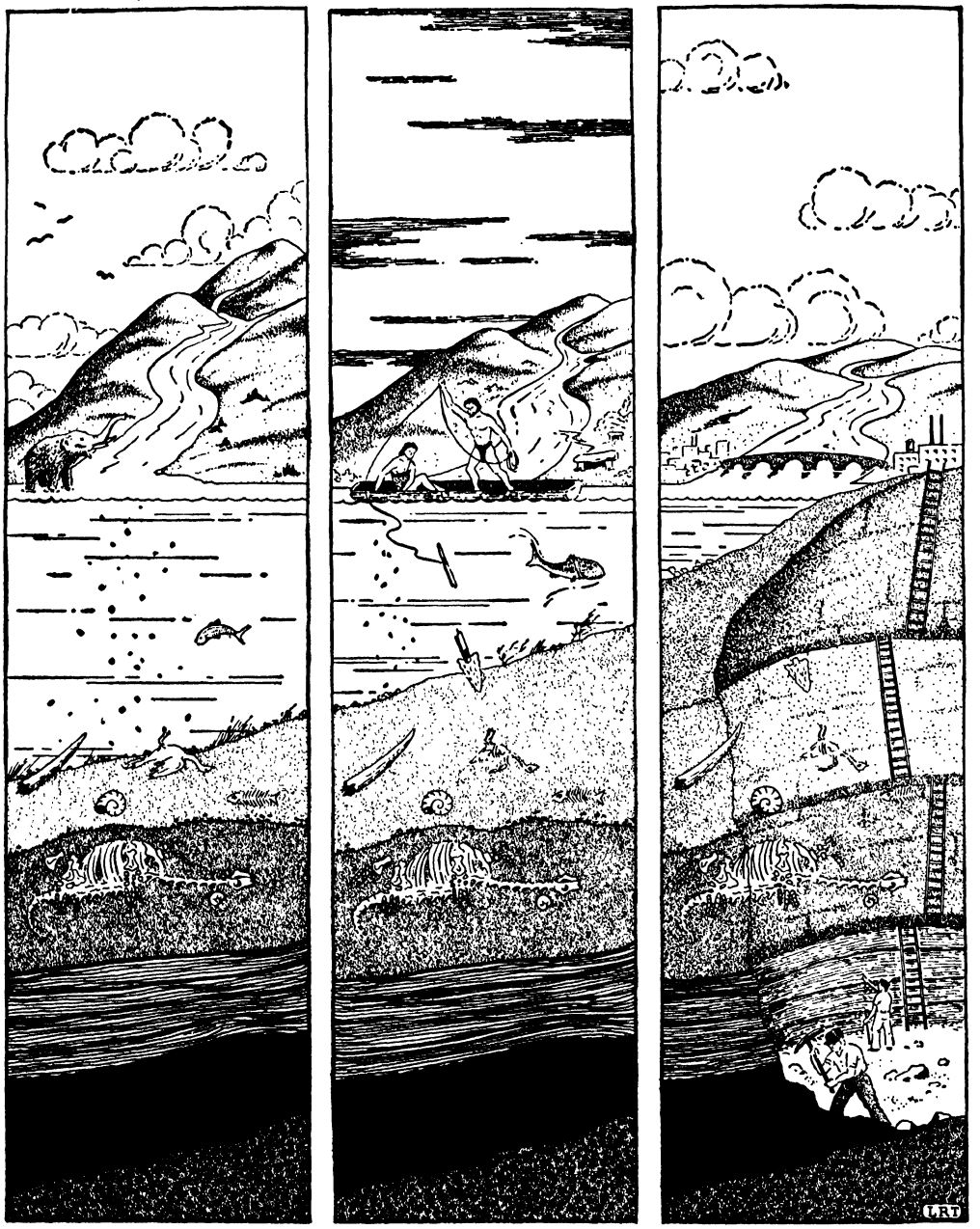
In time these animals and plants disappeared. Today, deep in the earth, we find rocks that contain the remains of the old animal and plant life of the earth. We call these remains fossils.

The rocks may be likened to a box in which nature has been packing things for millions of years. The things packed away last are near the top of the box. This box, however, was not always of solid rock. At one time it was mud and sand and water. The water dried up, and in time the mud and sand grew harder from heat and pressure, so that it is now rock, in places very hard.

How does it happen that we find ancient animals and plants in these rocks? When they died, they lay upon the ground. Sea animals or plants sank to the bottom of rivers, lakes and seas. The bodies in time were covered with layer after layer of mud or sand. As time passed, some of the land sank, and some of the



As the ages passed, the stream wore away a wider and wider path for itself, and became a river. The rains falling on the mountain loosed the soil and formed many tiny streams that flowed into the river. So it kept bringing down more earth and stones which fell on the bed of the sea, burying the reptile's body ever more deeply.



Higher and higher rose the ocean bed as the sand and stones continued to fall. The lower layers became hard rock. One day an elephant drinking in the river broke off his tusk, and this was carried to the sea. Then a bird was drowned and fell on the ocean bed. Dead fishes and shells sank and were buried, and new layers were formed. This steady heaping-up process continued for many centuries.

Hundreds of thousands of years after the plesiosaurus died, men began to live upon the earth. One day a man who had made a boat out of a hollow tree trunk went out to fish. The head of his harpoon broke off and fell to the bottom of the sea; this also was buried in the mud. And the stones and sand still fell, carried by streams and rivers. In the course of time the harpoon head was buried many feet deep.

The bottom of the sea crept higher and higher, till it became dry land. One day men began to dig, and the world's story was revealed as we read it here. First the head of the harpoon was found, then the tusk, the bird's skeleton, the shells, the fish and the skeleton of the reptile, all turned to stone. These stone relics have helped us to piece together the story of living things in ages long past.

rivers, lakes and seas dried up. Pressure within the earth itself forced up these beds of ancient bodies of water and formed them into dry land. The mud or sand in which animal and plant life had been imprisoned became rock. Later, men digging into these rocks, came upon animal and plant fossils—fascinating relics of a past age.

Old lake beds are often extremely rich in fossil remains of animals. In the old swamps of a far-off day, plants formed thick masses of vegetable matter, which have now turned into coal. One still finds the imprints of leaves and stems in the shale that lies above a coal seam.

Fossils are preserved in various ways. In some cases the original substance is preserved—such as the carbon in a leaf, or the bone or shell of some animal. In other cases all the original substance of the animal or plant has dissolved, but the shape itself is preserved. For example, a shellfish dies; its soft parts decay; the inside of the shell is filled with sand or mud; the sand is deeply buried. The sand or mud in the inside of the shell becomes solid. Thus the shape of the shellfish is preserved even after the shell itself has dissolved.

Sometimes the animal or plant literally turns into stone; its original substance is replaced by some mineral compound, such as silica or calcium carbonate. Such are the trees of the Petrified Forest of Arizona (see Index). The silica that has replaced the original wood still preserves all the details of the original structure.

In certain cases animals of long ago may be preserved unchanged by some fortunate accident. The bodies of some great beasts were protected by mud which did not turn into stone. The mammoth, a sort of elephant covered with long hair, became extinct (died out) many years ago in Siberia. The last of the mammoths sank into mud which became frozen hard. In this natural icebox the bodies of these animals have been preserved so wonderfully that they are found today with the flesh, skin and hair in perfect condition.

WHY DO WE LOSE THE SENSE OF SMELL WHEN WE HAVE A COLD?

What is the sense of smell and why can we smell some substances and not others? We must have some idea of the answers to these questions before we can understand why we lose the sense of smell when we have a cold. There are today two theories about smell. We may call one the chemical theory; the other, the infrared theory, which has to do with certain kinds of heat waves.

In the past, scientists have believed that the sense of smell came from a chemical reaction. The theory was that tiny particles of the object smelled—particles of oil from the rind of an orange, for instance—passed through the air to certain parts of the lining of the nose. There a chemical reaction was set up, and the typical "orange smell" was registered by the brain. Steam from hot coffee would act in the same way and give one the aroma of the beverage.

Now there is a new theory about the sense of smell. Many scientists today believe that this sense is not chemical in nature. Experiments seem to have proved that there are certain special sense organs in the nose that give off infrared radiation, that is, heat waves. These radiations, which are of particular wave-lengths, are absorbed by certain substances and not by others. When the infrared radiation from the nose is absorbed—by the orange, say—the special sense organs in the nose register a loss of heat. This is followed by a quickening of infrared radiation. This is all interpreted by the brain in terms of smell. Many objects and substances do not have the power of absorbing these heat waves, according to the new theory, and for this reason we can not smell them.

When we have a cold, the lining of the nose, the mucous membrane, gets swollen. It produces a much greater amount of mucus than usual, as we all can tell by the number of handkerchiefs or paper tissues we have to use in one day.

If smell is a chemical reaction, we can not smell when we have a cold because the extra flow of mucus prevents the particles of the object smelled from getting to the sensitive part of the nose. The mucus would also wash away any solid scented particles. Also, it may be that the poisons produced by the microbes that cause a cold poison the living cells of the mucous membrane and also the tiny ends of the nerves of smell that run to it. If this is so, then, even if scented particles do reach the sensitive part of the mucous membrane, they can not be felt.

Suppose, however, the new theory about the sense of smell is correct—that smell is caused by infrared radiation. In that case mucus of a cold probably affects the special sense organs from which come the infrared rays or heat waves. In some way the transfer of heat to the object is interfered with, and the brain registers no smell of any kind or only a faint impression.

WHY DO SMELLING-SALTS REVIVE US?

The feeling of faintness is usually due to weak action of the heart, lessening the blood supply to the brain. When the heart is working weakly, and the blood vessels of the skin are relaxed, we can often stimulate the heart to stronger action and cause a contraction of the blood vessels in the skin by sending messages to the brain from the skin and sense organs. Thus, a cold breeze blowing on the skin, or a loud noise, will often revive a person who feels faint. The breeze or the noise has acted as a stimulant.

It is in this way that smelling-salts revive us. The nerves in the nose are irritated and stimulated and send a message to the brain which responds by whipping up the heart and contracting the blood vessels in the skin. The result is that the brain receives more blood and the faint feeling passes away. It is mainly a question of blood supply to the brain, and a fainting person may be revived in the same way by lowering his head and raising his legs so as to give his brain more blood.

WHAT IS MEANT BY A FUSE IN TALKING ABOUT ELECTRICITY?

When a house or a motor car is wired, it is known how much electricity the wires can carry safely. Sometimes more current passes than the wires were intended to carry. Perhaps an accident has happened and two wires are touching and one is taking current from the other. Now, every wire carrying a current of electricity is heated by the passage of the current. If the wire is too small for the amount of current which passes along it, it grows very hot and a serious fire, or an injury to a person may result. So somewhere in the circuit a short piece of soft metal called a fuse is placed. This is usually made of a mixture of lead and bismuth, and melts if the wire gets hotter than is safe. Then no current can pass because the circuit is broken, and the danger is over. Sometimes not all the lights in a house are on one circuit. We should have a fuse for every circuit.

WHY IS IT THAT SMOKE DOES NOT HAVE A FORCE LIKE STEAM?

Steam is a word which we use in rather different senses. Sometimes we use the word steam for the cloud that comes from a kettle; but every engineer knows that that kind of steam is not of much use in his engines: in fact, it has no more force than smoke has.

The steam that *does* work and has force is water vapor, or gas, confined in a small space and pressing in all directions outward so as to get more room for itself. It desires to expand, and it is this force of expansion that makes it useful. When it has got out into the air, and has taken as much room as it pleases, it has no more force. The force is not in the cloud of steam outside the kettle, but in the steam inside that raises the kettle lid.

Smoke, on the other hand, has no force because it has no tendency to expand. Smoke is only a quantity of small pieces of solid matter which, not being very heavy, can be carried in a stream by the gases escaping from a chimney. These gases might have some force if confined in a small space.

WHY DOES INK STAIN WHILE WATER DOES NOT?

Water does not stain because it contains nothing that can stain. It may produce a mark because, where it falls, it may wash out coloring matter from a fabric, as in the cover of a book, but in pure water there is nothing melted or hung—dissolved or suspended, to use the proper words—that the water can leave behind where it falls. Milk has a number of tiny balls of oil hung in it, and in falling upon anything it is apt to leave behind a certain number of these balls of oil, which we call cream.

The case of ink is quite different, for this is water containing a number of colored things melted in it, among them salts of iron —a metal which has this peculiarity, that nearly all its salts are very highly colored. There is one peculiar salt, or mixture of salts, of iron that is deeply colored. It is called Prussian blue, and is often used in ink.

Ink stains because when this solution, as it is called, of salts is exposed to the air, the water flies away into the air, and the coloring matter is left dry, staining the paper, or the tablecloth, or whatever it may have fallen upon.

WHY IS WALKING EASIER ON A ROUGH SURFACE THAN ON A SMOOTH ONE?

On a smooth surface, such as ice or glass or a polished floor, sliding is easy. On a rough surface sliding is difficult and walking is easy; when you put your foot down, it stays where you put it until you raise it again. The many little uneven spots are so many points of friction, that is, points that resist slipping. So we are sure-footed.

ARE WE HEALTHIER THAN OUR ANCESTORS?

Yes, we are far healthier. We know at what ages our ancestors commonly died, even those who had most wealth and knowledge. Diseases which once raged are now unknown or very rare. Sixty or seventy years ago, for instance, typhus fever was very common, and now it causes hardly any deaths in the whole of the nation in a year, though the disease is still sadly common in some countries.

The average length of life is increasing. The expectation of life, as it is called, is longer than it was twenty years ago, and much longer than it was at the turn of our century, that is, in 1900.

WHAT DO WE MEAN BY A MURAL?

Usually, when we speak of a mural, we mean a mural painting, that is, a painting that has been made for the adornment of the walls of the building. The word includes also paintings on ceilings and vaulted roofs such as we see in churches and public buildings.

This kind of decoration has been known since earliest times. If we refer to the pages given under the heading Paintings in the Index, we shall read of the development of mural paintings through Egyptian, Greek, Byzantine and Roman times until it reached its peak in Italy during the Renaissance. Murals of Raphael and Michelangelo in this period have never been surpassed.

As a rule, a mural tells the story of some incident or series of incidents, while those in churches often are taken from the Bible. Murals are used to beautify government buildings, post offices, court houses, state capitols, libraries, churches and other public buildings. Many of our most famous artists have interested themselves in this form of art. Modern Mexican murals are famous.

WHY HAS A POSTAGE STAMP A PERFORATED EDGE?

Stamps are printed in large sheets and the perforations make it easy to tear them off singly or in large numbers without damage. The perforations, by marking a gap between the stamps, also enable large numbers to be counted quickly.

