The
TWIN-LENS CAMERA
Companion

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By

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with contributions by

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PRODUCING THIS volume has been a most interesting task. In it I have endeavoured to put down, without bias, my personal experiences with this fascinating type of camera—to detail my own methods of overcoming the problems that beset every photographer whatever his chosen form of apparatus. I have tried to analyse and to classify the various materials available, together with the different processing methods and formulae. I have tried to indicate what I consider the good and bad points of the various instruments, and to recommend proved methods of manipulation.

I have endeavoured at all times to be honest with the reader, so that he may accept my findings as seriously considered opinions. I have not written the book with the idea that *because* it is devoted to the technique of the twin-lens reflex camera, it must try to prove that all other types of apparatus are necessarily inferior.

Those world-famous photographers who have contributed the various specialised chapters, have similarly given their respective personal and considered opinions of the twin-lens camera for their own particular work. Because these opinions are personal, there are necessarily points of apparent variance in their remarks. Not all workers place the same importance on any one feature in a camera, nor in fact do the very features which make a camera ideal for one branch of work, always assume a similar importance when other tasks are attempted. So in assessing the various findings and opinions expressed by the different writers, I would ask the reader fully to appreciate that they are essentially personal, and that we have all tried to give our sincere opinions for his better guidance. He will no doubt be glad in this way to learn of more than one point of view.

A survey of the many illustrations, and the wide variety of subjects reviewed will, I think, endorse my own conviction that the twin-lens camera in its present form is an instrument with which almost any photographic task may successfully be attempted ; and one which in the hands of the average user produces a higher percentage of really good results, than will any one other type of camera ; while, in addition, it is considerably easier to use than most.

I offer this considered view, not only from my own experience, but from examination of the work of literally thousands of keen photographers, amateur and professional, since the time when the first twin-lens reflex came to this country.

In concluding these introductory notes I would like to acknowledge the considerable work done by Jacquelyn Judge, associate editor of *Popular Photography* and picture editor of *Photography*, of Chicago, who has so admirably collated and co-ordinated the American section of this book, a task which—at three thousand miles range—would otherwise have presented considerable difficulty.

Similarly I would like to add a word of personal appreciation to the authors of these ten individual chapters and of the fine accompanying illustrations which give the reader such a good insight into the methods of the masters, and the results which they obtain with the twin lens reflex.

In this country Geoffrey Gilbert deserves my thanks for his contribution on flash photography, and of course, the publishers themselves for placing at my disposal much of their collated information on colour developments and other current subjects.

Between us I hope that we shall have given the reader something that will interest, as well as instruct.

H. S. NEWCOMBE.

CAMERA TECHNIQUE

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DEMANDS ON A CAMERA

FROM THE very fact that you are reading this book, it seems reasonable to assume that you are already a photographer, or just about to become one. In either event I think that it will be time well spent, if we consider just for a moment what we—you and I—really require of a camera.

People take up camera work for a number of different reasons: to record the early days of children, to have a permanent record of travels at home and abroad, to illustrate other hobbies: sailing, golf, mountaineering, to preserve a record of the house and garden—or one's friends, to satisfy an artistic urge by producing pictures as such—or just to play with the technique.

What do these people want ? What sort of camera will best meet their needs ? Perhaps we can answer these questions more easily by first considering what cameras there are from which to choose. From the point of view of handling the camera rather than that of size and the purposes for which it is used, I think, we can divide most cameras into three principal basic types.

Those in which—as in most folding roll film models—we have to rely on a viewfinder to indicate what is likely to be in the picture, and in which we have to focus the camera by our own estimation of the distance between the camera and the subject.

Those in which the field of view is also indicated merely by some form of viewfinder, but where there is also some mechanical or optical method (rangefinder) for measuring the distance of the subject accurately, and so ensuring a sharp picture.

Finally, those in which the actual picture can be seen and composed on a ground glass focusing screen of the same size as the final negative.

The first type provides the less expensive models; the reasons will be obvious. It gives portability in the case of the majority of folding roll film models, but its performance is at times limited, and where really accurate results are desired, it is by no means easy to use.

The second type provides accuracy of focusing at all times but again, as reliance has to be placed on a viewfinder which is as a rule only a fraction of the size of the negative, accurate determination of exactly what is, and what is not, in the final picture is not always easy.

The third form of camera, which necessarily embraces all "reflex" models together with the now somewhat outmoded field cameras, and the regular folding plate models, provides in every case the facility of focusing with accuracy, and of determining precisely what will be in the final picture. With some folding models, however, this is hardly a speedy process.

To repeat the question—What do we want from our camera?

We, or the vast majority of us, require portability; we do not want the camera to be a burden. It is probably an accessory to some other sport or hobby, and a bulky instrument will frequently be left at home because it would be inconvenient to take it. Our camera, then, should be small and easy to carry.

It should also be inexpensive in upkeep, and should consume materials that are easily obtainable in any country in the world.

We want to take good pictures; for that we must see as much as possible of the picture before taking, and we want to see it as it will be recorded on the negative. In fact, one of our most important requirements is a viewfinder in which we can easily locate and compose our picture, where we can clearly see what we are taking and what we want to see on our final print. This we wish to do as conveniently as possible, without having to peer through small and awkward viewfinders which sometimes give us only a very approximate idea of our final result.

The number of good pictures will be increased if we have a means of making sure in advance that they will be sharp. We want to be able to measure distances accurately, and not have to rely on guess work, which may result in having to discard—because they are blurred and out of focus—pictures which we have no opportunity to take again.

Our camera must be daylight loading ; darkrooms are not always to hand. It should use unbreakable films rather than glass plates, and should be so constructed that it is ready for instant use immediately a suitable subject presents itself.

We also want our camera to be versatile, we may want to use it for candid portraits, perhaps for pictures showing much movement, or for posed studies, in fact for most subjects the average amateur is likely to come across. So it should also have a wide range of shutter speeds, and good lens equipment, particularly as we shall also wish to make enlargements of high quality from our negatives.

A tall order, perhaps ; but I submit and propose presently to prove that the modern twin-lens reflex fills more of these requirements than most other instruments.

THE REFLEX PRINCIPLE

THE ORDINARY reflex camera follows one general design. As its name suggests, it reflects the image of the objects in front of it on to a conveniently placed focusing screen where the image can be composed and accurately focused by the operator *right up to* the moment of exposure.

The rays of light passing through the lens to form the image on the film are intercepted by a mirror placed at 45 degrees, from which they reach a horizontal ground glass screen at the top of the camera. The distance from the mirror to this screen is the same as the distance from the mirror to the film, so by arranging and focusing the image visually, we may be sure that the picture will also be sharp and will contain exactly what we saw on the screen.

The principle is excellent. The single-lens reflex is a first-class hand camera with a full size focusing viewfinder which is at the photographer's command, as I have already said, right up to the moment of exposure. When the release button is pressed, however, the mirror which is hinged along its upper back edge folds away so that the rays from the lens may reach the film through the focal plane (roller blind) shutter which lies just in front of the sensitive surface of the film.

Herein are its drawbacks. When the button is pressed, the image on the top screen disappears instantly as the mirror flies up. This is apt to be somewhat disconcerting, and the user is not aware of any last-second alteration in his picture subject. His model may turn her head at the crucial moment, or—much more disturbing—may close her eyes for an instant, or pull a face (the photographer is not looking!). Camera-shy sitters are particularly prone to this. But these are static subjects; when we wish to take a moving object, almost anything may happen. What occasionally does happen is that while the mirror is being raised the fast moving subject has altogether disappeared from the field of view. Some sports photographers find it hard to anticipate the best moment for the exposure by that fraction of a second taken by the mirror to get out of the way, and the shutter to start moving across the film. Other people also find it difficult to hold a normal reflex steady because of the slight shock felt when the mirror reaches its position of rest.

These disadvantages vanished when the modern twin-lens reflex came into being.

THE TWIN-LENS REFLEX

THE TWIN-LENS reflex—in its present form—is an instrument of simple and robust construction without moving parts to its structure. It will wear well and retain its accuracy throughout a long life.

It consists fundamentally of two cameras. There is a lower camera—a box—on the front of which is mounted the taking lens, usually in some form of diaphragm (between-lens) shutter. Above is another equally simple box containing a *fixed* mirror (which cannot get out of adjustment) placed at 45 degrees to the lens, and on top a ground glass focusing screen. At the front of this upper box is a lens, usually of the same focal length as that used to take the picture. The ground glass screen is similar in size to the picture area of the film, so that a full size image of the picture is clearly seen at all times, *even during exposure.* The two lenses are coupled so that as the finder lens is moved to focus the image, the taking lens follows suit. This ensures a sharp image of the object on which the finder lens is focused.