The British post office was the first to begin the use of stamps in May, 1840, but they were not officially perforated until January, 1854, except in the parliamentary session of 1851. Then stamps perforated by a Mr. Archer were issued in the House of Commons, and were so much liked that in 1853 the Government paid Mr. Archer $20,000 for the patent.

Marginal perforations vary in number on stamps of different countries, and are a subject of great interest to stamp collectors, who use a special gauge for measuring and counting them.

WHAT IS "HEAVY" WATER?

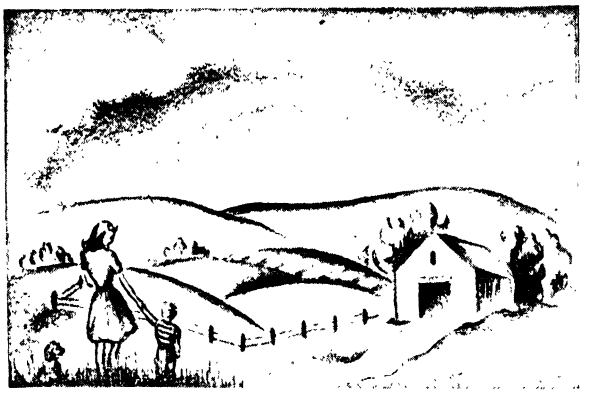
Water, as you know, is made up of two elements, hydrogen and oxygen. Every molecule of water contains two atoms of hydrogen and one of oxygen. Until 1931, scientists supposed that all pure distilled water had the same weight, volume for volume. This was, of course, supposing that every atom of hy-



Murals in public buildings often picture the story of some event of the past. This picture shows one of eight historical murals by Edvard Buk Ulreich, for the post office at Tallahassee, Florida.

drogen in the universe had the same weight as every other atom of hydrogen, and that every atom of oxygen had the same weight as every other atom. In the year 1931 Professor Harold Urey, with the aid of George Murphy and Dr. Ferdinand Brickwedde, discovered that some hydrogen atoms weigh about twice as much as the ordinary kind. An atom of ordinary hydrogen has one proton and one electron; an atom of heavy hydrogen has one proton, one neutron and one electron. Scientists call such a hydrogen atom a deuterium.

Varieties of an element are called its isotopes. Isotopes behave chemically much like the usual form of the element. Heavy hydrogen combines with oxygen in the regular way to form water. It is, of course, heavier than ordinary water. Discovery of heavy hydrogen was an important step in the study of the atom.



In 1934 Professor Urey was awarded the Nobel Prize in chemistry.

DO ANIMALS FEEL AS MUCH PAIN AS WE DO?

This can not be answered directly; indeed, when we come to think of it, we shall see that no one of us can really compare the amount of pain he feels with what anyone else feels. We can not feel anyone else's pain, and so we can judge questions like this only indirectly. Different human beings feel pain differently. Small babies and children are probably less hurt than grown-up people are by the same thing, though we may be misled by the fact that grown-up people usually control better the results of pain.

Probably women are slightly less sensitive to pain than men. On the average, they can drink fluids hotter, or hold hotter plates, without pain, than men can.

It is very possible that animals feel pain less than we do. Their nervous systems do not seem to be so highly organized as ours. Nevertheless they do feel pain, and it is our duty to give our pets and animals that serve us good care and kindness.

WHEN WE ARE LOOKING AT A RAINBOW CAN PEOPLE SEE THE OTHER SIDE?

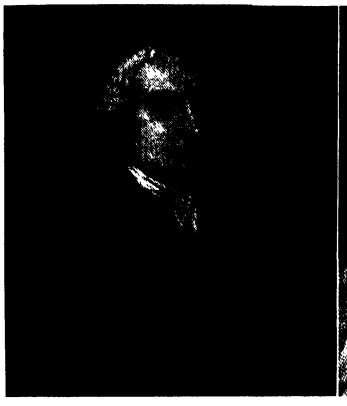
This is a natural question, and, of course, the whole answer to it depends on what a rainbow is. If it is anything like what it appears to be, there is no reason why, when we are looking at one side of it, other people should not be looking at the other side—as if it were, say, the arch of a railway bridge. But it is impossible that anyone can be seeing the other side of the rainbow.

What we call the rainbow is made by the reflection of sunlight from drops of water in the sky. Therefore, to begin with, the rainbow can appear to us only on the side of us opposite to the sun. Anyone trying to look at the other side of the rainbow would be looking toward the sun. Owing to the very nature of a rainbow, one can never be seen in this position. Now, if a rainbow is formed by the reflection of light from drops of water suspended in the sky that are so placed as to have our eyes between them and the sun, plainly there can be no other side to the rainbow.

HOW IS A HORSE MEASURED?

We say that a horse stands so many hands high, and this varies from seven to ten hands for a Shetland pony, to fifteen or seventeen hands for such magnificent animals as the Shire, Percheron, Clydesdale and the thoroughbred. The hand is a measure of length equal to four inches, and is used only for measuring horses. It came into use from the breadth of a man's palm, and it is probable that the placing of palm over palm up the foreleg of a horse to the shoulder once formed a rough-and-ready way of measuring it, much as we can roughly judge a length by spanning it if we know that the distance we can stretch comfortably from the tip of the thumb to the tip of the little finger is, if we are grown up, about eight inches, or if we play the piano, perhaps a little more.

THE NEXT WONDER QUESTIONS ARE ON PAGE 2320.







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Tobias Smollett. Jane Austen. Henry Fielding.

FICTION IN THE EIGHTEENTH CENTURY

PROBABLY three-fourths of the books that are read today by grownups for pleasure are fiction—that is, stories. Most of them are long stories in prose, called novels. The popularity of novels comes from the fact that they tell stories about imagined men and women; and that the reader can put himself in the place of an imaginary character, live the character's life, go through peril and suffering and joy and love. In short, while the reader is lost in the pages of a novel he is living another life, living at a faster pace than his real existence has, and feeling more keenly, yet with a delightful sense of unreality. Most novels have much to do with the emotion of love.

The novel, as we know it, is about two centuries old. Of course, story-telling is as old as civilization, by voice in narration, by acting on the stage and in books. But the novel as a distinct form of literary art is nearly new.

It is true that the prose tale was very well known through Lyly, Lodge, Greene and Sidney in the sixteenth century, through Mrs. Behn in the seventeenth century and Defoe in the early eighteenth century. But these early forms of novel were stories of adventure rather than studies of character under the influence of love. The novel as it exists today dates from 1740, when Richardson published his story PAMELA.

Samuel Richardson (1689-1761) was the son of very humble parents, his father being an ordinary carpenter in Derbyshire, where Samuel was born. The boy had very little education and at the age of seventeen he was apprenticed to a London printer, who made Samuel work so hard that he had no leisure for reading or study. But he made up for the time of which his master robbed him by sitting up at night to read any books he could secure. The candles used for these midnight studies he bought himself, so that his master might not have to pay.

An unambitious, steady, plodding, honest and industrious, and perhaps a very commonplace young man was this Samuel; but after fifteen years he had some reward from the printer, for he married his master's daughter, having now become a printer on his own account in a court off Fleet Street, close by the old Church of St. Bride. Here he continued for many years to carry on his business like any other printer of his time, living above his workshop and thus spending most of his time amid the smell of printer's ink. We can well believe that he was a kind and considerate master, and it is said he used to hide a silver coin among the types at night so that the first man to arrive at the workshop in the morning might have it as a reward.

Richardson was not far short of fifty years old when he determined to make himself famous by writing a novel. He was perhaps somewhat vain of his literary powers—which at the early age of thirteen he had first exercised by writing love letters for some village girls. In fact, he continued to oblige with such letters for many years. At any rate, PAMELA was the result of the little printer's resolution. He certainly succeeded in making himself famous. The rest of his days

were spent with much satisfaction in writing for the sentimental ladies of his time, to whom the pale and tearful heroines of his novels seem to have been strangely attractive.

Though so few of us read his writings today, the little printer certainly gave a great impetus to the art of fiction in England; and the careful and elaborate way in which he traced the natures of imaginary people was also imitated by writers on the Continent, chiefly in France. He died on July 4, 1761, and by his own request was buried in the Church of St. Bride, near to which much of his life had been passed.

Richardson's three important works were PAMELA, CLARISSA and SIR CHARLES GRANDISON; and PAMELA deserves to be called great. An American critic, William Rose Benét, places it among the fourteen outstanding prose works of the eighteenth century, though you might not find it very thrilling to read today. It is the story of a simple, unsophisticated country girl, servant to a squire of doubtful morals. Pamela marries and reforms him.

PAMELA, like most of Richardson's other stories, was written in the form of long-winded letters. The book was issued in "parts," as they were called, somewhat as the continued stories in our magazines appear, spread over some months. Nowadays our lives are much too varied and active to leave time for reading such very long and unexciting stories as he wrote, but our great-great-grandfathers had more leisure and fewer interesting books, so that they could find time to follow the slow and steady unfolding of his appallingly lengthy tales. In country villages people used to wait anxiously for the arrival of the next "part" of his novels to find out what was to happen to the characters; and when the heroine of PAMELA married the rather unmanly hero, church bells were rung in some villages as though Pamela had been a real person.

When an author invents some unusual way of telling a story, it frequently happens that another author will turn it into ridicule by writing what is called a parody of it. So it happened with Richardson's PAMELA, which an abler and far more gifted man than Richardson, two years after its appearance, took as the idea of a very different sort of story called JOSEPH ANDREWS.



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Samuel Richardson, author of PAMELA.

HENRY FIELDING, WHOSE NOVELS ARE FULL OF LIFE AND HUMOR

The writer of this was a born story-writer, a man of great force of character, the son of distinguished parents, and well educated. His name was Henry Fielding, and he was born in Somersetshire, England, on April 22, 1707.

Being fond of the pleasures of life and disinclined to work or to study too closely, Fielding left the University of Leyden, in Holland, and returned to London, when he was twenty. But he soon found that his father was not able to allow him so much money as he had expected, and he had to exercise his abilities by writing for the stage.

After a while he married a beautiful girl who had a small fortune; but this he soon contrived to spend, and at thirty-three he became a barrister (lawyer), though it was chiefly by writing books that he made his living. His wife died in 1743, and not long afterward he married a servant, who was a very good wife to him for the rest of his days. Poor man, he was not long to enjoy the success of the great books he had written or the advantage of the comfortable salary he received from a legal appointment given to him in 1749.

In that year Fielding wrote a very brilliant satire called MR. JONATHAN WILD THE GREAT, and in the same year appeared his most celebrated novel, THE HISTORY OF TOM JONES, which is one of the great masterpieces of English fiction. (This is also on William Benét's list of foremost eighteenth-century prose writings.) Fielding's third and last novel was AMELIA, which appeared in 1751. All his stories are written with a fine, vigorous feeling of life and overflow with humor, a quality in which Richardson was utterly deficient.



A scene from THE VICAR OF WAKEFIELD, by Oliver Goldsmith. The vicar's son, Moses, is about to set out for the fair, and the other members of the family are helping to get him ready for this thrilling expedition.

In 1754, while on a visit to Lisbon, where he had gone broken in health, Fielding died, and was buried in Os Cyprestres cemetery.

LAURENCE STERNE AND TOBIAS SMOLLETT WROTE LIVELY FICTION

Laurence Sterne was born in Ireland, though his ancestors were English. He was born on November 24, 1713, and educated at Halifax Grammar School and Cambridge University, becoming a clergyman in the year 1738. For a good many years his life was, no doubt, that of an ordinary English country vicar, except that, being satirical and bitingly sarcastic in his speech, thin in appearance and poor in health, he was probably by no means so pleasant a companion as a country parson ought to be.

When he was forty-six years of age he published the first two volumes of his clever and amusing book, THE LIFE AND OPINIONS OF TRISTRAM SHANDY. Very soon the wit and humor with which the characters in this great work were drawn had made the name of Sterne famous; and for years new volumes of the work continued to appear, until it was completed in 1767, just about two months before its author breathed his last.

On the whole, Sterne was not a pleasant kind of man to contemplate, and although his books are full of high spirits and laughter, it is not always the healthiest laughter, nor are his sentiments such as do credit to a preacher of the Gospel who during his later years may be said to have written under the shadow of death. His other famous book is called A SENTIMENTAL JOURNEY THROUGH FRANCE AND ITALY. It is very witty.

Tobias Smollett was a Scotsman, born near the "bonnie, bonnie banks of Loch Lomond" in March 1721. He went to school at Dumbarton and to Glasgow University, and when he was about fifteen was apprenticed to a surgeon in Glasgow. He wished, however, to be a writer, and at the age of eighteen went to London with a play which he had written. But no one would buy the play and, as he had no money, he went to sea as assistant to a naval surgeon.

After his return to London he practiced as a surgeon. He married a lady who had some wealth, and he wrote for a time more for pleasure than for profit. Later he adopted writing as a profession. He became a journalist, wrote histories and books of travel, translated foreign stories and edited papers.



Maria Edgeworth.



Culver Service
Horace Walpole.

But, above all, he produced three novels very similar in style to those of Henry Fielding, and nearly always mentioned in company with them as the best examples of English novels written before the time of Sir Walter Scott. They are full of interesting and lifelike characters, and his sailors, especially, are the breeziest, saltiest sons of the sea to be found in English story-books. The names of his three famous books are RODERICK RANDOM, PEREGRINE PICKLE and HUMPHREY CLINKER, the first being written in 1748, and the last in 1771, in September of which year Smollett died at Leghorn, in Italy, and was buried in the English cemetery in that city on the Mediterranean.

GOLDSMITH'S GENTLE HUMOR STILL CHARMS HIS READERS

In a former chapter (page 1867) we have told you about Oliver Goldsmith, whose VICAR OF WAKEFIELD is one of the most beautiful stories in the English language. Although he was a dramatist (his comedy SHE STOOPS TO CONQUER is a perfect stage play) and a poet (Johnson called him "the greatest poet since Pope"), we must never forget the importance of Goldsmith's work as a story-teller. No one reading this book today would realize that the writing of novels was so new when it was written. The narrative is easy, the plot is natural.

In 1766 Oliver Goldsmith published his VICAR OF WAKEFIELD, and in 1778 Fanny Burney published her EVELINA. (See the chapter that begins on page 1726.) These novels were free from the vein of coarseness that spoils Smollett and mars Fielding. Goldsmith did not again attempt fiction. Miss Burney, who had begun with great promise and won well-deserved popularity, spoiled her style in her later novels, CECILIA and CAMILLA, by imitating Doctor Johnson's most formal compositions. Before the close of the eighteenth century the novel had been fairly started and had been purified from its first failures in good taste.

In less than fifty years there were many writers of novels, and a larger proportion of the honors began to go to women than had been gained by them in any other field of literature. As with the drama in Shakespeare's day, fiction reached its greatest height of glory almost suddenly. Less than forty years lay between the coming of the better novel in the EVELINA of Fanny Burney, and the capture of the whole reading world by the novels of Sir Walter Scott. This sudden collection of stories, so varied in time, character and subject, can only be compared with the abundance of Shakespeare's plays two hundred years before.

Fiction broadened out, after the domestic stories of Richardson, into wild and romantic fancies. A fashion was set by Horace Walpole in his CASTLE OF OTRANTO, a fearsome, supernatural story. Walpole put his talents into all kinds of things, and of course he had to try story-telling.

He was followed by other writers bent on making the reader's flesh creep with mysteries. For a time, too, the novel made a fashion of using fine language that was quite unnatural. The most popular writer of that day was Mrs. Ann Radcliffe. Her ROMANCE OF THE FOREST is still worth reading as an illustration of a kind of fashion that, under various forms, creeps again and again into fiction and is thought by the uncritical to be thrillingly fine. Being unnatural, it fades away and is only smiled at by a later generation of readers.

MARIA EDGEWORTH, WHO WROTE ABOUT LIFE IN IRELAND

Two other women novelists who wrote in the late eighteenth and early nineteenth centuries are Maria Edgeworth and Jane Austen. Maria Edgeworth (1767-1849) began the localizing of the novel—that is, the special study of the character, manners and speech of a district. Her ground was rural Ireland, and her success probably had some

THE HEROINE OF NORTHANGER ABBEY



In NORTHANGER ABBEY Jane Austen makes gentle fun of the highly colored, spine-chilling fiction which was popular at that time, such as the stories by Mrs. Radcliffe. Her heroine, Catherine Morland, is very fond of such stories and longs to have the sort of adventures that her favorite tales describe. When she visits friends who live in a picturesque old manor house she lets her imagination run away with her common sense, with results which are amusing, but which very nearly bring unhappiness to herself and to others.

effect in prompting Sir Walter Scott to present to the world in fiction the Scotsman, past and present.

The Edgeworths were an English family made Irish by living in Ireland for two centuries. They kept up a constant connection with England, where Maria was born, and while they were quite Irish in their ways they were able to see Ireland from the outside as well as the inside.

Maria Edgeworth's father was a wayward man of genius, fanciful, masterful and full of fads, and one of his fads was to regulate the writings of Maria according to his own ideas. As his ideas of writing a novel were clumsy, his admiring daughter was handicapped by his interference; but her pictures of the Ireland she knew, in CASTLE RACKRENT, THE ABSENTEE and ORMOND, are the best pictures we have of it in her day.

Miss Edgeworth brought fiction back to real life; and because she makes us feel she is writing about men and women as they are, her stories will live as pictures of life in the past that have a historical as well as a human value.

JANE AUSTEN MAKES QUIET, DULL LIVES SEEM EXCITING

And so it is in an even greater degree with Jane Austen's novels. These are of a far choicer workmanship. Jane Austen was a Hampshire girl, daughter of the rector of Steventon, where she was born on December 16, 1775. Her first complete novel, but one that was not published till after her death, NORTHANGER ABBEY, was a mixed description of Bath, then the chief health resort and social center of England, and a clever exposure of the style of Mrs. Radcliffe's tales, in the height of their popularity. SENSE AND SENSIBILITY (1811), PRIDE AND PREJUDICE (1813), MANSFIELD PARK (1814) and EMMA (1816), make up a complete study of life in rural England.

Readers who want sensation, high-flown sentiment, an exciting or involved plot, stirring adventure, problems of passion or boisterous laughter need not trouble themselves with Jane Austen. But Jane, writing only about a quiet life which she knew very well, gives us a picture of the thoughts and ways of English gentlefolks at the end of the eighteenth century. It is faithful in drawing and delightful in its quiet humor.

Of the life of the poor and humble, we scarcely have a glimpse in her books, and the governing class that circled round the court is equally left alone. She seems even to be unaware of earth-shaking events of her day—the Napoleonic Wars, for instance. It is the comfortable landed gentry to whom Jane Austen introduces us. Her writing gives us the most finished picture of a section of English society that any novelist has drawn.

It has been said, and there is some truth in the criticism, that the men and women in any one of her stories are much like those of any other story, but with their circumstances and aims somewhat changed. That is natural since a rather narrow round of country life is shown with no sensational characters or incidents introduced. But this only makes the quality of her skill the finer when she holds our interest.

She fully understood her own limitations and never tried to do what was beyond her power. She wrote herself of "the little bit of ivory, two inches wide, on which I work with so fine a brush as produces little effect—after much labor." But that fails to do justice to her method, though it suggests it. Scott was nearer the truth when he spoke of "the exquisite touch which renders commonplace things and characters interesting from the truth of the description and the sentiment."

Miss Austen lived a very quiet country life, with gradually failing health before she reached middle age. She died at Winchester in her forty-first year on July 18, 1817, and is buried in Winchester Cathedral.

A LIST OF THE GREATEST PROSE WORKS OF THE EIGHTEENTH CENTURY

A few words more about William Rose Benét's list of the fourteen greatest prose works in English published in the eighteenth century. All but one are by British writers—the one exception is Benjamin Franklin's POOR RICHARD'S ALMANAC. Nine are novels: ROBINSON CRUSOE, by Daniel Defoe; PAMELA, by Samuel Richardson; THE HISTORY OF TOM JONES, by Henry Fielding; THE ADVENTURES OF PEREGRINE PICKLE, by Tobias Smollett; THE CASTLE OF OTRANTO, by Horace Walpole; THE VICAR OF WAKEFIELD, by Oliver Goldsmith; TRISTRAM SHANDY, by Laurence Sterne; EVELINA, by Fanny Burney, and PRIDE AND PREJUDICE, by Jane Austen. GULLIVER'S TRAVELS, by Jonathan Swift, is not really a novel, though it is imaginative writing.

THE TATLER, essays by Addison and Steele; Dr. Samuel Johnson's DICTIONARY; and THE DECLINE AND FALL OF THE ROMAN EMPIRE by Edward Gibbon end the list.

THE NEXT STORY OF LITERATURE IS ON PAGE 2264.

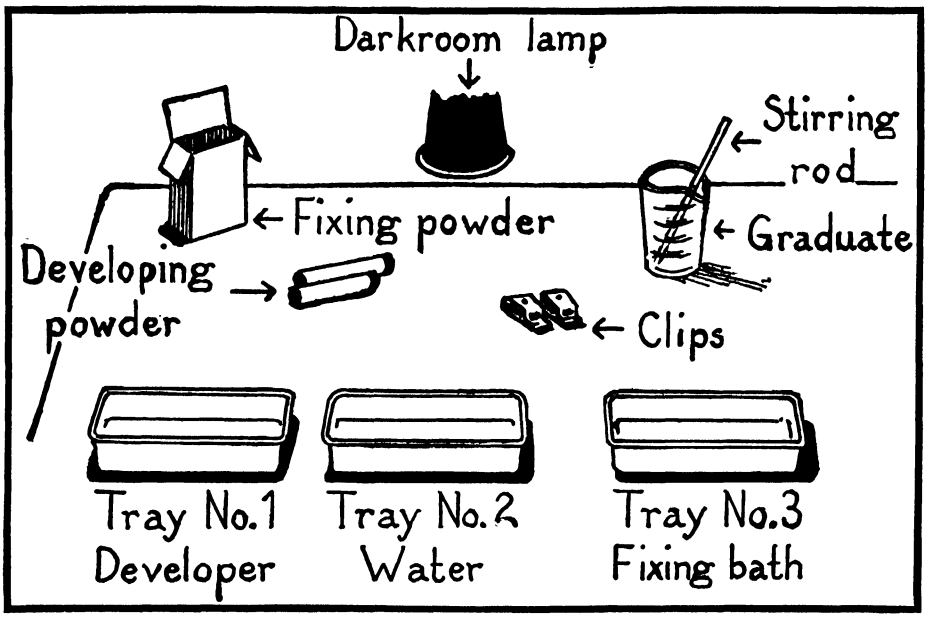


Figure 1

HOW TO DEVELOP AND PRINT FILMS

IN The Book of Knowledge we show you how to take interesting snapshots. When all the exposures in your camera have been made, you may, if you wish, have it developed by a photo-finishing service. But many boys and girls prefer to develop and print their own pictures. As you mix the developing and fixing solutions, you will feel like some mysterious magician of the Middle Ages. And it will really seem like magic to you when objects gradually take form on the blank film or printing paper.

It is not necessary to have an elaborate or costly outfit to make good negatives or prints. You will find that the following articles will be quite sufficient: a darkroom lamp, three trays, two film clips, developer and acid-fixing powders, a four-ounce tumbler graduate (which is simply a glass with a spout and with marks on the side to indicate the number of ounces of liquid it contains), a glass or hard rubber stirring rod, and a supply of sensitized printing paper. It is also necessary to have a darkroom for developing pictures by the method that we are going to describe. The reason for this is that your film is very sensitive to light, either daylight or artificial light. That is what made the film take a picture in the first place: light. It is to prevent this light from striking your film that you must find a place that is totally dark.

However, you will find that it is quite easy to find such a room at night almost anywhere. A large closet, an attic room, a corner of the basement, any of these will do. Of course you must have enough light to work by. How can you do that, without affecting the film? Well, some film is sensitive to light of all colors. That is called "panchromatic" and it must be developed in the dark; there is no other way. Other film is not panchromatic. It is sensitive to light of most colors, but not to red light. Therefore, if you are going to develop a film that is not panchromatic, you may have a subdued red light in your darkroom. There are various types of lights of this kind. You may use a candle lamp, bound in a metal frame, if electric light is not available. Where it is available, it is best to use a darkroom electric lamp, which can be screwed into any convenient socket. This lamp will not affect film that is not panchromatic, unless the film is held too close to it.

How can you tell whether the film that you are going to develop is panchromatic,

that is, whether it is sensitive to red light, so that you cannot safely develop it by a subdued red light in your darkroom? The box in which the film came may have the word "panchromatic" on it. However, if it does not say "panchromatic," you still cannot be sure, for some trade names mean that, without saying so. If you are using Kodak film, and the big word "Kodak" is printed

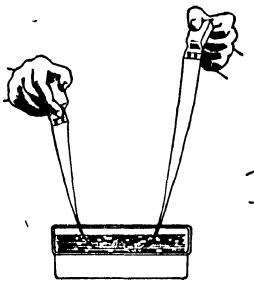


Figure 2

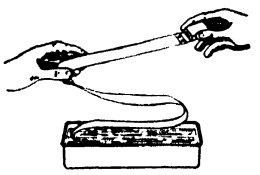


Figure 3

in red on the box, then the film may be developed by red light. If the word "Kodak" is printed in green or blue, then the film is panchromatic and must be developed in total darkness. In case of doubt about other films, ask the store that sold you the film.

THE FIRST STEPS IN DEVELOPING FILMS

Now let us suppose the film is not panchromatic. When you are ready to develop your pictures, be sure that not the least bit of white light is penetrating your darkroom; then light your candle or electric darkroom lamp. We have already shown how your work table should be arranged. Set your three trays on the table in front of you, making sure that they are at least 18 inches from the lamp. Next, fill your graduate tumbler to the four-ounce mark with water, which should be at 65 degrees Fahrenheit. Open one of the developing powders and put the contents, as indicated by the directions on the box, into the graduate. Stir this with the stirring-rod until the chemicals are dissolved; then pour this developer solution into the first tray. Add four more ounces of water to the solution and tray No. 1 will be ready. Put clean water in the second tray. Tray No. 3 should now be filled with eight ounces of the fixing solution; you will find detailed directions for preparing this solution on the package containing the fixing powders. The contents of all three trays should be between 65 and 70 degrees Fahrenheit or about the usual temperature of water from the cold water faucet.

TURN YOUR BACK ON THE LAMP

You are now ready to develop your film. Turning your back to the darkroom lamp, so that the film will receive the minimum of even the red light, unroll the film from its spool and detach it from the paper. Place a film clip on each end of the film. You will notice when you have done so that one side of the film will naturally curl in; that is the face or emulsion side. Be careful not to touch the face of the film. Next, pass the film, face up, through the water in the second tray (as in Figure 2). This should be done several times, in order to remove air bubbles. Where air bubbles are present, it is impossible to develop the film evenly, because the bubbles will prevent the solution from reaching each part of the film. Be sure that the film is thoroughly wet and that there are no air bubbles before you proceed.

Now pass the film, which must still be face up, through tray No. 1, containing the developer solution (as in Figure 2). Keep the film constantly in motion for four minutes. In a minute or two images will begin to appear, and you will be able to make out the unexposed sections between the individual negatives. In about two minutes you will be able to distinguish different objects in the picture. Remember that the films should be developed long enough to bring out all the details. You will find that not all the negatives on your film will be of equal density. This does not matter, for, as we shall see, you will be able to take care of this in the printing. The film should be developed for the length of time stated on the developer package, usually about four minutes.

PASSING THE FILM THROUGH THE FIXING BATH

When the film is fully developed, take it out of tray No. 1 and rinse it by passing it through the water of the second tray; then put it immediately into tray No. 3, containing the fixing solution or fixing bath, as it is sometimes called. Pass the strip of film through the fixing solution (as in Figure 2); do this three or four times. Then remove the clips from the ends of the film. Place one end of the film into the tray and lower the strip into the solution in folds (Figure 3). To be sure that the fixing solution reaches each part of the film, gently press the places where the folds occur. When all the film has been thoroughly covered with the solu-

tion, it is no longer in danger of being ruined by white light. If you wish to have more light to work by, therefore, you may disconnect your darkroom lamp and use any ordinary electric bulb. The film should remain in the fixing bath for *twice* the time that is necessary to clear it of its milky appearance. This should take about fifteen or twenty minutes.

THOROUGH WASHING IS IMPORTANT

The film is now ready to be washed. This may be done in several ways. You may use your No. 2 tray, replacing the water in it with fresh water. If more than one roll of film is to be developed at a time, a fourth vessel (such as a washbowl) should be provided for the washing. Place the film in the tray or washbowl until it is entirely covered by the water, and allow it to remain in the water for five minutes. Then remove the film, refill the tray or bowl with fresh water and again let the film remain in it for five minutes. Repeat this until the film has remained for five minutes in each of six changes of water. If you wish, you may give the film two changes of water as described above; then you may leave it in the tray or bowl under running water for an hour.

PREPARING TO PRINT YOUR PICTURES

When the film has been thoroughly washed, put a clip on each end of it and hang it up to dry, by one of the clips. The film should be allowed to swing clear of the wall so that it will not be spoiled by contact



From "All the Children"

A sink with running water is not necessary, but it is a great convenience in developing and printing films.