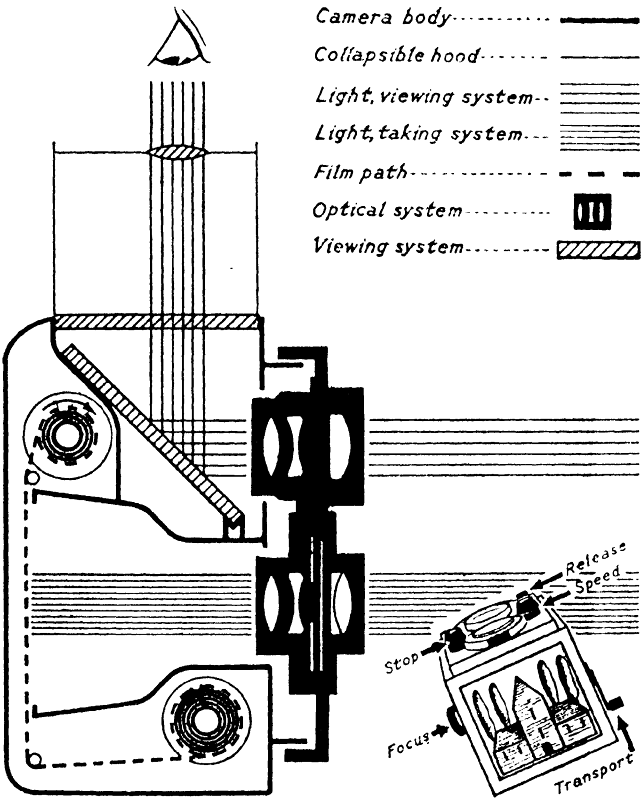
To give honour where it is due it should be mentioned that efficient twin-lens cameras of this basic design were being made and sold in Great Britain around 1890. These models were, however, hardly portable, and used glass plates with all their attendant drawbacks.

When the German firm Franke und Heidecke first offered their Rolleiflex to the photographic world, in about 1929, they created an entirely new form of photography.

The new camera was constructed with a precision found at that time only in the best 35 mm. cameras. It captured the public imagination and was an immediate success. Fitted with the *f* 4.5 Zeiss Tessar lens and Compur shutter speeded from 1 second to 1/300 second, it was manifestly capable of serious photography. Added to this efficiency was the fact that it used a normal type of roll film, obtainable anywhere.

Professional workers, usually the most conservative of camera users, soon found that it was not quite the " toy " that they had at first imagined but that it could compete on fairly level terms with much of their larger apparatus for all but a few specialised needs.

The speed and ease with which the desired picture can be found, isolated, and secured with the modern twin-lens camera; the ample depth of satisfactory definition



Individual makes of twin- ens reflex cameras differ in detail, but basically they all follow the .same design and embody the following features : A rigid body comprising separate taking and viewing systems, the lenses of which are coupled and move in unison. A shutter and iris diaphragm on the taking lens. A focusing screen and magnifier to enable the viewing image to be critically examined. A film transport mechanism, (sometimes connected to the shutter winding mechanism to prevent double exposures).—See p. 16.

Bottom right : The operative features of a well designed twin-lens camera, as they appear to the photographer with the camera in normal taking position.

given by its lenses even at full aperture ; the convenience of daylight loading of 12 exposure films at low cost, and finally, the fascination of using such well made and easily handled equipment, make it easy to understand why the modern twin-lens has swept the photographic world.

THE BASIC DESIGN

ALMOST ALL present day twin-lens reflexes follow the same basic design. They have a rigid boxform body—usually die-cast from metal or moulded in plastic—divided into two parts. The lower one is the camera itself; the upper, the finder, contains a mirror which reflects the image on to a horizontal screen.

So that the image shall be clearly visible even out of doors in bright sunshine, the top of the camera has a folding metal hood to exclude extraneous light. This is commonly fitted with a short focus magnifying lens through which parts of the image can be critically examined, and the utmost sharpness quickly obtained.

The standard focusing screen is a sheet of ground glass. Some makers, however, modified this to some extent, and have made the focusing screen a plano-convex lens with the plane surface facing the mirror. This surface is matted to show the focused image, while the curved upper surface provides a rather more brilliant image than the ordinary ground glass. An additional advantage of the curved surface is that the overhead sky reflections, which are often a worry when focusing on a flat screen are eliminated.

There is one model where this principle has been carried a stage further. Only the centre spot of the plane surface of the screen is matted, while the rest is clear. Only this central spot is therefore used for focusing, while the rest acts as a viewfinder of the brilliant type.

Focusing the twin-lens camera is accomplished by turning a knob, moving a lever, or rotating a knurled lens mount. Whichever the method, the principle is substantially the same. The finder lens and the taking lens move in unison; they are geared together or are mounted on a panel which moves forward as the adjustment is made, over a focusing range from infinity (∞) to some 3 or 3½ feet. This is adequate for the majority of subjects, and as we shall see later, there are accessories which amplify this range.

The shutter generally fitted to cameras of this type is known as a diaphragm or between-lens shutter (Compur or similar) which operates between the components of the lens, as distinct from the focal plane shutter—customarily found on single lens reflexes—which consists of a slotted curtain and passes across in front of the film at the moment of exposure. In its best forms the diaphragm shutter is speeded up to 1/500 second and this is adequate to arrest all but the fastest movement. This diaphragm shutter has the advantage of accurate slow speeds down to ½ or 1 second, which is not as frequently found in shutters of the other type. A further point is that the between-lens shutter is quiet in operation, and quite noiseless when used for brief time exposures—not an unimportant matter when the camera is used for portraiture.

A built-in "self-timer" device is not uncommon. With it the shutter may be set and released by the operator who then has time (generally 13–15 seconds) in which to take his place in a group, or to become his own foreground object in a landscape. While perhaps used only on occasion, this device is a useful accessory; its full value is not appreciated until it *is* wanted.

The designers of the first modern twin-lens camera elected to standardise on the then popular 2¼ × 2¼ inch (6 × 6 cm.) roll film (size No. 117). This size, although not necessarily the same film number, is still the accepted standard today, and I consider that it is the most suitable. Other sizes have come into being, but the majority of makers have adhered to the original format.

In the original instrument the 117 film gave a strip of six exposures. Later, someone realised that the popular 3¼ × 2¼ inch film (No. 120) of 6 or 8 exposures was the