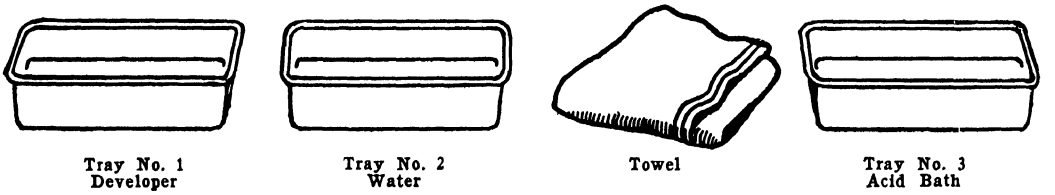
with any object. If a shelf is available, hang the film from the edge of the shelf. When the film is dry at last, you are ready to cut it up into its individual negatives, of which there will be six or eight or more.

THERE IS NO TURNING BACKWARD

There are several important things to remember about the development of films. First of all, the film must not be placed in the No. 1 or No. 2 trays (if the water in No. 2 has not been changed) after it has been fixed in the No. 3 tray. Remember, too, that none of the fixing solution from the No. 3 tray must be allowed to touch the film until it is ready for the fixing bath; otherwise the film will be spotted or ruined.

tray will contain the developer solution. To make this solution, fill the tumbler graduate with four ounces of water; put one of the developers into it and stir it with the stirring-rod. Then pour the solution into tray No. 1 and add eight ounces of water. Fill tray No. 2 nearly full with fresh clear water. Finally place eight ounces of the fixing solution in tray No. 3; this is to be prepared according to the directions on the box. The towel is provided so that you will be able to wash and wipe your hands between operations. Your prints would be spoiled if you handled undeveloped paper with fingers that had just touched the fixing solution.

When everything is ready, put out the printing light and turn on the safelight. Open the printing frame and lay a negative,



Tray No. 1, at the left, contains the developer, the second tray contains clear water. The towel should be placed next, then Tray No. 3, containing the acid bath. Always set your table in this order.

Figure 4

Be sure, also, that the developer solution is at a temperature of 65 or 70 degrees, as we have mentioned above. The film will be over-developed if the solution is too warm, under-developed if it is too cold.

You are now ready to print your pictures from the negative. Printing consists of putting an image on sensitized paper by light through the negative. You will need a ruby or orange safety light (or safelight, as it is often called) and also a white printing light, such as that furnished by an ordinary electric bulb.

Various kinds of printing papers are used, depending upon the negatives and upon the effects that you wish to produce. If your negatives have not sufficient contrast, choose a paper that will bring out the contrasts more clearly. If, on the contrary, the negative has sharp contrasts of dark and light, you should use a paper that will soften them.

Remember that the supply of printing paper must be guarded from the light until it is ready to print. It should be kept in its envelope or under cover in order to shield it from the printing light.

You will also require three trays and a towel. Arrange these as in Figure 4. The first face up, upon the glass (the face is the dull side of the negative). Place a sheet of printing paper face down upon the negative. You will find that the paper has a slight curl; the face is on the inside. In some cases the trade name of the paper is printed on the back. Now replace the back of the printing frame and fasten it. During the above operations the only light in the darkroom should be that from the safelight.

Hold the printing frame toward the printing light at a distance slightly more than the diagonal of the negative, as indicated in Figure 5. Then make the exposure; that is, turn on the printing light for a short period of time.

THE TIME OF EXPOSURE VARIES

You will find that the average time of exposure required will be 26 seconds when the print is held 8 inches from a 25-watt lamp. However, this will not apply in all cases. Much will depend upon the density of the negative and upon the kind of paper that is used. There is a good way to determine how much time is required to print a given negative. Cut a piece of printing

paper into strips about an inch wide, and place one of them over an important part of the negative. Expose it for what you consider to be the correct amount of time. Then place it in the developer tray and keep it in the solution for forty-five seconds. If the details are not dark enough in that length of

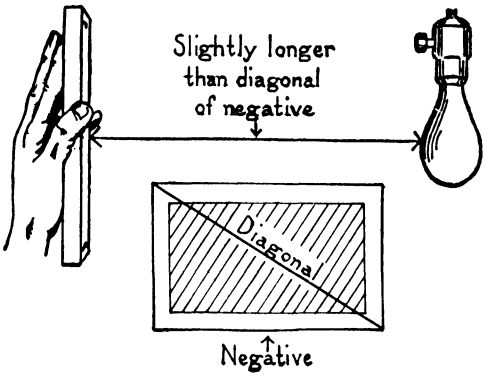


Figure 5

time, you will know that the exposure was too short; if the print is too dark, it means that the picture was overdeveloped. Take another strip of printing paper and either lessen or increase the time of exposure until you have a satisfactory print in forty-five seconds. Then mark the time required on the margin of the negative.

THE FINAL STEPS IN PRINTING

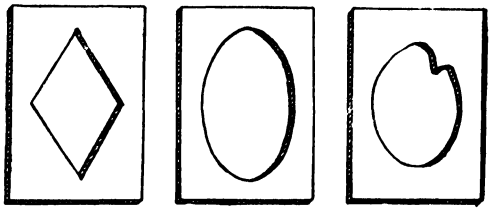
When the print has been exposed to the light for the correct amount of time, it is ready to be developed. It should be removed from the printing frame and slid into the developer solution (tray No. 1) face up. Soon the darker portions of the picture will begin to appear and in about forty-five seconds it should be as dark as desired. Remove the print from the developer solution and place it in the second tray containing clear water. Rinse it in this water for five to ten seconds, turning the print over once or twice. Then put it in the acid fixing bath (tray No. 3). Leave the print in the fixing bath for at least fifteen minutes. Move the print about occasionally so that it will be evenly fixed. Eight ounces of the fixing solution will fix about thirty average size prints (2¼ by 3¼ inches). After this, throw the solution away and prepare some fresh solution.

While the print is lying in the fixing solution, you may make other prints, letting them accumulate in the fixing bath until the first one has been there about fifteen minutes. Then the print that has been there longest can be removed each time that another print is put in. Be sure to wipe your hands carefully on the towel before you handle a fresh print.

When the prints are fixed, remove them from the fixing bath, place them in a clean tray or bowl and wash them thoroughly for about one hour in running water. If this is not available, the print may be placed in the tray or bowl of water and left for five minutes in each of ten or twelve changes of water. Move the prints from time to time so that the water will act evenly on every part of the prints.

When the prints have been thoroughly washed, drain off the surplus water and lay them face down on clean uncolored cloths or on towels which are free from lint. When they are thoroughly dry at last, your task is done. Your prints are now ready to be mounted in an album or sent to your friends.

You may provide neat margins for your pictures by using a "mask." This is simply a sheet of black or opaque paper, from which is cut a piece corresponding to the size of the desired print. In order to print, the mask is placed in the printing frame and the negative is placed above it, with the back or shiny side of the negative next to the glass, as before. Place a sheet of printing paper face down upon the negative. This sheet is to be larger than the opening of the mask; the portion of it that is covered by the mask will be the margin of the finished picture. Now close the back of the printing frame and print as before. These masks may be of any shape, oval, square or rectangular. They may even be cut to represent an artist's palette or some other interesting figure of that sort. Figure 6 shows some masks.



Masks

Figure 6

Article prepared with the help of the Eastman Kodak Company.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 2377.



WHO wrote the fairy tales? This question has kept scholars busy for 2,000 years and has not yet been settled, except for that small percentage of stories known as "modern originals," like ALICE IN WONDERLAND or THE UGLY DUCKLING, whose authors are known.

A full 85 per cent of the world's fairy tales belong in the field of folklore; they were told for hundreds, even thousands, of years before they were collected into written or printed form. We tell you about the world's Unwritten Literature on page 215. The names of their creators are lost in the distant reaches of time.

Some modern writers have made an art of collecting folklore, editing and adapting the tales to suit the audiences of different lands. They are collectors rather than creative authors, but they have often rewritten the old tales in new styles. When different authors write the same story in different countries at different periods of time, all of them may be credited with the story, yet it is original with none of them.

This was aptly illustrated when a master of ceremonies on a modern radio quiz program asked "Who wrote CINDERELLA?" and accepted "Perrault" as the right answer. A flood of contradictions came in to the studio by telephone and mail; and the studio officials consulted librarians. They studied many volumes of reference and answered that Perrault had indeed written the story in 1697, but the Italian writer, Basile, had written it in 1620. Even then it was not new; it was an old folk tale, an oriental story introduced into Europe by the Crusaders and the Moors of Spain, perhaps four hundred years before.

Many of our best loved fairy tales, like PUSS IN BOOTS and BEAUTY AND THE BEAST, are of incredible antiquity. They have passed from one speech to another, across continents and oceans, spreading over the world with the migration of races, with slaves taken in war, with wives purchased from distant kingdoms, with wandering gipsies. They were taken to Indonesia by the Hindus and Mohammedans, to East Africa by the Arabs, to South Africa by the Dutch, and to the United States by the colonizing Europeans and the African slaves. Excavations in Egypt have revealed fairy tales written on papyrus, dating back to the Middle Kingdom, 2160-1788 B.C. Thus, when we find these stories in modern books, each tale may be credited to a long line of writers, the earliest of whom took it from the spoken tale of peasants or of bards who sang the narratives to the music of small stringed instruments.

Modern original fairy tales, on the other hand, have only a single creator. Hans Christian Andersen of Denmark is generally given first place among writers of original fairy

tales, but almost every nation may cite with pride a Selma Lagerlöf, a Lewis Carroll or a Frank Stockton.

Variants Fairy-tale material—more particularly of the old traditional tales—changes as it passes from nation to nation. These differing forms of the same tale are called variants. Sometimes the change is intentional, to bring the story closer to the interests and understandings of different peoples; sometimes it is accidental. Cinderella dances her charming way into the hearts of children on glass slippers that are purely accidental. For centuries Cinderella's slippers were of velvet or of a fine fabric as were all slippers of aristocratic ladies in olden times. Then an English translator mistook the Old-French word *vair,* fine soft fur, for *verre,* meaning glass, and thus was born a new and uncommonly happy variant. The number of variants for the more popular stories may exceed 100, with a different writer for each variant. CINDERELLA and PUSS-IN-BOOTS have the largest number of variants. RED RIDING HOOD and BEAUTY AND THE BEAST have variants that differ widely each from the other.

What is a fairy tale? A fairy tale is not necessarily a tale about fairies; it may deal with nonsense like ALICE IN WONDERLAND, with talking animals like the UNCLE REMUS TALES, or with ogres and giants like JACK AND THE BEANSTALK. But always the fairy tale deals with magic. The magic may be personified by fairies, elves, or pixies, gnomes, dwarfs, sprites, or hobgoblins, giants, mermaids, ogres or trolls, brownies, leprecauns, dragons or talking animals. When a fairy tale becomes traditional in a land, revealing the beliefs, customs and aspirations of the people, it is classed as a folk tale, a part of folklore.

Africa The vast continent of Africa is the home of a folklore as varied as the races which make up its people. African folk tales have been collected by Europeans, chiefly British; although in the protectorates and colonies under France, Belgium, Portugal and Spain, writers of these nationalities have made collections, not yet accessible in translations to English-speaking people. The races of Africa differ in origin, language, appearance and means of subsistence, ranging from the pigmies of the equatorial forests to the bushmen of the southern arid districts, and include Europeans, Arabs, Turks, Berbers, Hamites, Semites and Libyans. There is no one writer who has collected the fairy tales of all Africa; instead, each writer or collector has worked within a small area. Major A. J. N. Tremearne, in a book called HAUSA SUPERSTITIONS AND CUSTOMS, has written some of the fairy tales of the Hausas of northern Nigeria. They tell of a far-gone day when all the animals lived together in peace. Children like particularly the Hausa story ONE CANNOT HELP AN UNLUCKY MAN, a primitive variant of the English tale MR. VINEGAR. W. H. Barker and C. Sinclair collected WEST AFRICAN FOLK TALES. G. McCall Theal collected, under the title KAFFIR FOLK TALES, stories of the eastern border of the Cape Colony. A typical Kaffir story is THE GREAT CHIEF OF THE ANIMALS which begins: "There was once a woman who had occasion to leave her home for a short time, and who left her children in charge of a hare. . . ." The story relates what happened when a monster animal came by and swallowed the children and, later, the mother—a familiar theme in folk tales. We know it in THE WOLF AND SEVEN LITTLE KIDS.

The Hottentots of Africa have the simplest of stories, very short, like fables, and only missionaries have been able to collect them without being killed in the process. The Reverend G. Krönlein was notably successful in this regard, but he was not a writer; he told the stories to Dr. W. H. J. Bleek who wrote them in a book called REYNARD THE FOX IN SOUTH AFRICA. From the Masai tribe, a nomadic people of British East Africa, A. C. Hollis, a writer of more than ordinary talents, collected the native tales and published them in a book called THE MASAI. From the Congo district the co-authors Chadwick and Lamprey collected tales in a volume called THE ALO MAN. The title refers to the name given the wandering story-teller of the African villages. These Congo stories have a humor lacking in the Masai tales which reflect the bloodthirsty, warlike character of the nomadic Masai.

Arabia The chief contribution of Arabia to tales of magic and wonder is THE ARABIAN NIGHTS ENTERTAINMENT OR THOUSAND AND ONE NIGHTS. We do not know who first made up these stories—probably many men had a part. Nor do we know who first wove them into one pattern around the characters of a woman-hating emperor and a beautiful maiden who charmed him with her stories. Not all of the stories in THE ARABIAN NIGHTS are Arabian; some have been traced from the Sanskrit through the Persian, and some (ALADDIN, for example) are Chinese. Most of them, however,

bear the earmarks of the Arab tale—elegance, with many episodes and diversions, and a lust for pleasure and luxury. The first good English translation of THE ARABIAN NIGHTS was made by Dr. Edward W. Lane in 1840. Dr. Lane gathered the stories from among the Arabs in and around Cairo; his translation still stands as the most scholarly and comprehensive. It is said, however, that today's Arabs, gathering about their campfires on the desert or in the market-places, prefer stories from THE ROMANCE OF ANTAR, a forty-five-volume cycle supposedly written by al-Amáee. These are not children's stories but "tall tales."