SUMMARY OF TWIN-LENS REFLEX CAMERAS

Name	Taking lens	Viewing lens	Shutter	Shutter Release	Film winding and size	Focusing Screen	Focusing Range	Direct Finder	Body	Notes
Rolleiflex Auto De Luxe	Tessar or Xenar 75 mm. f 3.5	Heidoscop f 2.8	Compur R. 1–1/500, B, D.A.	On body	Lever auto-matic Size 120	Ground glass	∞–3½ ft.	Eye-level reflex	Die-cast metal	Accessory backs for plates and 35 mm. film
Rolleiflex Standard (New)	Tessar 75 mm. f 3.5	Heidoscop f 3.1	Compur R. 1–1/500, B, no D.A.	On body	Lever auto-matic Size 120	Ground glass	∞–3½ ft.	Eye-level reflex	Die-cast metal	Accessory backs for plates and 35 mm. film
Rolleiflex Standard (Old)	Tessar 75 mm. f 3.5, 3.8 or 4.5	Heidoscop f 3.1	Compur or Compur R. 1–1/300 or 1/500, B, T.	Under shutter	Lever, semi-automatic Size 120	Ground glass	∞–3½ ft.	Frame	Die-cast metal	Accessory backs for plates and 35 mm. film
Original Rolleiflex	Tessar 70 mm. f 3.8 or f 4.5	Heidoscop f 3.1	Compur 1–1/300 B, T.	Under shutter	Knob, visual Size 117 (can use 620)	Ground glass	∞–3½ ft.	Frame	Die-cast metal	
Rolleicord II	Triotar 75 mm. f 3.5	Heidoscop f 3.2	Compur 1–1/300 B, T.	Under shutter	Knob, semi-automatic Size 120	Ground glass	∞–3½ ft.	Eye-level reflex	Die-cast metal	Accessory backs for plates and 35 mm. film
Rolleicord IA	Triotar 75 mm. f 4.5	Heidoscop f 3.2	Compur 1–1/300 B, T.	Under shutter	Knob, semi-automatic Size 120	Ground glass	∞–3½ ft.	Frame	Die-cast metal	Accessory backs for plates and 35 mm. film
Rolleicord I	Triotar 75 mm., f 4.5	Heidoscop f 3.2	Compur 1–1/300 B, T.	On shutter	Knob, visual Size 120	Ground glass	∞–3½ ft.	Frame	Die-cast metal	
Ikoflex III	Tessar 80 mm. f 2.8	Teronar f 2.8	Compur R. 1–1/400, B, D.A.	On body	Lever auto-matic Size 120	Condenser type	∞–4 ft.	Van Albada	Die-cast metal	
Ikoflex II	Tessar or Triotar 80 mm. f 3.5	Teronar f 3.5	Compur or Compur R. 1–1/300 or 1/500, B.	On body	Knob, auto-matic Size 120	Condenser type	∞–4 ft.	Frame	Die-cast metal	
Ikoflex I	Novar 80 mm. f 6.3 or 4.5, Tessar 80 mm. f 4.5	Teronar f 3.5	Compur 1–1/300 B, T.	On shutter	Knob, visual Size 120 or 620	Condenser type	∞–4 ft.	Frame	Die-cast metal	
Superb	Heliar or Skopar 75 mm. f 3.5	Helomar f 3.5	Compur or Compur R. 1–1/250 or 1/400, B, T, D.A.	On shutter	Lever, visual Size 120	Ground glass	∞–3 ft.	Frame	Die-cast metal	
Focusing Brilliant	Heliar or Skopar 75 mm. f 3.5 or 4.5	Special lens	Compur R. 1–1/500 B, T.	On shutter	Knob, visual Size 120	Condenser type	∞–3 ft.	Frame	Moulded plastic	Focusing only on centre spot of screen
Fothflex	Foth Anast. 75 mm. f 3.5 or 4.5	Anast. f 3.5	Focal Plane 2 sec.–1/500 D.A.	On body	Knob, visual Size 120	Ground glass	∞–3½ ft.	Frame	Pressed metal	
Zecaflex	Tessar, Xenar, etc. 75 mm. f 3.5	Anast. f 2.9	Compur R. 1–1/400, B, T, D.A.	On shutter	Knob, visual Size 120	Ground glass	∞–3 ft.	None	Folding body with bellows	
Perfecta	Tessar, Xenar, etc. 75 mm. f 3.5	Anast. f 3.5	Compur 1–1/300 B, T.	On shutter	Knob, visual Size 120	Ground glass	∞–6 ft.	None	Folding body with bellows	
Ansco Reflex	Ansco Anastigmat 83 mm. f 3.5	Anast. f 3.2	Ansco 1/2–1/400 B.	On body	Lever, auto-matic Size 120	Ground glass	∞–3 ft. 8 in.	Optical	Metal	
Ciroflex	Wollensak Velostigmat 83 mm. f 3.5	Wollensak f 3.2	Alphax 1/10–1/200 Rapax 1–1/400 B, T.	On shutter	Knob, visual Size 120	Ground glass	∞–3 ft.	Frame	Welded steel	
Argoflex E	Varex 75 mm. f 4.5	Anast. f 4.5	Argus 1/10–1/200 B, T.	On shutter	Knob, visual Size 120	Ground glass	∞–3½ ft.	Frame	Moulded plastic	
Argoflex II	Varex 75 mm. f 4.5	Anast. f 3.5	Argus 1/10–1/200 B, T.	On shutter	Knob, semi-automatic Size 120	Ground glass	∞–3½ ft.	Frame	Die-cast metal	
Kodak Reflex	Kodak Anastigmat 80 mm. f 3.5	Kodak Anast. f 3.5	Flash Kodamatic 1/2–1/200, B, T.	On shutter	Knob, visual Size 120	Ground glass	∞–3½ ft.	Frame	Metal	Flash synchronizing point
			NON STANDARD	*TYPES*						
Contaflex	Sonnar 50 mm. f 1.5 or 2 (Standard lens)	80 mm. f 2.8	Focal Plane 1/2–1/1000, B, D.A.	On body	Knob, auto-matic 35 mm.	Condenser type	∞–3½ ft.	Van Albada	Die-cast metal	36 exposures enlarged viewing image
Rolleiflex (Sports) 4 × 4 cm.	Tessar 60 mm. f 3.5 or 2.8	Heidoscop f 2.8	Compur or Compur R. 1–1/300 or 1/500, B, T	On shutter	Lever, semi-automatic Size 127	Ground glass	∞–3½ ft.	Frame	Die-cast metal	12 exposures 4 × 4 cm. Accessory back
Pilot	Tessar, Xenar, etc., 45–50 mm. f 2 to 3.5	Anast. f 2.8	Compur 1–1/300 B, T.	On shutter	Knob, visual Size 127	Ground glass	∞–3½ ft.	Optical	Folding body	16 exposures 3 × 4 cm.

The above table lists only the true twin-lens reflex cameras, i.e., those where the viewing lens also serves f focusing purposes. There are also a large number of cameras resembling the twin-lens reflex in appearance (Voi ländner Brilliant, etc.) which are, however, really normal box cameras with a large brilliant view finder. In the classification of types of film winding and indicating mechanism, semi-automatic means that the fi can be wound on without consulting the numbers, as the winding key or lever comes to a stop when enough film has been wound on for the next exposure. The film can, however, be wound further without making an exposure. With the automatic mechanism film winding and shutter release are interlocked in addition, so that both double exposures and unexposed frames are prevented.

same width, and appreciably longer. If some means of measuring the amount of film required per exposure could be devised, the strip would give up to double the number of exposures for each loading, as compared with the original film.

Latterly the film makers have helped by numbering the ordinary 120 films 1–12 to cater for the 6 × 6 cm. camera in which there is no mechanical measuring device for the film. The numbers can now be read through the usual red window in the camera body.

The old cameras designed expressly for 117 film cannot generally be used with the 120 size which has a spool of slightly larger diameter, but it is usually possible to adapt such instruments so that the spools of the 620 size (also 3¼ × 2¼ inch) film can be used. These spools are of appreciably smaller diameter than the 120 size.

Another feature found on some of the more expensive twin-lens reflex cameras is a double exposure prevention device. This works by locking the shutter once an exposure has been made, until the film is wound on for the next exposure. In some cases that interaction is carried even further : the film cannot be wound on until the shutter has been released. This avoids unexposed negatives.

Not all makers have striven to remove the necessity for thought on the part of the user to this extent; and admittedly the possession of a camera with these features is a luxury rather than a necessity. It is, however, a great aid to securing good pictures if personal attention has only to be given to matters such as exposure, focusing, composition, etc., and the other matters can be left to the camera itself.

Having considered broadly the general characteristics of this type of instrument, let us examine it in a little greater detail.

VARIABLE FEATURES

UP TO the time this book was written all the good 6 × 6 cm. twin-lens cameras have originated in Germany or the United States. Approximately a dozen manufacturers have produced instruments of this type—for the most part following the general basic design of the original Rolleiflex but incorporating various modifications according to their own particular fancy. On page 20 will be found a comparison of twenty or more of the best known models, and this can be supplemented with some additional details. They refer to the main points in which these cameras vary, namely—the methods of film transport, of auxiliary eye-level viewing, of shutter operation—besides the optical equipment and body construction.

Many of the European models rely on a lever shift system for transporting the film through the camera, others employ the film winding knob; this system is found in most of the American designs. The choice is entirely a matter of personal preference. Both are perfectly satisfactory and while the lever is probably quicker in use, the knob provides a rather more robust mechanism.

The better models usually employ a mechanical exposure indicating device; the use of the red window through which the number on the actual film can be read off is restricted, in the main, to the cheaper types. An ingenious device, found on the new Kodak Reflex, is an adjustable indicator on the winding knob, which can be set to show the type of film with which the camera is loaded.

Almost all models provide some form of eye level viewing—the Ikoflex III with its large Albada type direct vision optical finder giving automatic adjustment for parallax correction is easily the most ambitious—but the inverted yet visible focusing image afforded by the later Rolleiflex and Rolleicord models has some advantages when a high viewpoint and the ability to focus are required at the same time. The more customary method provides for part of the metal hood to open as a direct vision frame finder in which the picture can be composed after focusing by scale or on the screen in the usual way.

Opinion seems to be divided as to the ideal place for the shutter release button. Some makers favour the camera body, others use the normal release lever which protrudes from the side of the shutter itself. In general, a release on the body is a convenience; but the necessary chain of levers and links to convert pressure on the button into the movement required to release the shutter sometimes makes it harder to hold the camera still for the slower exposures, than when a hair-trigger release is touched off on the shutter itself.

Lens aperture on most models is *f* 4.5 or *f* 3.5—the latter limit being imposed by the size of shutter usually employed. In the Ikoflex III a larger shutter is used and so lenses with apertures up to *f* 2.8 can be fitted.

The lenses used in twin-lens reflex cameras are nearly always highly corrected anastigmats. They are often three-component lenses of the Triotar or similar types, while the more efficient Tessar lenses are frequently fitted on more expensive models. The twin-lens reflex has, therefore, lens equipment equal to any precision camera, and the negatives made with these cameras allow sharp pictures to be produced at high degrees of enlargement. As the between-lens shutters used on most of these cameras are built into the lens system, lenses cannot be interchanged.

Incidentally, the diaphragm shutters lend themselves to flash synchronization more readily than do those of the roller-blind type, and in the Kodak Reflex a built-in flash synchronizer is in the shutter fitted to the camera. With this model flash photography requires only a battery case and reflector, and an electric cord to plug in to the socket on the side of the camera body.

Some of the cheaper German cameras have bodies of moulded plastic; while this is pleasant to handle and light in weight, the better models are still made of die-cast metal for the sake of the greater mechanical accuracy obtainable. The new American Ciroflex, representative of models employing a welded steel body, is an example of yet a third form of construction.

There is no wide difference in size between the various makes—this, after all is governed largely by the dimensions of the film itself—and the majority of models are reasonably similar in appearance. The customary finish is a covering of leather or leather grained substance, with a neat trim of shiny black enamel or plating.

NON-STANDARD TYPES

BOTH IN what has been said so far and in most of what follows I have deliberately confined this book to the twin-lens reflex camera taking pictures of the 2¼ inch square size, because I believe this is the most sensible size for a twin-lens reflex, and because the majority of manufacturers—and users—seem to subscribe to this view.

The discussion of the characteristics of this type of camera, together with its advantages and limitations, has therefore been carried on from this point of view.

There are also a number of models deviating from the standard type of the twin-lens reflex and they, too, enjoy a certain popularity. Let us see some examples.

The makers of the Rolleiflex, the prototype of the 2¼ inch square twin-lens reflex, have also put on the market a smaller model, the Sports Rolleiflex. This uses No. 127 film (Vest Pocket) and takes 12 pictures, 1⅝ inch square (4 × 4 cm.). There are several Sports Rolleiflex models which were issued at various times; the main differences between them lie in special details such as bayonet ring for accessories, encased shutter, etc., which were introduced in the larger models at the same time. The construction of the Sports models resembles that of the 2¼-inch square Rolleiflex. Although in my opinion the smaller size loses on balance in comparison with the 2¼-inch square, the 1⅝-inch square model has always had a vogue with the ladies who seem to appreciate its somewhat smaller overall bulk. The latter also makes it very suitable for taking pictures when mountaineering, etc., where small size and low weight are needed. The lens fitted is a Tessar *f* 3.5 or *f* 2.8, set in the Compur or Compur Rapid shutter.

Another small twin-lens reflex, tending even more to a true miniature size, is the Pilot. This also used No. 127 size film, but the square picture shape has been abandoned, and the camera takes 16 exposures 3 × 4 cm. As the film travels vertically, the pictures are arranged horizontally with their larger dimension across the film strip when the camera is held normally. Various lenses are fitted with apertures up to *f* 2. One of the features of this model is the design which permits the camera to be folded up. The taking lens is connected with bellows while the viewing lens telescopes into the top part of the body. The overall thickness of the camera is thus reduced to about 1½ inches which makes it quite a pocketable model.

In a somewhat different class is the Contaflex. Although this is relatively heavy and bulky, it uses 35 mm. film, giving 36 pictures, 24 × 36 mm. in size (1 × 1½ inches). It is, in fact, a combination of a twin-lens reflex and a true 35 mm. miniature camera, with the emphasis on the 35 mm. rather than on the standard twin-lens reflex features. Because of this, the technique of its materials and manipulation is rather outside the province of this book. The Contaflex is unique among the twin-lens reflex cameras in affording real interchangeability of lenses, with eight objectives listed in focal lengths from 3.5 cm. to 13.5 cm. The viewing lens has a focal length of 8 cm. and the viewing screen is of corresponding size, giving an enlarged image of what will be on the film. By mechanical coupling and suitable screen masking, the field given by the various lenses, and coincidence of focusing, are assured.

However, our text is the technique of the 2¼ inch square twin-lens reflex, so let us devote ourselves to getting the best out of this particular format which has become almost the universal size for such instruments.

SO OUR twin-lens is a precision camera which successfully bridges the gap between the real miniature—the 35 mm. type—and the much more cumbersome instruments taking quarterplate or larger sizes of materials.

The twin-lens reflex combines most of the *advantages* of both the large and the small camera; and at the *same* time, avoids most of their respective disadvantages. The fact that owing to the solidly mounted reflex mirror it is usually a boxform instrument, gives it a quality of ever-readiness typical of box cameras. The instantly visible screen—the full size image—the ease of rapid and accurate focusing, all add to its charm

At different times people have offered the opinion that a square picture, which is the natural shape for the reflex principle, is undesirable, and I would like to take this opportunity to clear up a popular misconception on this very matter.

I have heard it said that 2¼ inches square is "only 3¼ × 2¼ inches cut down". This is very far from the truth. The average 3¼ × 2¼ inch camera is fitted with a lens of about 4¼ or 4½ inch focus; whereas the usual focus of the objectives fitted to our square size is generally 3 or 3½ inches, which includes every bit as much as does the longer focus lens on the larger film, but on a slightly smaller scale.

We can put this in a different way. If we use a 3 inch lens on a V.P. sized negative (1⅝ × 2¼ inches), we shall obtain about the same image as we would with a 4¼ inch lens on a 3¼ × 2¼ inch negative, though the latter would be larger. If, therefore, we use the 3 inch lens for the 2¼ inch square negative, we have as much on it as we had with the V.P. negative, and some more in addition, since the rectangle has been made wider, and has become a square. The 3 inch lens with a 2¼ inch square negative corresponds to a 4¼ inch lens with a 3¼ inch square negative. A 3¼ × 2¼ inch negative therefore includes *less* than the 2¼ inch square when the two are used with their appropriate focal lengths of lens.

Far from the square shape being a drawback, possession of this extra space, and the power to fill it with the picture, when desired, is an advantage. I find, in actual practice that a square shape is easy to fill with a picture in a satisfying fashion. Often when I have used my 2¼ inch square and had intended ultimately to enlarge my picture to an oblong shape, I found that almost the complete negative yielded a square, or very nearly square, composition.

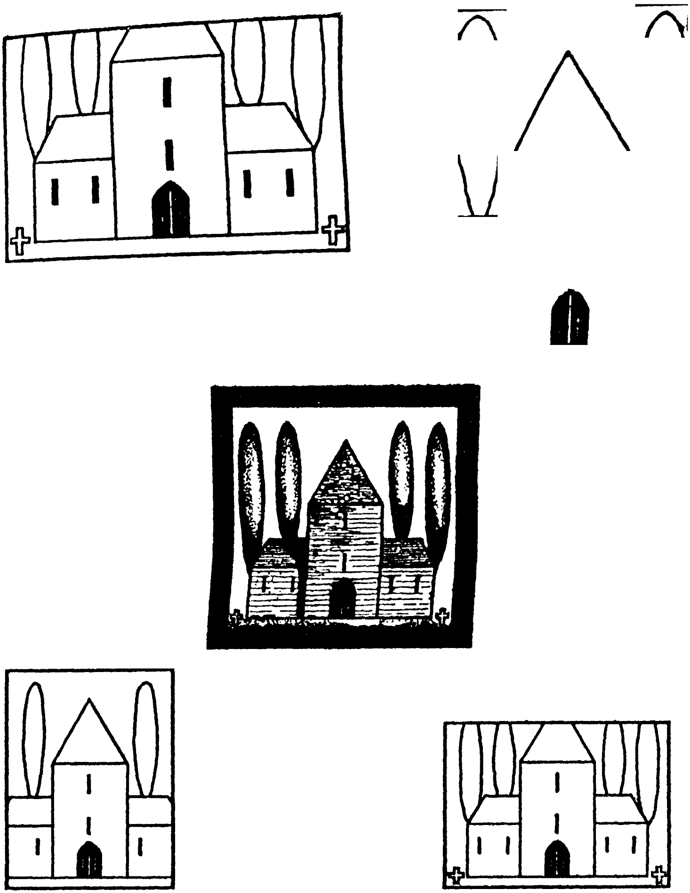
One other consideration—with a square camera one does not need to worry which way it is held. One can concentrate on securing the picture first. It can always be trimmed as an upright or an oblong afterwards if desired—and without losing anything that would have been available with a camera of more conventional shape.

Moreover, as a square camera is always held the same way up, one will naturally choose the most comfortable holding position, and there is no need to vary this whatever type of picture is taken.

Modern photography almost always involves the production of enlargements from negatives of an appreciably smaller size. Obviously a 2¼ inch square negative has to be enlarged proportionately more than a 5 × 4 inch negative to produce a comparable result ; and the more a negative is enlarged, the poorer by absolute standards will be the definition in the ultimate print.