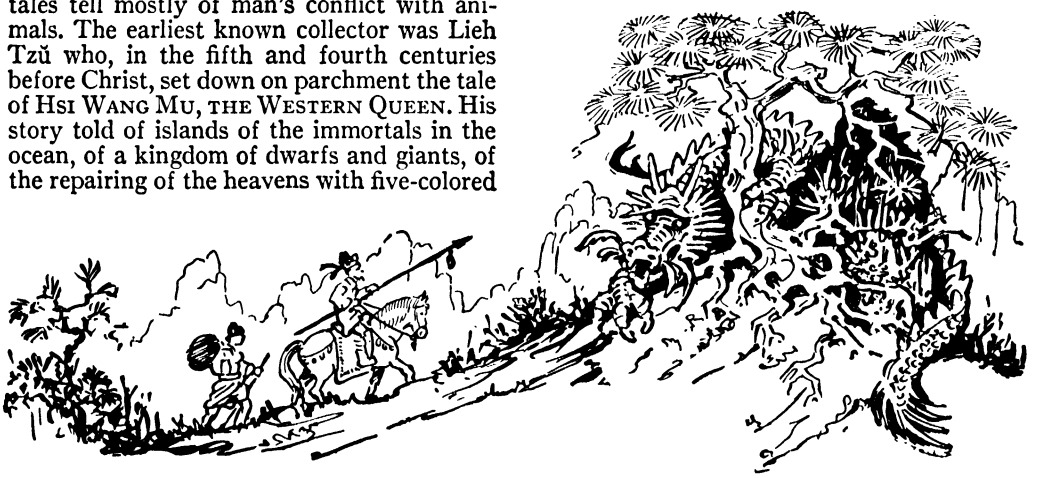
Australia The true Australian fairy tale is not the European story brought by English colonists. It is the story of the Australian native, told for generations beside the campfire or in the shade of the gumwood tree. They are savage, primitive stories, as may be seen in Dr. W. Ramsay Smith's MYTHS AND LEGENDS OF THE AUSTRALIAN ABORIGINALS, and in Mrs. K. Langton Parker's AUSTRALIAN LEGENDARY TALES. The latter stories are dedicated to "Peter Hippi, King of the Noongahburrahs."

Canada No Canadian writer has as yet explored fully the folk-tale past of both French Canada and British Canada. The most comprehensive writer to date is Cyrus Macmillan who collected two volumes — CANADIAN WONDER TALES and CANADIAN FAIRY TALES.

China More than three thousand years before Christ, the Chinese had a well-developed folklore, telling of historic fights with savage tribes and wild beasts and of adventures in deep forests. Chinese fairy tales tell mostly of man's conflict with animals. The earliest known collector was Lieh Tzŭ who, in the fifth and fourth centuries before Christ, set down on parchment the tale of HSI WANG MU, THE WESTERN QUEEN. His story told of islands of the immortals in the ocean, of a kingdom of dwarfs and giants, of the repairing of the heavens with five-colored stones, and of a great tortoise which supports the universe, all themes used extensively by later writers. In the seventeenth century A.D. a scholar by the name of P'u Sung-ling wrote a celebrated group of stories, *Liao Chai chih i* (STRANGE STORIES FROM A CHINESE STUDIO). In the translation of Herbert A. Giles, we see that these stories are quite unlike the European fairy tales; they are complicated, moralistic and full of dealings with the dead. An earlier writer, Li Kung-tso, in the ninth century, wrote the *Nan k o meng*, or DREAM OF THE SOUTH BRANCH, a veritable Arabian Nights, with its adventures occurring on the south branch of a Huai tree—a type of locust. From this title the Chinese have a saying: *Nan k o chih meng*—"a dream of the south branch"—which they call any idea which is visionary or fantastic. Some of China's best stories have been translated by the German scholar, Wolfram Eberhard in CHINESE FAIRY TALES AND FOLK TALES, also by Herbert Giles, and Norman H. Pitman. China has produced no important writer of fairy tales since the seventeenth century.

Croatia Best of the Croatian writers was Iv. Berlic Mazuranic, whose stories were translated into English by F. S. Copeland under the title: CROATIAN TALES OF LONG AGO. Croatian tales are similar to the Serbian.

Czechoslovakia Czechoslovakian fairy tales are the composite folklore of Bohemia, Moravia, Slovakia and Austrian Silesia, all provinces in which story-telling has long been an art. With the exception of the Bulgarians, Czech is the oldest among all Slav literatures, and



The Chinese children of old loved stories about dragons. Here is a Chinese St. George and a dragon.

until the seventeenth century was the richest. Karel J. Erben of Prague collected a notable volume in 1865: PANSLAVONIČ FOLKLORE, including stories of neighboring states other than those making up modern Czechoslovakia. CZECHOSLOVAK FAIRY TALES, a collection by Parker Fillmore, contains many of the oldest Czech tales.

Denmark The world's most beloved writer of original fairy tales was a Dane, Hans Christian Andersen (1805-1875). Born in the village of Odense, the son of a poor cobbler, Andersen was a strange, homely child, subject to fits. His grandfather had been insane, and the villagers said young Hans had inherited the madness; they were sure of it when the boy began to tell fantastic tales to younger children. At fourteen, after his father's death, Hans went to Copenhagen, dreaming of becoming an actor, a pitiful ambition for one so homely and awkward. His struggles to support himself were heart-breaking, but when he was thirty he wrote four fairy tales and, to his surprise, they were published and readers asked for more. Soon he was famous, not only in Denmark but all over the world. THE UGLY DUCKLING, supposed to have been written about himself, is called his best story. THE DAUNTLESS TIN SOLDIER, THE TINDER BOX and THE EMPEROR'S NEW CLOTHES are also known to children the world over. Denmark is also rich in traditional tales of dragons, imps and "Old Eric." The best-known collector was Svend Grundtvig (1824-1883); others were Evald Kristensen, Ingvor Bondesen and Carl Gether.

Egypt Egypt, seat of one of the world's oldest civilizations, has a folklore dating back to two thousand years before Christ. The British Museum has some of the early tales on their original papyrus, excavated from ancient tombs. Such a story is THE DOOMED PRINCE, used by Lewis Spence in MYTHS OF ANCIENT EGYPT; this story, reminding us of THE SLEEPING BEAUTY, begins: "There was once a king who was sore at heart because no son had been born to him." These words, written 4,000 years ago, might have been written today, so little has the style and material of the fairy tale changed. F. H. Brooksbank has made a collection called LEGENDS OF ANCIENT EGYPT, which includes some fairy tales as well as legends. The stories reveal the gloomy temperament of early Egyptians, a gloom that was understandable in a peasantry that found life hard, with little justice from harsh rulers; and where even nature seemed against them.



There is wintry magic in many of Denmark's tales.

England English writers are famed for their fairy-tale collecting in other lands. This was a natural outgrowth of England's world-wide colonizing and trading. The English have also done well with collecting the fairy tales of their own land and with the writing of original fairy tales. English fairy tales were printed as soon as the first printing presses were set up, but they were in the form of small, unsigned books, called chapbooks, a single tale to a book. The first important collection did not appear until 1842. Then a scholarly antiquarian, James Orchard Halliwell, published THE NURSERY RHYMES OF ENGLAND. He followed it a few years later with POPULAR RHYMES AND NURSERY TALES. These two books, later reprinted in one volume, NURSERY RHYMES AND TALES, are still regarded as basic in their field. They contain the now famous stories: THE THREE LITTLE PIGS, THE OLD WOMAN AND HER PIG, TFENY-TINY and TITTY MOUSE AND TATTY MOUSE.

The next important name in English fairy-tale collecting is that of Joseph Jacobs. Jacobs was born in Australia in 1854, spent



English tales have fairies, sprites and hobgoblins.

most of his life in literary work in England, and died in America, in Yonkers, New York, in 1916. He collected six volumes of English, Celtic, Indian and European fairy tales. His books gave the world the most popular and representative stories from those lands, in a form interesting to children while remaining true folk tales. In the introduction and notes to his books, Jacobs gave a wealth of information on the science of folklore which is invaluable to scholars, teachers and parents. In his rare combination of scientific accuracy and literary workmanship, Joseph Jacobs ranks with the Brothers Grimm of Germany.

The name of Andrew Lang (1844-1912), a Scot who spent most of his life in England, is well known to the world's children. Lang searched for good stories in the published collections of every country, and he edited them in books of which the best-known series was named for colors: THE BLUE FAIRY BOOK, THE RED FAIRY BOOK, THE VIOLET, CRIMSON, YELLOW, BROWN, GREEN and PINK FAIRY BOOKS. THE BLUE was his first and is still the favorite, for it contains the cream of the world's fairy tales. For thirty-six years Lang lived in a fairy-tale world, until at last he had published close to a hundred books, as well as magazine articles. Of himself he said: "Some are born soldiers from the cradle, some merchants, some orators; nothing but a love of books was given me by the fairies."

England's best loved writer of original fairy tales was Lewis Carroll, pen-name for Charles Dodgson (1832-1898), a minister and a lecturer at Oxford. Because he talked with a stammer and walked with a queer jerky step, Dodgson felt ill at ease with adults and sought, instead, the company of children. One hot day—so the story runs—he sat on the banks of the River Thames with a little girl named Alice and her sisters. To amuse the children, he made up a humorous tale of what might happen to Alice if she could get inside the earth. Later, he wrote the story at greater length, calling it ALICE IN WONDERLAND. Its nonsense delighted the British public, and Dodgson wrote a second book: THROUGH THE LOOKING GLASS AND WHAT ALICE SAW THERE.

Dinah Mulock Craik (1826-1887), a Staffordshire writer, attained early fame with a novel: JOHN HALIFAX, GENTLEMAN. Later in life she wrote THE LITTLE LAME PRINCE, THE ADVENTURES OF A BROWNIE and THE FAIRY BOOK. The first two, which are unusually appealing stories, are original tales, though based on folklore; the last is a collection. Mrs. Craik always remained proud of her early novel, and signed later books, not with her name, but with the phrase: "By the author of John Halifax, Gentleman." Kenneth Grahame (1859-1932) wrote only one successful book, but its stories have entertained children for half a century: THE WIND IN THE WILLOWS, an account of the adventures of Mr. Toad, Mr. Badger, Mr. Rat and Mr. Mole along the river bank. Charles Kingsley (1819-1875) wrote two books of fairy tales: a collection of Greek myths and an original story, THE WATER BABIES—the adventures of a chimney sweep who turned into a mer-baby. Kingsley's books were popular in the last century, but their length and lack of humor have caused them to lose the children's favor.

George MacDonald (1824-1905) wrote AT THE BACK OF THE NORTH WIND, THE PRINCESS AND THE GOBLIN and THE PRINCESS AND CURDIE, three original fairy tales. MacDonald's own life was more interesting than his stories. Born in Scotland, he was a sickly lad, often ill with pleurisy and not expected to grow up; in spite of this, he lived to be 81, "too stubborn to die" as his relatives said. He became a pastor in Sussex, England, but he was so uncommonly stubborn when he thought he was right that he was forced to resign. Thereafter he took to writing, and except for his fairy tales, he used his poems and novels to set forth his opinions.

Laurence Housman (1865-) wrote two volumes of fairy tales, but his stories are best suited to older children, or to adults of sensitive mind; they are romances, delicate and reserved. Rudyard Kipling (1865-1936), England's famous poet and novelist, was a versatile fairy-tale writer. Born in Bombay, India, he heard in childhood the native tales of jungle animals, and he later wrote them in THE JUNGLE BOOKS and JUST SO STORIES. Educated in England, he traveled extensively. He settled for a while in America where he married Caroline Balestier and with his own hands built a home in Vermont. But he quar-



A fairy not much bigger than a mushroom.

relled with his wife's relatives and with neighboring Vermonters, and returned to England in a huff. There he wrote his famous KIM, and two books of fairy tales. In 1907 he was awarded the Nobel Prize in literature.

Finland Finland has the oldest folk-tale collection of the Scandinavian states: a volume called THE KALEVALA, whose origin is lost in antiquity. In the nineteenth century Zaccharias Topelius and Elias Lönnrot gathered THE KALEVALA into a complete record. Its stories are retold in English in THE SAMPO by James Baldwin and in THE WIZARD OF THE NORTH by Parker Fillmore. Fillmore made another collection of Finnish tales called MIGHTY MIKKO.

France Charles Perrault (1628-1703), of France, was the first writer to put traditional fairy tales in such charming and dramatic style that they became great literature as well as great folklore. Perrault's fame rests upon a mere eleven tales, but his versions are still considered the best and have been more widely copied than any others. It was in 1697 that Perrault, an architect and a favorite at the court of Louis XIV, published a collection of eight stories which he called THE TALES OF MOTHER GOOSE *(Contes de ma Mère l'Oye)*. These included THE SLEEPING BEAUTY, BLUEBEARD, LITTLE RED RIDING HOOD, PUSS IN BOOTS, CINDERELLA and TOM THUMB. Perrault first published in the name of his son, fearing ridicule from his sophisticated court friends, but his stories were met with acclaim, and the collecting and writing of fairy tales immediately became a fashionable French pastime. Perrault said he had heard the stories told to his son by the nurse, but the compact and dramatic form were the products of his own genius. Today a monument to Perrault stands in the gardens of the Louvre in Paris—a life-size bust surrounded by a ring of dancing children, Puss in Boots in their midst.

Among the many fairy-tale writers who followed Perrault, in France, three aristocratic ladies excelled: the Countess D'Aulnoy, Madame Murat and Mademoiselle de la Force. The Countess D'Aulnoy (Marie-Catherine, 1650-1705) was a woman of uncommon beauty and wit. Faded portraits of her still survive to prove her as lovely as one of her own imagined fairies. She wrote dozens of tales of which the best remembered are THE YELLOW DWARF, THE KING OF THE PEACOCKS, THE BLUE BIRD and THE WHITE CAT. She was not entirely an original writer, nor did she go to the peasantry to hear them tell their tales, as Perrault had done. She found her incidents in the literature of other lands, notably in the work of the Italian writers, Basile and Straparola.

Madame Murat, daughter of the Marquis de Castelnau and wife of the Count de Murat, was born in 1670. She is said to have been a gay, lighthearted girl with a fondness for fun that she carried sometimes to lengths which shocked even the gay court of that day. When she settled down to the harmless pastime of writing fairy tales, many, including the Count, her husband, were relieved. Her stories were not well suited to children; they were sophisticated and dealt more with lovers than with fairies.

Mademoiselle de la Force (1650-1724), a granddaughter of the Duc de la Force, was a poet and novelist, but she is remembered chiefly for her fairy tales, particularly THE ENCHANTER, THE PALACE OF VENGEANCE, TOURBILLON and GREEN AND BLUE. Mademoiselle de la Force outdid all her competitors in marvels: there were palaces of gold and precious jewels that flew from place to place, gardens with jeweled trees and multitudes of super-beings.



PUSS IN BOOTS comes to us from France.