The constructional accuracy of the better types of 2¼ inch square reflexes, however, goes far to overcome any lack of sharpness by ensuring that the film is held exactly in the focal plane during exposure, and that the lens is given every chance to produce a negative in which the definition is as sharp as possible. The lenses fitted to such instruments are computed for this exacting work, and made with a higher degree of correction than is customary in lenses intended for use on larger apparatus.

Compared with 35 mm., the 2¼ inch square negative is over four times as large in area. The degree of enlargement needed is therefore much less than with the smaller negative. This is in itself an advantage, particularly as any minute flaws such as specks of dust will be less evident on the finished print.



A 2¼ × 2¼ *inch picture is not a* 3¼ × 2¼ *inch picture cut down.* The square picture (*centre*) includes all of the larger negative (*top left and right*) on a slightly smaller scale. Actually the 2¼ inch square includes what would be shown in a " vest pocket " picture, with the height of the upright format (*bottom left*) and the width of the horizontal view (*bottom right*). It also includes the four corners which do not appear on any other shape of picture. In my opinion it has all the advantages. —See p. 27.

The small size of the film itself makes it easy for the designer to ensure that it will lie flat in the camera ; this as with all better roll film cameras, is generally assured by the provision of a flat, spring-loaded pressure plate which holds the film up in contact with the "gate".

Another merit of the small size of film is, as we shall see later, the relatively short focal length of lens used which also plays a part in securing sharpness over a number of different planes even when it is used at large apertures.

Focusing with a twin-lens camera is considerably easier than with any other type of instrument employing a ground glass screen—easier even than with a larger reflex. This is because we are using one lens solely as a finder, and it is always used at full aperture. Not infrequently this aperture is greater than that of the lens with which the picture is being taken, and because of this, the image on the ground glass screen is well illuminated. With any ordinary single-lens reflex it is usual to stop the lens down to the aperture to be used, after which the image is focused and the exposure made. If the aperture used is small, the illumination is so poor on the screen, that it is hard to determine when the picture *is* sharply focused. This trouble does not arise with the twin-lens. Furthermore, the fact that a larger than usual aperture is used for focusing makes it very easy to see when the image is at its sharpest point, as it goes in and out of clear focus quickly, instead of just slowly getting sharper or less sharp as the knob is turned.

The use of 12 exposures on one roll of film is another instance of the useful compromise found with roll film cameras of this type. There are times when the 36 exposure loading of the 35 mm. miniature is inconveniently generous as it involves waiting, sometimes quite a long time, until the film is completely exposed and ready for development.

Large cameras taking plates or cut film have the opposite drawback ; the number of spare plate holders carried is usually rather limited, though the material can be processed exposure by exposure.

LIMITATIONS TO OVERCOME

WHEN A manufacturer—whatever he makes—describes his product, he will make the most of its advantages and ignore or minimise its drawbacks and shortcomings. To do this in a book like ours would be unfair to the reader, and possibly to the camera itself. To appreciate just what can, and what cannot be done with an instrument puts the user in a stronger position to produce the best results from his camera.

I have already said something about the merits of the twin-lens reflex but it must not be overlooked that it is far from being a camera to put in one's pocket. True, with its ever-ready case it is an easy instrument to carry; but in the case of most models it is after all a box; and this we must accept.

Because it is a reflex, in which the focusing screen is horizontally disposed at the top of the camera, it is necessarily held, as a rule, in a position between the waist and the chin of the user. This, to my mind, is a real drawback. It will be obvious, although often overlooked, that when we look at any object, we do so from our own eye level. If the camera is held at the same level, it will of course see what the eye sees ; but if it is held a foot or so lower, its point of view will be very different.

In photographing objects at a reasonable distance from the camera (landscapes, buildings, groups, etc.), this slightly lower viewpoint normally will not matter. When, however, we bring our camera nearer to the subject, the difference becomes appreciable. In the case of portraits of adults, the " lower-than-usual " viewpoint is frequently responsible for the criticism that the picture is " not a good likeness " (horrid expression !). The fact is, that the camera is seeing the sitter from a position from which we would never study him, unless we were seated ; and the picture, looking up under the chin, emphasising the nostrils and foreshortening the top of the head, is one which naturally appears different from what we expect. In the case of child photography, however, the low viewpoint is often a definite asset. It is quite common to come down to a child's level when talking to it, and the lower camera position gives what is a reasonably natural viewpoint in such a case.

All reflex cameras suffer from one defect, namely, lateral reversal of image. What is on the left of the subject appears on the right of the screen, and *vice versa.* This is inclined to make picture composition a little difficult at first, although one soon gets accustomed to it; it is, however, disconcerting, and particularly irritating where one is focusing on printed matter. This lateral reversal of the image is a feature of all reflecting viewfinders (including the "brilliant" type), and it is particularly apparent if we compare the reflex camera with a roll film or miniature model using a direct vision finder.

More serious perhaps to the architectural photographer is the lack of movements such as swing back and rising front, by which he is able to secure pictures of tall buildings

(*Continued on p.* 41)

A WALK ROUND LONDON WITH THE TWIN-LENS CAMERA will prove its scope better than pages of text.

We start (page 33) in the heavily bombed neighbourhood of St. Paul's Cathedral and our picture promptly demonstrates the depth of sharpness afforded by the lens. The twin-lens is so easy to focus.

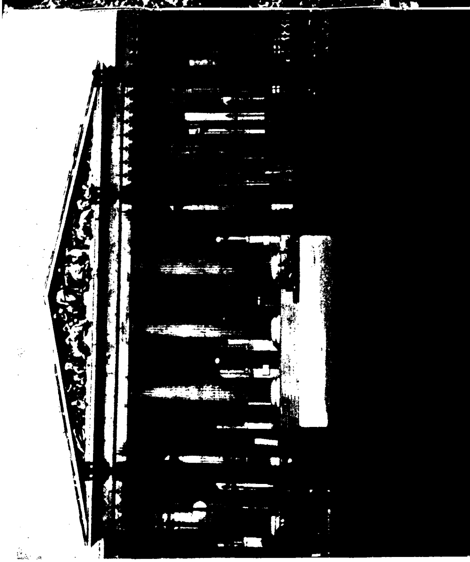
Around the Houses of Parliament (pages 34 and 35) with Big Ben, Queen Boadicea's chariot, and Oliver Cromwell's statue, we are surprised by the rich pictorial yield of the square shape.

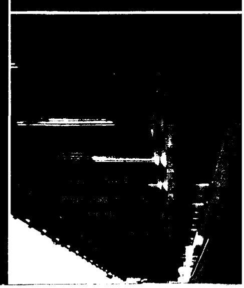
At the British Museum (pages 36 and 37) we find quite a few views which lend themselves to shapes contained in the square. By cutting off some of the empty foreground of the first shot (page 36 *top*) we could get a much better oblong arrangement.

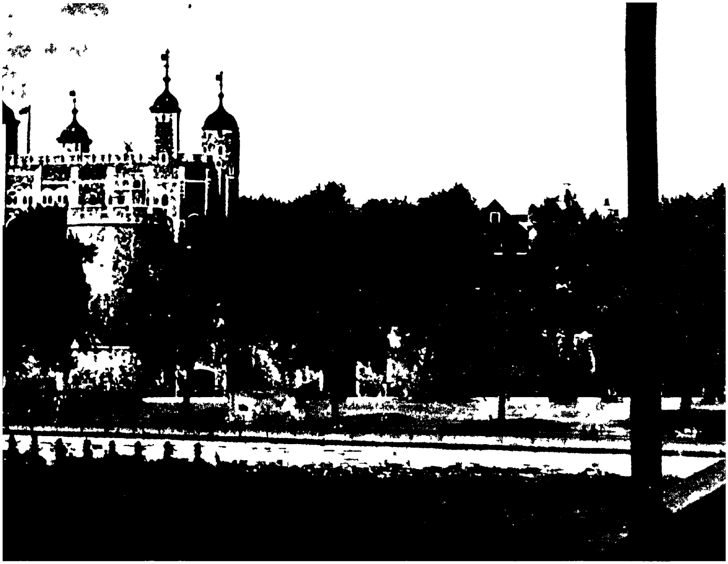
Arriving at the Tower (page 38) and the Tower Bridge (page 39) we carry this technique further and deliberately take pictures on our square negative designed to be used as oblongs or uprights.

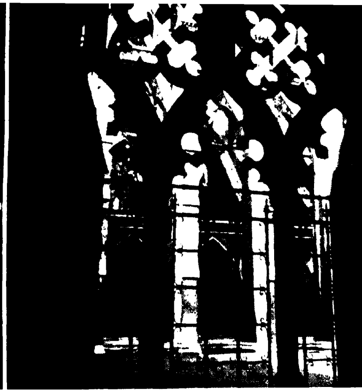
By watching all the time the views presented on the focusing screen, the twin lens camera gives us a regular course in composition. It veritably finds the pictures for us. At the same time, we also learn something about some peculiarities of our camera.