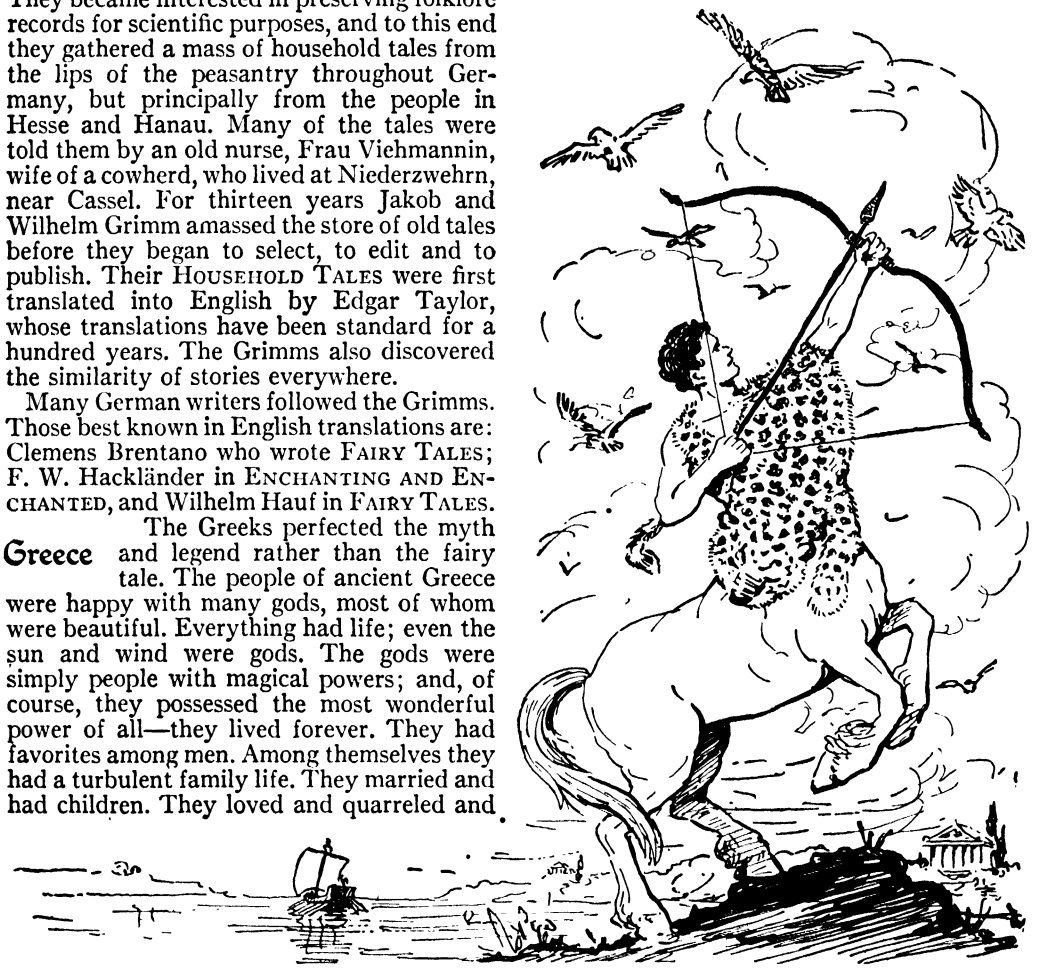
Édouard Laboulaye (1811-1883), a lawyer born in Paris, wrote technical books; but he is remembered for his three fairy-tale books: THREE WONDERS OF THE WORLD, THE SPINNING QUEEN, and THE LITTLE GRAY MAN.

Germany To Germany goes the honor of making a science of fairy-tale collecting. Writers of other nations had collected the old tales to entertain and amuse, but the Teutonic passion for method and exactness led to a systematic collection and classification. This work was accomplished by the two Grimm brothers. Their versions of fairy tales, first published in 1812 in a volume called *Kinder-und-Haus Märchen* (CHILDREN AND HOUSEHOLD TALES), set a new pattern. Jakob Ludwig Karl Grimm (1785-1863) and his brother, Wilhelm Karl Grimm (1786-1859) were both scholars. They became interested in preserving folklore records for scientific purposes, and to this end they gathered a mass of household tales from the lips of the peasantry throughout Germany, but principally from the people in Hesse and Hanau. Many of the tales were told them by an old nurse, Frau Viehmannin, wife of a cowherd, who lived at Niederzwehrn, near Cassel. For thirteen years Jakob and Wilhelm Grimm amassed the store of old tales before they began to select, to edit and to publish. Their HOUSEHOLD TALES were first translated into English by Edgar Taylor, whose translations have been standard for a hundred years. The Grimms also discovered the similarity of stories everywhere.

Many German writers followed the Grimms. Those best known in English translations are: Clemens Brentano who wrote FAIRY TALES; F. W. Hackländer in ENCHANTING AND ENCHANTED, and Wilhelm Hauf in FAIRY TALES.

Greece The Greeks perfected the myth and legend rather than the fairy tale. The people of ancient Greece were happy with many gods, most of whom were beautiful. Everything had life; even the sun and wind were gods. The gods were simply people with magical powers; and, of course, they possessed the most wonderful power of all—they lived forever. They had favorites among men. Among themselves they had a turbulent family life. They married and had children. They loved and quarreled and made mistakes, and only a few of them were always good. Many of our stories of ancient Greek gods and half-gods are gathered from tales told by the blind poet, Homer. Important humans of very early times were supposed to be of half-divine origin, superior to mere men; there was Hercules, hero of strength, Theseus, slayer of the dread minotaur, Jason who led the Argonauts in search of the Golden Fleece and who tamed the savage bulls, and Meleager who hunted the Calydonian bear. America's famed Nathaniel Hawthorne (1804-1864) modernized some of the early Greek stories in his TANGLEWOOD TALES.

Perhaps the best collection of modern Greek fairy tales is E. M. Geldart's FOLKLORE OF MODERN GREECE. This is a London publication; it contains the well-known CONSTANTES AND THE DRAGON . . . "Once on a time there



The centaur, part horse and part man, was a fabulous creature in the myths of ancient Greece.

was an old man who had three sons and all three determined to go and learn a trade . . ."

Hungary Few nations have had the embattled history of Hungary. More than a thousand years ago these poetical, musical, fighting people settled down in the middle of Europe, and they have been embroiled in trouble ever since. Their martial history is reflected in their fairy tales, told by Magyar peasants still living in houses of mud bricks, whitewashed, and thatched with straw. Fairies are few, and the "evil eye" runs through the tales. The principal fairy-tale writers are Gardonyi, Mora, Mikszath and Yokai. Entertaining translations of Hungarian fairy tales have been made by Nandor Pogany (with illustrations by Willy Pogany), by Rosika Schwimmer and by May McNeer and Charlotte Lederer, the latter calling their book TALES FROM THE CRESCENT MOON . . . "the moon is a sickle to the farmer who sees it bend above his rye."

Iceland Iceland has one of the oldest histories of folklore. Jón Arnason is the best of the Icelandic collectors. In his volume ICELANDIC LEGENDS, he includes fairy tales as well as legends. The stories abound with elves and trolls, and reveal the sea-roving nature of the people and their unceasing battle with storms, winds, mist and sleet, and the always-menacing ocean. A. W. Hall has also helped bring Iceland to the world's attention with his book ICELANDIC FAIRY TALES. See also pages 216 and 217 for more about Icelandic sagas.

India India is often called the mother of folklore. From excavations on the sites of very ancient civilizations have come records of the earliest folk tales. Among the most interesting of India's stories are the JATAKA TALES, part of the three great divisions of the Buddhist Scriptures, written in the third century before Christ. It would seem disrespectful to class the lives of Buddha as fairy tales, except that the Jataka writers themselves so classed them by their form. They are now retold entertainingly for English-speaking children by Ellen C. Babbitt, in JATAKA TALES and MORE JATAKA TALES. One of the more scholarly translations of JATAKA was made by T. W. Rhys-Davids of England. The first English translation from the original Sanskrit, which was the language of the early Aryan invaders of India, was made by a Guild of Jataka Translators which, under Professor E. B. Cowell of Cambridge University, brought out a complete edition of the JATAKA between 1895 and 1907.

A second important collection of India is



India has been called the mother of folklore.

known as the FABLES OF BIDPAI. These stories, supposed to be 2,000 years old, were first called *Hitopadesa,* meaning "wholesome instruction," and the wise man who related the stories was Veshnov Sarma. The manuscript was long preserved with secrecy by the monarchs of India, but Chosroes, a Persian king, who reigned in the sixth century A.D., sent a learned physician to India to obtain the manuscript by fair means or foul. The emissary bribed a scholar to steal the book, and translated the stories into Persian, attributing them to a wise man named Bidpai. Thus even in India the name of Bidpai, rather than Sarma, came to be connected with these famous stories.

Scholars have traced the source of the FABLES OF BIDPAI to an even earlier book of India, the *Panchantantra,* or THE FIVE BOOKS. This work acquired the form we know today under Buddhist influences in the second century before Christ. Some of the Panchantantra stories which children like are: THE BRAHMIN, THE THIEF AND THE GHOST, HOW SUPERSMART ATE THE ELEPHANT and THE UNFORGIVING MONKEY.

Another early work was SEVEN WISE MASTERS, sometimes called SEVEN COUNSELLORS, OR PARABLES OF SANDABAR. This book is supposed to have been written by Sandabar, an Indian philosopher, who lived a hundred years before Christ. This book illustrates the unaccountable transition of stories from one country to another, for some of Sandabar's stories are similar to tales in THE ARABIAN NIGHTS; and they also plainly form the origin of many Italian and French tales.

Mary Frere is one of the best modern collectors of India's tales. In 1865, Miss Frere lived in southern India where her father was governor of the Bombay Presidency. Her native ayah, or nurse, told her Hindu tales of



No tales have greater splendor than those of India.

the Deccan, that peninsula of Hindustan south of the Vindhya Mountains. Miss Frere published them under the title OLD DECCAN DAYS. This book includes the popular VALIANT CHATTEE-MAKER, notable because it contains humor, and Hindus as a rule do not indulge in humor.

Another important collection was made by Lal Bahari Day, who in 1883 took down the stories direct from old Brahmans and Bengali women, and called his book: FOLK TALES OF BENGAL. At the present time, several native scholars and writers, fired by a new national consciousness, are at work taking down from the lips of the people the folklore of their own regions. Thus they are following the example of Day and Mary Frere in writing the stories as told by the people themselves.

Ireland

Ireland is the veritable homeland of the fairies. Even today many an Irish countryman would swear he could watch the fairies dancing in a moonlit glade on any pleasant night, if only he cared to go out and look for them—and chance their displeasure should they catch him peeping.

The earliest manuscript of Gaelic literature is THE BOOK OF THE DUN COW *(Leabhar na h-Uidhre)*, which was transcribed from older books by Maelmuire Mac Ceilechair, who died in 1106. It was a great day for Irish literature when T. Crofton Croker collected some of the old Gaelic tales. He published them in 1825, under the title FAIRY LEGENDS AND TRADITIONS OF THE SOUTH OF IRELAND. That started others on the trail. The next important collector was Patrick Kennedy, a Dublin bookseller who declared that he believed implicitly in fairies, as should every man who was willing to take the evidence of his own eyes. To prove his point he brought out, between the years 1866 and 1871, three books of tales that were very popular at the time. His work still stands as one of the best sources of Irish fairy tales. Dr. Douglas Hyde and William Larminie also compiled tales that have been much retold.

Outstanding among Irish original creators is Frances Browne (1816-1879) whose book GRANNY'S WONDERFUL CHAIR still remains a classic. The life of Frances Browne was in itself an endearing tale. Born in a mountain village where food was always scarce but a good story was always at hand, Frances was the seventh in a family of twelve. At eighteen months, she was left blind by smallpox, but so brilliant was her mind that when, later, her brothers and sisters recited their lessons, she memorized them. She bribed her sisters, by doing their work, to read to her, and when they wearied, she cajoled them into continuing by making up stories. She taught herself to write—she who had never seen a written word—and by the age of twenty-one, driven to Edinburgh by a famine in Donegal, she was able to support herself, her mother and her sister by selling poetry and stories. Her fairy tales are tender and warm.

To mention all the Irish writers who have interested themselves in fairy tales would be to name almost all the Irish writers. The great poet, William Butler Yeats (1865-1939) collected a volume of IRISH FAIRY AND FOLK TALES. Ireland's First Lady of the Theater, whose friendship contributed so much to Yeat's later success, Isabella Augusta, Lady Gregory (1852-1932), published a translation of two Irish cycles of tales, THE TUATHA DE DANAAN and THE FIANNA, and wrote THE KILTARTAN WONDER BOOK. James Stephens, the poet, wrote four volumes of fairy tales.



The Irish tales generally have wit and gaiety.

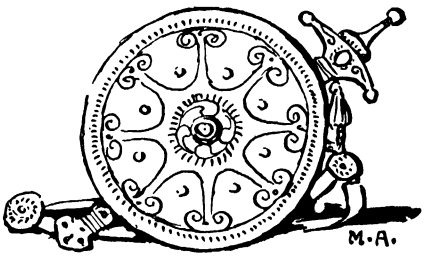
The name of Padraic Colum, born in Ireland in 1881, and now living zestfully in America, is well known to children. Colum first heard fairy tales in a county workhouse where his father was superintendent. The workhouse was on a main highway between east and west, and poor travelers—scissors-grinders, fiddlers, peddlers, tramps and strays—often stopped in for a night's shelter and a bit of supper and breakfast. They told stories to while away the evenings, and small Padraic stored them away in his quick mind; they emerged later as THE BOY WHO WAS APPRENTICED TO AN ENCHANTER, THE BOY WHO KNEW WHAT THE BIRDS SAID, THE CHILDREN WHO FOLLOWED THE PIPER and many another tale of enchantment.

Seumas McManus (1869-) was Ireland's prince of story-tellers as well as a master of the written tale. McManus told his fairy tales all over North America, before university and club groups, and was one of the most appealing visitors ever to cross our continent. McManus never ceased marveling that American magazines would pay him $100 for a story. "My Donegal neighbors," he joked, making little of his own talents, "knowing that anyone who wished could shovel up bags full of such stories among our hills, could hardly credit the simplicity of the American people!" McManus' best-known collections are DONEGAL FAIRY STORIES, IN CHIMNEY CORNERS and THE DONEGAL WONDER BOOK.

Ella Young (1867-), of County Antrim, Ireland, wrote CELTIC WONDER TALES



The "little people" of Ireland lived under the hills.



Many an Irish tale is about hero-kings.

and THE WONDER SMITH AND HIS SON, together with many another story of Antrim fairies and giants. She left Ireland to live in the United States and thereafter published THE TANGLE COATED HORSE and THE UNICORN WITH THE SILVER SHOES.

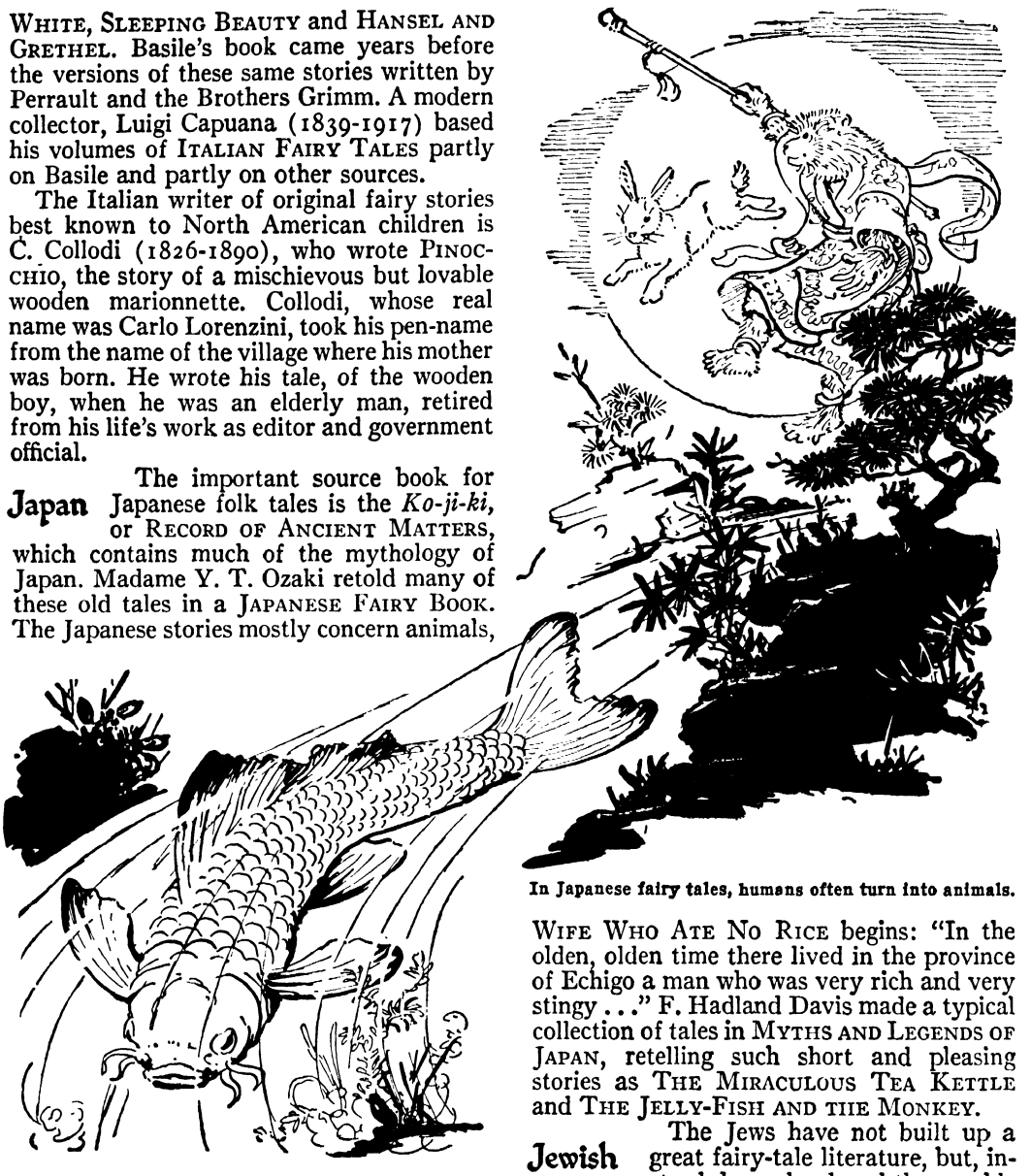
Italy Because of difficulties in translation, Italian writers were not given credit for producing fairy tales until long after French, German and English writers had established themselves. Now it is realized that Italian writers preceded other Europeans in the collection of old tales. The earliest known collector was Giovan Francesco Straparola, a native of Carravaggio, whose book, now known as STRAPAROLA'S NIGHTS, was first published in part in 1550 and fully in 1554. Straparola's seventy-four stories included versions of PUSS IN BOOTS, BEAUTY AND THE BEAST and other fairy tales that are still familiar today. Although the world in general did not know of Straparola's work until the latter part of the eighteenth century, Italian ambassadors to the French court of Louis XIV must have possessed copies, and they were doubtless willing to translate them, because fashionable French ladies received acclaim for writing fairy tales which are now recognized as translations of Straparola.

Following Straparola as an important world figure in the writing of fairy tales came Giambattista Basile (1575-1637), whose *Pentamerone* (FIVE BOOKS) was written about 1620, but in so archaic and difficult a Neapolitan dialect that the book was read by only a few Italians. For over half a century it remained unknown, not only to the world, but even to Italy itself. Basile, a gentle imaginative person, was born in Naples; he collected his stories as he traveled about the country as a soldier, a profession he detested. He was a poet; his sister was one of the most popular singers of the day. Basile divided the *Pentamerone* into five days, each containing ten stories, among which were CINDERELLA, RAPUNZEL, SNOW

WHITE, SLEEPING BEAUTY and HANSEL AND GRETHEL. Basile's book came years before the versions of these same stories written by Perrault and the Brothers Grimm. A modern collector, Luigi Capuana (1839-1917) based his volumes of ITALIAN FAIRY TALES partly on Basile and partly on other sources.

The Italian writer of original fairy stories best known to North American children is C. Collodi (1826-1890), who wrote PINOCCHIO, the story of a mischievous but lovable wooden marionnette. Collodi, whose real name was Carlo Lorenzini, took his pen-name from the name of the village where his mother was born. He wrote his tale, of the wooden boy, when he was an elderly man, retired from his life's work as editor and government official.

Japan The important source book for Japanese folk tales is the *Ko-ji-ki*, or RECORD OF ANCIENT MATTERS, which contains much of the mythology of Japan. Madame Y. T. Ozaki retold many of these old tales in a JAPANESE FAIRY BOOK. The Japanese stories mostly concern animals,



In Japanese fairy tales, humans often turn into animals.

as do the Chinese and Korean. Madame Ozaki's book contains THE MATSUYAMA MIRROR, Japan's most popular contribution to the world's fairy tales, and THE TONGUE-CUT SPARROW. Both of these stories are well retold in Teresa Peirce Williston's JAPANESE FAIRY TALES. Lafcadio Hearn, a citizen of the world who finally became a citizen of Japan, also published JAPANESE FAIRY TALES written by himself and others.

Japanese fairy tales usually begin "In the olden, olden time . . ." Thus, the story THE WIFE WHO ATE NO RICE begins: "In the olden, olden time there lived in the province of Echigo a man who was very rich and very stingy . . ." F. Hadland Davis made a typical collection of tales in MYTHS AND LEGENDS OF JAPAN, retelling such short and pleasing stories as THE MIRACULOUS TEA KETTLE and THE JELLY-FISH AND THE MONKEY.

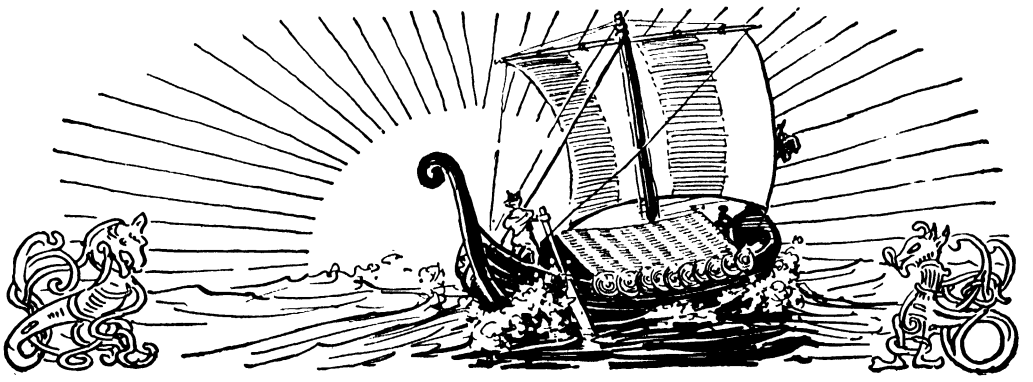
Jewish The Jews have not built up a great fairy-tale literature, but, instead, have developed the parable and the legend. The rabbis of old were good story-tellers and understood that a story is the best sermon. In STORIES FROM THE RABBIS, Dr. Abram S. Isaacs of New York has made this plain and the LIBRARY OF JEWISH CLASSICS further reveals the Jewish mastery of the parable. It was used to best purpose by that Master Jewish story-teller, Jesus of Nazareth. As to pure fairy tales, the Jews have a few and these may be read in JEWISH FAIRY TALES by Gerald Friedlander and THE MAGIC FLIGHT by Yossef Gaer.

Korea Korean folk tales were first collected by Yi Ryuk, who lived around 1500, and by Im Bang (1640-1722). But the Korean stories best known in English-speaking lands were written by the American, William Elliot Griffis, an educator and clergyman who went to Japan in the middle 1800's to organize Japanese schools along American lines. He collected both Japanese and Korean stories. His KOREAN FAIRY TALES contains PIGLING AND HER PROUD SISTER, which is the Korean variant of LITTLE ONE-EYE, and THE MIRROR THAT MADE TROUBLE, which is a variant of the Japanese story THE MIRROR OF MATSUYAMA. The Korean tale, in the Griffis versions, is long and entertainingly told, revealing customs of Korea in its olden days.

Norway Of all the Scandinavian countries, Norway has the most interesting folklore. Trolls skip through the dark woods; giants stalk the hillsides during the long, dark Northern nights; and princes and princesses, no matter how charming, are often turned into stone. The two great collectors of Norwegian folk tales were Peter Asbjörnsen (1812-1885) and Jorgen Moe (1813-1882). These two were boyhood friends who wandered through the countryside together listening to the peasants' tales, and later, when Moe had gone into the ministry and Asbjörnsen had become a scientist, they worked together in collecting and writing the old tales. They published two volumes: NORWEGIAN FOLK TALES in 1842-44, and NORWEGIAN FAIRY TALES AND FOLK LEGENDS in 1845. These books were translated into English by Sir George Dasent, under the titles POPULAR TALES FROM THE NORSE and TALES FROM THE FJELD. Later, Gudrun Thorne-Thomsen, who was born in Norway but who emigrated to America and became a teacher, translated and adapted the Asbjörnsen and Moe stories in EAST O' THE SUN AND WEST O' THE MOON.

Persia The great national epic of Persia (Iran) is the *Shah Nameh*, or BOOK OF KINGS. The hero is Rustem whose adventures sparkle with magic, riches and daring. The writer of these narratives was the great poet, Firdausi, who lived in the eleventh century and who worked for thirty-three years on the *Shah Nameh*. He presented it to the Sultan, but received abuse instead of praise. After many years the Sultan repented, belatedly realizing Firdausi's genius, and sent him money to relieve his dire poverty. The gold arrived as Firdausi was being carried to his grave. The English writer, E. M. Wilmot-Buxton, translated the *Shah Nameh* under the title THE BOOK OF RUSTEM. Many of Persia's short fairy tales remain untranslated, but R. Levy has given the English-speaking people a few in THREE DERVISHES AND OTHER PERSIAN TALES AND LEGENDS.

Poland Poland's folklore, like the Serbians', consists largely of legends, but modern writers are building a growing library of fairy tales. Bishop Ignacy Krasicki (1735-1801) is known as the "father of the Polish fairy tale"; his FAIRY TALES AND FABLES series is a fine contribution to the world's literature. Writing in the same period was Stanisław Trembecki, who was court poet to the king. A little later, Poland's great romantic author and poet, Adam Mickiewicz (1798-1855), wrote fairy tales, but most of them were satires best suited to adult reading. Mickiewicz was followed by Lucian Rydel (1890-1918), author of the dramatic fairy tale THE ENCHANTED CIRCLE, Maria Konopnicka (1842-1910), Jana Kasprowica (1860-1926), Władysław Orkan (1875-1930), Wacław Berent (1873-), Emil Zagadłowicz (1888-), Wacław Sieroszewski (1860-) and Kornel Makuszyn-



The folklore and fairy tales of Norway have trolls and giants, and strange adventures on sea and land.

ski (1884-). Of the professional fairy-tale writers in Poland the best known are Kazimierz Glinski, whose work has been translated both by British and American writers, Jan Lemanski, Benedykt Herbz and Julian Ejsmond.

Portugal Portuguese fairy tales are akin both to the European and to the Moorish. H. Monteiro made notable collections in PORTUGUESE FOLK TALES and TALES OF OLD LUSITANIA. The latter tales display the subtle humor of the Portuguese.

Rumania Rumania, like all the other Balkan states, possesses fairy tales of great beauty and imagery. Petre Ispirescu is the country's noted collector. Ispirescu was born in Bucharest in 1830, was educated for the priesthood, but decided he preferred to work as a printer. He rose to become an important publisher, and collecting fairy tales became his hobby. He liked to tell the old stories to his small relatives as he walked with them in his garden in the cool of the evening. They enjoyed the stories so greatly that he published them in a pamphlet. Between 1872 and 1876 the pamphlet grew into three popular volumes of RUMANIAN TALES AND LEGENDS. A fourth volume followed, STORIES OF AN OLD GOSSIP. These four volumes are among the most important of the world's fairy-tale lore. Ispirescu died a poor man, for his stories brought little money.

Russia To Russia goes the honor of possessing the largest collection of folk tales—more than 1,500. There are no fairies in the Russian tales—or *skazki,* as is their Russian name—but there are witches and devils who take the form of man for their own evil purposes. The four great Russian collectors are: Alexander N. Afanasiev (1826-1871), J. A. Khudyakof, A. A. Erlenvein, and E. A. Chudinsky. In the south of Russia collections were made by Kulish and Rudchenko, but these tales were written in dialect and have not yet been suitably translated. The most important collector was Afanasiev. His enormous collection included 3,000 pages containing 332 stories, many given in several variants. His volume RUSSIAN POPULAR TALES was published in 1863.

Afanasiev was a colorful person. While still a student he traveled about the countryside during summer vacations, writing down stories told him by the peasants; and the Russian peasant, like all his Slav brethren, has a genuine talent for narrative. When word went out of what Afanasiev was doing, stories began to flow in to him from all over the country. He did not modernize or improve on his material, but copied it faithfully in the peasants' own words. His stories reveal how closely akin are the Slavic and European tales. THE DUN COW is a variant of LITTLE ONE-EYE; THE BEAR, THE DOG AND THE CAT is like THE BREMEN TOWN MUSICIANS, and THE MIRACULOUS HEN is like our GOOSE



There are no fairies in the folk tales of Russia; but animals, witches and devils appear in many a story.