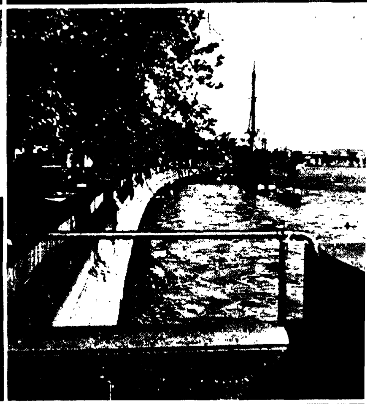
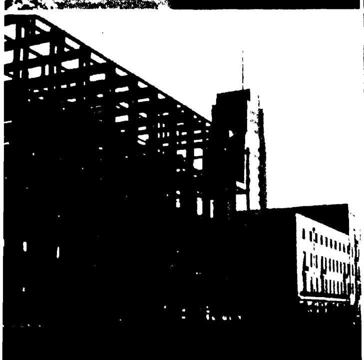
(*Continued on p.* 41)






without tilting the camera upwards. Again this defect is not peculiar to one type of instrument but is found on the majority of the more portable models other than twin-lens, as well.

The bulk of twin-lens models provide focusing down to about 3 or 3½ feet. This is perhaps somewhat limiting in comparison with the double extension of most plate cameras, but the makers have covered this point by providing, in many cases, accessory lenses which allow the camera to be used at closer ranges when desired (p. 109).

By far the greatest drawback to this type of camera, to my mind, is the fact that it is designed for use with its normal lens alone, and is not provided with a variety of other lenses of differing focal lengths, as are other modern cameras. Undoubtedly a range of such lenses is an advantage, but the construction of the majority of twin-lens models makes its inclusion an impossibility, because, as we have already seen, the between-lens shutter is built into the lens system.

Compared with the best 35 mm. miniatures, the lens equipment of the twin-lens reflex is not as suitable for photography in poor light. Some of the high versatility of the 35 mm. camera has had to be sacrificed to produce the typical twin-lens reflex. The latter has instead many

In the cloisters of Westminster Abbey (page 40 *top*) we see framed by a Gothic window how a small sideways shift would change the contents of the picture by altering the relationship between foreground and background.

By the Thames embankment (page 40 *centre*) we see from the way Captain Scott's *Discovery* appears and disappears on the focusing screen, how whatever we get on our film is influenced also by the height at which the camera is held.

Outside London University (page 40 *bottom*) we notice two potential weaknesses of our camera ; it often takes in too much foreground and is inclined to look at high buildings at too emphatic an angle.

features which make it suitable for work which is more in the line of larger cameras.

One of the other limitations of this design is that of parallax. We have seen that the finder lens is situated above the taking lens, and so it cannot see *exactly* the same view as the lens forming the photographic image. The difference is slight, and in the case of all reasonably distant subjects it can safely be ignored; but when taking really close-up shots, portraits, etc., it is desirable to bear in mind that the difference does exist.

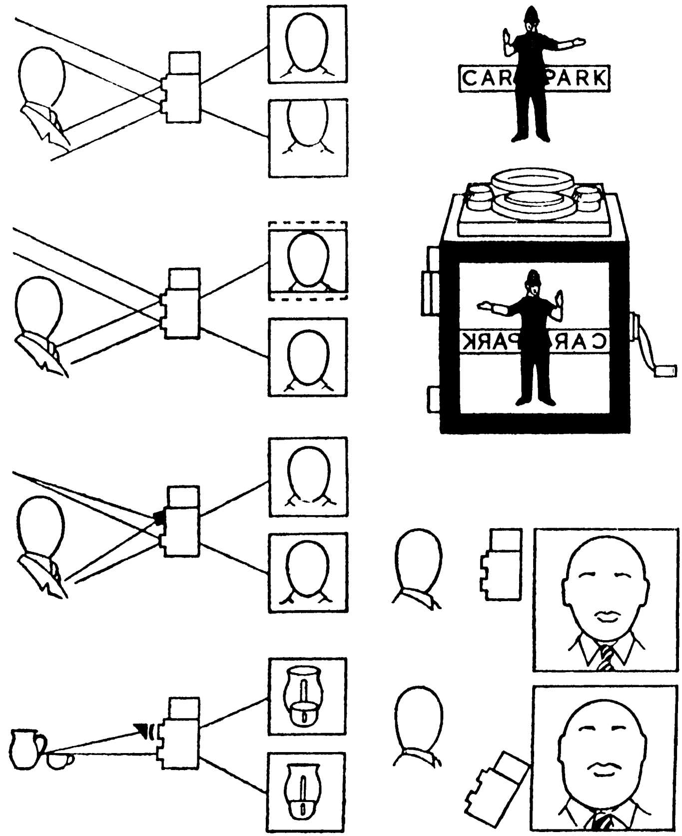
How is this problem solved ? In some cameras the top focusing screen is fitted with a moving mask which slides forwards and back as the camera is focused to different distances, so that the amount included on the screen always agrees with the amount in the picture.

Other models deal with this in a different way. The mask surrounding the top screen is a trifle shorter (in height) than the actual film picture area, so that when pictures of distant objects are taken, the picture will actually include a shade (about 3 mm.) more at the top of the picture than was seen on the screen; while when the camera is used at the closest distance, the picture will include about 3 mm. more at the base.

One camera even deals with this problem by having the finder lens mounted in such a way that it is made to point downwards to an increasing extent as the camera is focused for near distances. In other words, the lines of sight of the two lenses converge, and both lenses are pointed at the same part of the object, irrespective of the distances focused on.

For really close work the different viewpoint of the finder lens, even when corrected for parallax, makes an appreciable difference, but in general the user is not seriously conscious of its existence. There is, however, no way of overcoming the difference in viewpoint of the two lenses, and the fact that the lower lens is seeing the subject from a slightly lower position should be borne in mind when taking really close portraits.

This more or less covers the list of what may reasonably be called faults and limitations. When assessed, they are not very serious; we must remember that no camera can



Left : Parallax makes the finder show more at the top of the picture than appears on the film (*top*). This is often corrected by reducing the viewing screen (*upper centre*), so that the film always includes what is visible. If the lens is tilted (*lower centre*), both images cover the same area. In very close subjects (*bottom*) the higher viewpoint makes quite a difference.—See p. 42.

Right : Every reflex image is laterally reversed (*top*). There is a definite difference (*bottom*) in perspective between normal and low camera positions.—See p. 31.

have advantages of all camera types without some compromise. In this case the advantages more than balance the limitations imposed by this compromise.

The designers have—and I think wisely—been of the opinion that it was of greater importance to give the user those features which are essential to success in the majority of his needs, even at the expense of leaving off the basic camera some of the details which are only seldom required.

THE CAMERA LENS

WE HAVE already come across some mention of the lenses used in the twin-lens reflex. Before we discuss the use to which our lens is put, it will be worth while to devote a few minutes to generalities so that there shall be no confusion when technical terms are discussed.

Long ago, someone discovered that a pinhole in the closed shutter of a window projected an inverted image of what was outside the window on to the opposite wall.

The photographic lens, even in its simplest form, does precisely this. The earliest lenses had a very small aperture (diameter) because it was found that the lens could not give a sharp image at a large opening, due to various optical defects such as astigmatism, curvature of field, etc.

By building up a lens system of several separate single lenses, these and other optical defects were gradually corrected, until the production of a lens capable of producing a sharp image even when used at a large aperture became an accomplished fact.

When speaking of the *aperture* of a lens we use a purely relative term; the size of this aperture has to be associated with the *focal length* of the lens, before it has any real meaning.

If we consider a camera lens as a window permitting light to enter a darkened room (the camera), it will be evident that a large window (aperture) will let in more light in any given space of time than will a small one. The strength (intensity) of this light falling on the facing wall (the film) will, however, be governed by the distance from the window to the wall itself, because the intensity of illumination of the wall is reduced in proportion to the square of the distance that the light has to travel before reaching the wall. If, therefore, we have a lens of relatively long focus (as might be used on a large camera) it will require to have a bigger glass aperture than would a shorter-focus lens, in order to give the same effective brightness of image on the film.

As one cannot then compare the actual physical diameter of different lenses to indicate their efficiency, it has become the custom to divide the diameter of a lens into its focal length, and the resulting fraction serves to express its rapidity whatever its actual size or focal length. Thus a lens of 4 inches focal length (distance to film when set to give a sharp image of an object at infinity) will have to measure ½ inch in diameter if its speed is to be *f* 8 (or 1:8 as it is sometimes written). If the maximum opening of the lens is 1 inch across, the aperture will then be described as *f* 4.