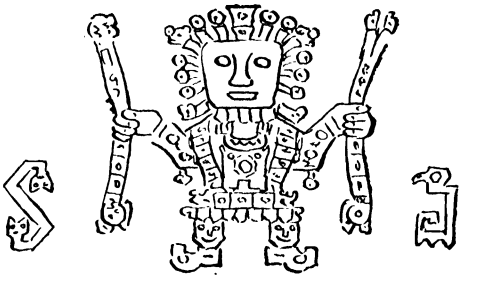
THAT LAID THE GOLDEN EGGS. But there is this difference: in the variants of Afanasiev one sees the wide stretches of Russian plowland, the gloom of deep, dark forests, the shimmer of the winding Volga. One sees small village huts half buried in heavy snow, peasants wresting a bare living from the soil and warring on the wolf, the bear and the fox. The tales of Afanasiev reveal a mighty, a courageous and a powerful people.

Khudyakof's collection, GREAT RUSSIAN TALES, was published in 1864, and contained 122 stories. Erlenvein's, called POPULAR STORIES and published in 1863, contained 41 tales. Chudinsky's, called RUSSIAN POPULAR TALES, contained 31 stories. The work of those four men forms the source for most of the Russian fairy tales published in England and America, but there are other notable collectors. Dr. Friedrich Kraus published in Vienna, about 1885, a group of stories (TALES AND LEGENDS OF SOUTH SLAVONIA) told him by his Russian mother who had been brought up in a village of charcoal-burners, deep in a Slavonian forest. An American writer, Louise Seymour Houghton, used Dr. Kraus's stories in her book THE RUSSIAN GRANDMOTHER'S WONDER TALES. The work of Robert Nisbet Bain, an English writer, is also familiar, particularly his collection called COSSACK FAIRY TALES. This book contains one of the best variants of THE STRAW OX, Russia's most popular tale. Alexander Pushkin, Russia's foremost poet, who was killed in a duel at Petrograd in 1837, preceded all of the above writers in making a collection of folk tales, but his was small: a group of stories from the Caucasus Mountains, best of which is THE LITTLE HUMPBACKED HORSE.

Scotland The collecting of fairy tales in Scotland began about the year 1860 at which time J. F. Campbell (1822-1885), of Islay, published the first of four volumes, calling it POPULAR TALES OF THE WEST HIGHLANDS, a group of 120 stories. Since that time few writers have collected Scotch fairy tales, perhaps because Scotland has few original stories, perhaps because the English customs, manners and ideas were adopted by the Scotch three hundred years ago.

Serbia The Serbs belong to the Slavonic family of races, the family that includes the Russians, Poles, Czechs, Slovaks, Bulgars, Croats and Slovenes. All of them are excellent story-tellers, and they have a folklore that is rich and poetical. In Serbia, the sons of the peasants, in the olden days, usually settled in cottages near those of their parents, thereby forming large clans which worked the fields together by day and gathered in the home of the chief during the long evenings to enjoy the telling of their national stories. Fairy tales to the Serbs were more than a form of entertainment; they were a means of maintaining their national spirit while they were under the oppressive yoke of the Turks after their losing battle in 1389. They kept their own stories alive by telling them from one generation to another. The tales were often recited in swinging ten-syllable blank verse and to the accompaniment of the guste, a one-string instrument that gives out a mournful but melodic sound.

The most notable collector of these old tales was Vuk Stefanovich Karajich, a self-taught Serbian peasant, whose work appeared between 1814 and 1866. Karajich is famed for compiling the first national dictionary, but the world owes him equal gratitude for his compiling of fairy tales which he took down from the lips of his fellow-peasants and the aristocracy. Other Serbian collectors and writers were W. M. Petrovitch who wrote HERO TALES AND LEGENDS OF THE SERBIANS, A. H. Wratislaw, who collected SIXTY FOLK TALES FROM SLAVONIC SOURCES and Madame Elodie L. Mijatovich who, in 1918, published in America sixteen of Serbia's best stories under the title SERBIAN FAIRY TALES. This last volume contains *Pĕpĕluga,* the Serbian CINDERELLA, and also the popular story THE BEAR'S SON . . . "Once upon a time a bear married a woman and they had one son . . ."



The Indians of South America had many strange legends.

South America Because the languages and cultures of the South-American countries are, in the main, of Latin origin — Spanish, Portuguese and French — the writers of the Central and South-American republics, as well as of Mexico and the independent states in the West Indies, have produced fairy tales that are the counterparts of those found in the mother-countries. Spain's *Biblioteca del Folk-*



Each of the Indian tribes had its own tales.

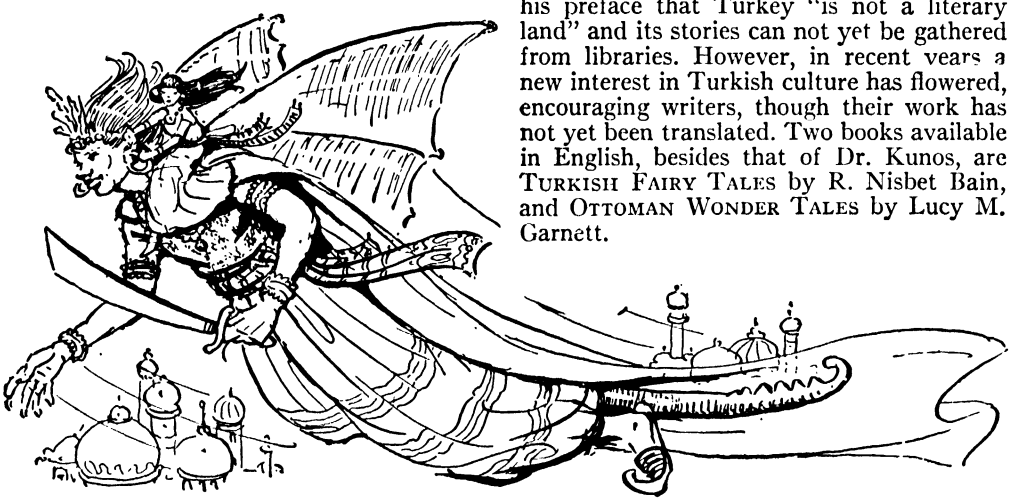
Lore is the source book for many South-American tales. The stories of native Indian tribes are not so much fairy tales as they are myths and legends. Some of the best of these were collected by Charles J. Finger (1871-1941) in TALES FROM SILVER LANDS, and by Frank Henius in STORIES FROM THE AMERICAS.

Spain Spain, that dramatic land which has known Roman, Gothic and Moorish rule, built up a marvelous folklore until the sixteenth and seventeenth centuries. Then a national decline set in, which in time crushed even the spoken literature. The *Biblioteca del Folk-Lore* is often quoted as a source of Spanish tales. Among individual collectors are Fernan Cabellero, who wrote SPANISH FAIRY TALES, and Gertrudis Segovia who wrote SPANISH FAIRY BOOK. Translations of the old tales have been made by J. Munoz Escamez, and by Bernard Henderson collaborating with C. Calvert. America's own Washington Irving made an early collection of Spanish stories in TALES FROM THE ALHAMBRA.

Sweden Sweden takes just pride in her writer of original fairy tales: Selma Lagerlöf. Born in Marbacka in 1858, Miss Lagerlöf won early recognition by a novel: GÖSTA BERLING'S SAGA. After study in Italy and a year's travel, she wrote a children's fairy tale that became a classic; it is now known in English as THE WONDERFUL ADVENTURES OF NILS. Later she wrote THE FURTHER ADVENTURES OF NILS. In 1909, Miss Lagerlöf received the Nobel Prize in literature, and in 1914 she was elected to the Swedish Academy, the first woman to be so honored. She has written more than a dozen books, but children know only Nils Holgersson through whose eyes they have seen all of Sweden. Zacharias Topelius, a collector, is also a credit to Sweden.

Switzerland Because Switzerland was so long under the control of Germany and Austria, Swiss fairy tales are much like the German. However, Swiss legends and hero tales, particularly of the Alpine regions, are unique, and have been collected by more than fifteen writers. A few fairy tales are found in F. M. Froelicher's SWISS STORIES AND LEGENDS, and in Roger Duvoisin's THE THREE SNEEZES AND OTHER SWISS TALES.

Turkey Turkey possesses a fantastic kind of fairy tale dealing with jinn or genii, magical beings supposedly created 2,900 years before Adam and cast out by Allah for refusing to worship Adam. Dr. Ignacz Kunos gathered a collection called FORTY-FOUR TURKISH FAIRY TALES by listening to the Ottomans in and around Stamboul. Dr. Kunos points out in his preface that Turkey "is not a literary land" and its stories can not yet be gathered from libraries. However, in recent years a new interest in Turkish culture has flowered, encouraging writers, though their work has not yet been translated. Two books available in English, besides that of Dr. Kunos, are TURKISH FAIRY TALES by R. Nisbet Bain, and OTTOMAN WONDER TALES by Lucy M. Garnett.



The magical creatures in Turkey's tales were jinn, or genii, who could do marvelous things.



Br'er Rabbit and Br'er Fox—from America's folklore.

United States

The people of the United States have their roots transplanted from all over the world, and the migrating peoples brought their folklore with them. Thus the child of North America knows CINDERELLA in its French version, TOM TIT TOT in the English, BREMEN TOWN MUSICIANS in the German, THE STRAW OX in the Russian and BR'ER RABBIT in the African.

Perhaps the best of the American folk tales came from Africa with the slaves who were settled in the South. It was from them that Joel Chandler Harris collected his UNCLE REMUS TALES. Harris was born in Eatonton, Georgia, in 1848. As a child he loved to visit Negro cabins to hear the stories about clever Br'er Rabbit and cleverer Br'er Fox. Later, he served an apprenticeship to the printing trade and became an editor of the ATLANTA CONSTITUTION, in which he printed many of his Afro-American folklore studies. Among his twenty-six volumes of folk tales, the most important are UNCLE REMUS: HIS SONGS AND SAYINGS, NIGHTS WITH UNCLE REMUS, MR. RABBIT AT HOME, and STORIES OF GEORGIA. Harris was beloved by Negroes and white people alike; he was a stout, unpretentious kindly man, so modest that he was dismayed when he was elected, in 1905, a member of the American Academy of Arts and Letters. He died in 1908, but his Br'er Rabbit lives on, always young and wise.

The majority of American fairy-tale writers have collected stories of other countries rather than of their native land. Parker Fillmore (1878-) collected Czechoslovak, Yugoslovak and Finnish tales without leaving his home country. "I lived," he wrote, "in the Czech settlement of New York's East Side where the neighborhood library had the finest collection of Czech literature and Czech prints outside of Prague." It was not only from the library, however, but from personal acquaintance with Czechs, Slovenes, Serbs, Croats and Finns that Fillmore gleaned the material for his stories.

Charles J. Finger, a transplanted Britisher, collected stories of South-American Indians during extensive travels in South America. Published under the title TALES FROM SILVER LANDS, this book won him the Newbery Prize. He followed it with TALES WORTH TELLING, stories from many lands. William Elliott Griffis (1843-1928) rewrote the fairy tales of Belgium, Holland, Japan, Korea, Switzerland and Wales. He was an authority on Japan, a country where he lived for many years after being chosen to fill Japan's request for "someone to organize schools along American principles." He taught at the Imperial University in Tokyo.

Horace E. Scudder (1838-1902), a Boston publisher and a member of the Massachusetts State Board of Education, published three books of fairy tales, fables and folk stories: THE CHILDREN'S BOOK, BOOK OF FABLES AND FOLK STORIES, and THE BOOK OF FOLK STORIES. Scudder's work is admired for its scholarly editing and for the excellent format in which the books were printed and bound.

Kate Douglas Wiggin (1865-1923) worked with her sister, Nora Archibald Smith, collecting and editing the fairy tales of many countries. Together they published TALES OF LAUGHTER, TALES OF WONDER, THE FAIRY RING, MAGIC CASEMENTS, THE TALKING BEASTS, PINAFORE PALACE and THE ARABIAN NIGHTS. Both sisters were talented; Mrs. Wiggin's genius was recognized not only in America, but in England as well. Born in Philadelphia and raised in Maine, she spent most of her life in California where she organized the first free kindergarten west of the Rockies. She also founded the California Kindergarten Training School. Her variants of the old fairy tales are among the best.

The United States has produced many writers of original fairy tales. Margery Bianco (1878-1944) wrote stories of unusual appeal for children: THE LITTLE WOODEN DOLL, POOR CECCO, THE VELVETEEN RABBIT—all stories of toys that came to life; most of her work was illustrated by her talented daughter, Pamela. Hugh Lofting (1886-1947), another Englishman who moved to America, had a series called the DR. DOLITTLE BOOKS, about a country doctor who learned animal language in order to help sick animals. One of his volumes received the Newbery Prize. Katharine Pyle wrote original stories and also collected fairy tales: THE COUNTERPANE FAIRY, the KATHARINE PYLE FAIRY BOOK and FAIRY TALES FROM FAR AND NEAR. She had a famous brother, Howard Pyle (1853-1911), who collected and rewrote legends, such as the stories of Robin Hood. Both Howard and Katharine illustrated their own books. Frank R. Stockton (1834-1902), a Philadelphia writer, was a man of great imagination and youthful lightness of spirit. His fiction showed great humor, and his fairy tales are light and charming. Best of his tales are included in OLD PIPES AND THE DRYAD, THE BEE-MAN OF ORNE, THE FLOATING PRINCE, THE QUEEN'S MUSEUM and FANCIFUL TALES.

The native Indians of North America, as of South America, have produced fewer fairy tales than myths and legends. The earliest collector of Indian tales was H. R. Schoolcraft, who lived among the Indians and in 1839 brought out a widely reprinted work: INDIAN TALES AND LEGENDS. George Bird Grinnell, an American naturalist, published STORIES OF THE BLACKFOOT TRIBE, gathered when he was Indian Commissioner. Amelia Williams Harrison (1852-1903) collected AMERICAN INDIAN FAIRY TALES.

Similarity of Material

Fairyland is sometimes below the earth, sometimes below the water, sometimes on the summit of a mountain, or in a moonlit glen; but it is always a land of surpassing beauty where honesty and purity of heart are rewarded and evil is punished. The youngest son is always gentler, smarter and in the end luckier than his two older brothers; the youngest daughter is always the one mistreated and always the most beautiful; animals talk and inanimate objects are magically transformed. Above all the subconscious desires of simple people are magically satisfied: the peasant becomes king; the mistreated is showered with gold and precious jewels; injustice from those high in rank is punished. No writer, for 4,000 years, has changed these situations. The fairy tale, no matter what nation gives it birth, exists solely to satisfy the interests and the unspoken longings of the young-at-heart and the hopeful.

By MARGARET LIMA NORGAARD

Illustrated by Margaret Ayer

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