Because light intensity follows the law of inverse squares, the comparative speed of any lens aperture has similarly to be calculated—i.e., an *f* 4 lens is *four* times as rapid as a lens working at *f* 8 ($4 \times 4 = 16 : 8 \times 8 = 64$), and at *f* 8 an exposure *four* times as long as that given at *f* 4 would be necessary to produce an equal effect on the film.

Most English cameras of the type under discussion bear the following scale of apertures:

f 3.5* *f* 4 *f* 5.6 *f* 8 *f* 11 *f* 16 *f* 22

Their Continental counterparts are generally calibrated :

f 3.5* *f* 4.5 *f* 6.3 *f* 9 *f* 12.5 *f* 18 *f* 25

The difference between these two scales is so slight that if an exposure meter is calibrated in one system, and the camera in the other, the nearest equivalent numbers (e.g. 9–8 or 11–12.5) may safely be used.

It is worth noting that, with the exception of the largest apertures (marked *), each successive number on both scales passes half as much light as the preceding one.

The " speed " of a lens is described by quoting its maximum possible aperture, e.g., f3.5. When a smaller aperture is required the *iris* leaves are closed down to the desired extent as indicated on the scale provided.

Apart from the effect on exposure as mentioned above, the effect of thus stopping down the lens is to increase the depth of field (see later) and in the case of lenses of poor quality, to improve the definition given. A lens of the highest quality, however, yields good definition even at its full aperture.

Most 6 × 6 cm. cameras are fitted with lenses of 75 or 80 mm. focal length. The former of course embraces a slightly wider angle, while the longer focus lens yields a trifle larger image size at a given distance.

Many lenses now being made appear bluish-purple in colour by reflected light, although water-white when examined by transmitted rays. This is due to a coating of a microscopically thin film (about 4/1,000,000 of an inch thick) of magnesium fluoride or other suitable mineral.

This coating considerably reduces the amount of light reflected from the glass-air surfaces of the lens. This reduction in the light lost by reflection will of course result in an increase in light transmitted. The increase is of the order of 4 or 5 per cent at every glass-air surface—which means an increase in lens speed at any given aperture of something between 25 and 30 per cent according to the number of surfaces involved.

This speed increase is useful—but much more valuable is the fact that the diminution of reflections means the almost complete elimination of flare-spots (see p. 70) and an appreciable increase in image contrast and clarity.

LET US now examine the manipulation of the camera a little more in detail.

Loading the camera is a simple operation differing little from a similar process with a box camera. It should be carried out in dull light for safety—indoors—or if that is impossible, in the shade. The camera back is opened (or removed) and the empty spool inserted in the take-up chamber (where it can be turned by the film winding lever or knob). The new film is then inserted in the other chamber. Care should be taken to engage the pins in the end of the spool when the camera is so fitted.

The seal on the film is removed and the leading end of the backing paper carried over the rollers, and attached to the slot in the take-up spool, taking care that it is central between the spool flanges, so that it will wind evenly.

The back is now replaced, and the film wound until No. 1 is visible in the red window (or automatic counter on some models).

On the cheaper models the film is transported after each exposure by turning the knob or lever provided until the next number on the backing paper appears in the red window at the back of the camera. With the semi-automatic models the red window is not used after the film has been wound into position for the first exposure; the exposures are counted by a special mechanism (which is often interlocked with the shutter release, preventing double or blank exposures).

The latest Rolleiflex is even more automatic. The backing paper is threaded through between two metal rollers before it is fastened on to the take-up spool. These metal rollers act as feelers; when the film attached to the backing paper passes through them, the automatic winding mechanism is set in motion. As soon as sufficient film has been wound on for the first exposure, the winding knob or lever is locked, and the film can only be wound on when this lock is released—simply by firing the shutter—until it stops again ready for the next exposure. When the whole of the film has passed through the camera in this way, the locking mechanism is put out of action, so that the end of the backing paper can be wound up before the film is removed from the camera.

The shutter fitted to most twin-lens reflex cameras is, as already mentioned, a between-lens type, usually Compur, or similar. These must be "pre-set". This means that for all speeds except B. and T. settings (sometimes marked Z. on German cameras), pressing the release will have no effect unless the spring governing the speeds is first tensioned. This is done by moving a suitable lever on the shutter. The tension of the spring will be felt when this is done, and the lever is pulled over until a catch inside the mechanism jumps into place, and holds the lever. If the release is pressed, this catch is released and the shutter opened for the predetermined time to which it is set.

For time and brief time exposures (T. and B.), no such preliminary tensioning is necessary with Compur shutters, though some other shutters have to be tensioned for all speeds. Where this tensioning is not needed, the release is pressed to open the shutter, and the latter closes again when it is released (B.) or when the release is pressed a second time (T. setting). Some models of the Compur shutter do not possess a T. setting at all, the shutter has to be kept open by pressure on the release lever all the time. In this case a special cable release is usually provided with a lock to keep the shutter open when required for long time exposures. The reason lies in the double exposure prevention mechanism which allows the release to be pressed once only for each exposure.

The speeds are set by moving the appropriate ring with the attached scale indicating the shutter speeds past a pointer. For all instantaneous exposures this can be done before or after tensioning, but in the case of Compur Rapid shutters the highest speed (1/400 or 1/500) must only be set or changed *before* tensioning, as an additional spring is introduced to give the high speed.

Some twin-lens reflex cameras have the shutter completely encased, and the speeds are read off (together with the aperture) in a peep window at the top of the camera. Thus they can be seen while observing the image on the screen. Setting of the speeds and apertures (see later) is done either by control knobs or wheels.

On certain more expensive models tensioning the shutter is accomplished at the same time as the film is wound on. It is therefore coupled with the double exposure prevention device.

Where a delayed action mechanism is built in, this is simply operated by tensioning a spring connected to a clockwork. When the shutter release is pressed, this clockwork is set in motion and delays the actual opening of the shutter by about 15 seconds.

One of the advantages of most twin-lens reflex cameras is the readiness for almost instant use. The lenses are normally set at the infinity position, so all that is necessary is to open the hood, focus and expose.

On most models the hood itself opens immediately when the release catch is touched. Closing in most cases is done by folding down the four flaps of which it consists in their right order. Usually this is : right side, left side, back and front. With some cameras pressure on the back flap will automatically close down the side flaps as well, and the front is then folded on top. With certain models pressure on the front flap will automatically fold up the whole hood.

Almost all modern cameras have so-called "Ever-ready" cases and this description is particularly apt in the case of the twin-lens reflex. Usually releasing a simple catch allows the top and front of the case to fall away, fully exposing the hood and camera front for instant use.

Such a case also has openings at the sides for the film winder and the focusing knob, so that these operations can be carried out without removing the camera from the case. Because of these various openings, the Ever-ready case, while affording protection for the camera under normal conditions, is not entirely weather proof. For maximum protection of the camera, when it is not required at a moment's notice, a normal leather case is therefore preferable, as it fully encloses *all* parts of the camera.

The above description must necessarily be generalised; differences in the finer details will usually become apparent when the particular camera is studied together with the makers' directions (or a *Camera Guide*).

HOLDING THE CAMERA

MUCH OF the success (or otherwise) of twin-lens camera work depends on the care with which the camera is held at the moment of exposure. The negatives are going to be enlarged several diameters, and they must be sharp; therefore it is vital to avoid camera movement at this critical moment.

With the Ever-ready case the strap round one's neck provides a very desirable support against camera shake. In the absence of such a case, it should be borne in mind that most twin-lens models are fitted with a neck strap. This is for *use*, not ornament. The strap should be placed round the neck and adjusted so that the camera is high on the chest in a position where the image can clearly be seen and the shutter released while a slight but steady downward pressure is maintained against the resistance of this strap or that of the Ever-ready case. It is a safeguard to exhale before releasing the shutter. It is also advisable not to make an exposure immediately after any considerable exertion such as heavy work, climbing, etc., as it is not so easy under those conditions to keep the camera absolutely still.

The secret of avoiding camera shake lies as much in releasing the shutter gently so as not to jerk the camera, as in keeping it still during the actual exposure. The length of time for which the camera can be held still varies with different people. Usually 1/50 second can be taken as the slowest *safe* speed with the camera held in the hand. There are, however, various ways in which the steadiness of a camera can be increased. Additional stability can be obtained by leaning on a table or on a wall with the elbows; the neck strap mentioned also helps. Under favourable conditions hand held exposures can be made up to 1/10 second. For all longer exposures the camera must be directly placed on a firm support or on a tripod. It is still possible to jerk the camera even on a tripod. We must therefore be careful about this, particularly when using a cable release; the latter must never be held so that it is taut.

In the normal way it does not matter how *slowly* the release button is pressed—the exposure will always be as indicated on the dial. When, however, taking rapidly moving subjects, our own movements must be brisk, or we shall miss the shot. To arrest a fast moving object at the right spot, it is necessary to anticipate, and release the shutter just before the desired position is reached. This can only be learned by actual experience—but going through the necessary motions, even without a film in the camera, will help enormously.

Because we are using a camera taking a square picture, we have only to learn *one* secure holding position which simplifies the "drill" of camera handling. It is well also to accustom ourselves to using the camera at eye level with the direct vision finder. In such a case, it will be found easiest to hold the instrument flat against the *side* of the cheek, alongside the nose so that the camera back rests firmly against chin and cheek. This is better than trying to hold it *in front* of the eye where the nose may in some cases prevent the camera being held steady.

Using the camera in this way, one necessarily looks out a little sideways through the finder; but this is no hardship in actual practice.

The box form of the twin-lens coupled with its top screen allows it to be used in several different ways to cope with all sorts of conditions. In candid shots—and similar subjects —in fact anywhere where camera consciousness on the part of the subject must be avoided—the ability to shoot backwards and sideways to the apparent line of interest will often secure a picture that would otherwise be unobtainable.

In a crowd or on other occasions where a high viewpoint is desirable the camera can be held above the head. With any of these more extravagant holding positions a higher shutter speed than normal is necessary.

The most stable camera position is the one already described, using the neck strap. If we try unusual ways of handling the camera the risk of camera shake is much greater.

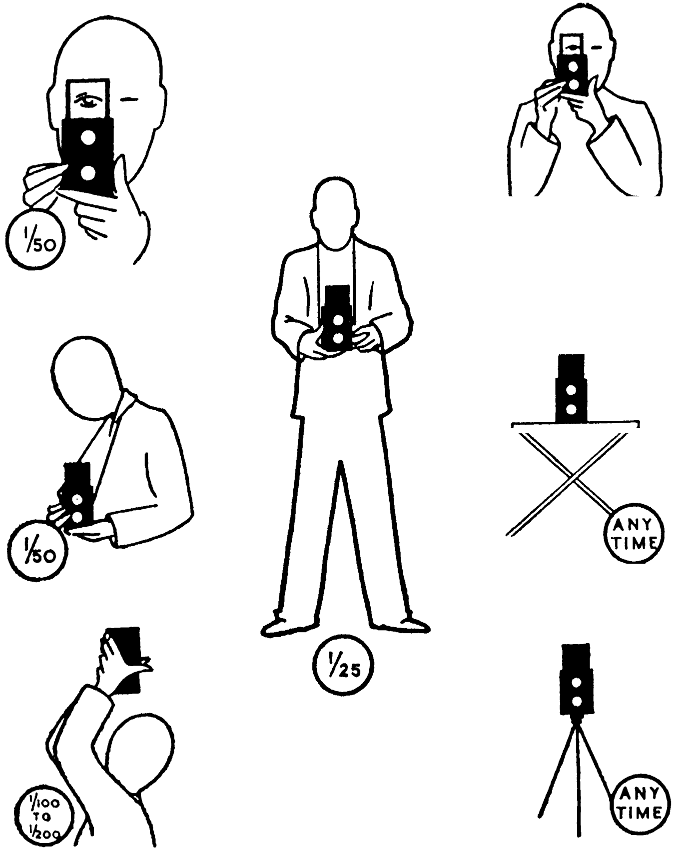
THE TECHNIQUE of using the viewfinder is simple enough ; particularly because of its large size, and the fact that the image observed is similar to the image which will appear on the film. All that is therefore necessary is to point the camera at the subject, and watch the image on the screen. The picture can then be composed at will.—See page 140.

In many cases the focusing screen has horizontal and vertical lines ruled on it. These serve several purposes. Firstly, they indicate approximate boundaries for composition if the picture is to be composed for a horizontal or vertical format. They also show how the picture space can be geometrically divided up for suitable placing of principal and subsidiary subject interest. Finally, they are very valuable guides for keeping the camera level, to avoid sloping horizons or converging verticals. Some models even have a spirit level for use when the camera has to be levelled accurately for exacting work.

One feature of this type of viewfinder is the lateral reversal already mentioned. This means that the picture on the screen is what we would see if we observed the scene in a mirror. This is, in fact, what we are doing. One quickly gets used to that, and after a very short time this reversal is not even noticed.

There is, however, one case where it is necessary to bear this in mind, namely, when following moving subjects. The natural tendency would be to move the camera in the direction in which the object appears to be moving on the screen in order to keep the subject in the reflex finder it is actually necessary to move the camera in the opposite direction.

Quite frequently moving objects are followed in the direct vision finder. There, of course, no reversal takes place.



Supported by its neck sling (or Ever-ready case) a shutter speed of 1/25 sec. is the slowest that can safely be given. When the camera is used at eye level, or in any of the less stable positions, a faster speed is recommended. A solid support or firm tripod is necessary for longer exposures.—See p. 50.

Always hold the camera still at moment of exposure, and release shutter slowly and gently.

FOCUSING

WE HAVE seen that the ground glass screen serves as a large viewfinder. In addition—and this is its most important function—it is used to ensure that the subject is accurately focused on the film.

When we turn the focusing knob, both the finder lens and the taking lens move forward or backward together. On some cameras they are both mounted on a common panel, and that moves forward as a whole; on others the lenses are coupled together and are screwed out or in during focusing. The effect is the same in each case; when the image is sharp on the top screen, it will also be sharp on the film.

The image on the screen is always under observation, and as the focusing knob is turned to or fro, the picture will be seen getting sharper or more blurred. As we watch the image getting sharper and then blurring again, we can obtain the position where it is at its sharpest.

One way of doing this is by the method known as "bracketing". We start with the camera set at infinity and slowly turn the knob until the image is sharp, and then just starts getting blurred again. We note the position of the knob at this point, and then turn it in the opposite direction until it is again just beyond the point of sharpness. We now have two settings of the knob with the point of sharpness somewhere in between.

The focusing knob is then turned in the opposite direction again, and by repeating the process we can narrow down our limiting settings between which the image appears sharp, until we get the most accurate point.

Really critical focusing is simplified in many models by the provision of a fold-away magnifying lens attached to the focusing hood. Through it the screen image may be examined at about double normal size, which is a considerable advantage. The drawback to its general use lies in the fact that the whole screen cannot be so examined, but only the central portion lying directly under the magnifier. It is worth noting that a larger area is visible if the eye is close to the magnifying lens, than when it is used with the camera in the customary chest-level position. As the screen is just as necessary for picture composition as for focusing, the usual compromise is to employ the magnifier while securing the sharpest definition on the principal object, and then to fold it away so that the whole screen is made available for composing and picture arrangement.

In many cases the viewing lens has a larger aperture than the taking lens. This means that the depth of field (see below) on the screen is rather less than on the film. The focusing image thus shows a much more rapid transition from sharp to unsharp, and accurate focusing is made easier, because we can better see when the image *is* sharp.

DEPTH OF FOCUS

NORMALLY, WHEN the eye looks at an object, that object is clearly defined, while everything nearer or further away is more or less blurred. A lens, however, has what is known as *depth of field* or *depth of focus.* This expression is used to describe the extent to which a lens can render near and distant objects sharply at the same time, and it deserves some consideration.

Strictly speaking, like the eye, no lens if properly corrected can focus more than one plane at a time ; which is of course the reason why our cameras are provided with such accurate focusing adjustment.

If a lens requires to be, e.g., precisely 3 inches from the film to give a sharp image of an object at infinity, it will have to be moved out to a slightly greater distance from the film to focus an object at say 20 feet distance. When this is done, the infinity (∞) object will be slightly unsharp. The rays of light forming the image of an object at infinity meet accurately at a point when the film is in position of exact focus, and then cross and commence separating again afterwards. If in order to focus a nearer object we move the film further away from the lens (or the lens further away from the film—which is the same thing), the object at infinity no longer records as a sharp point on the film, but as a somewhat blurred disc. Its size depends on the distance that we have had to separate the film and lens in order to get the nearer object sharp. This new distance between lens and film again depends on the closeness of the object on which we are trying to focus.

A sharp image is therefore formed when rays of light coming from any point of the object meet in a corresponding point on the film. If the lens-to-film distance is

(*Continued on p.* 61)

WHAT THE TWO LENSES OF THE TWIN-LENS CAMERA SEE is illustrated on the opposite page. The examples chosen are somewhat unfair to the better type of twin-lens cameras as they exaggerate what really happens, but the exaggeration is meant to carry a warning, as the fact remains that, particularly at close range, the viewing lens and the taking lens transmit views from a different point and at different angles.

The old cannon on London's Horse Guards' Parade (page 57 *top*) teaches that not everything may be on the film (*right*) that appears on the focusing screen (*left*).—See also p. 42.

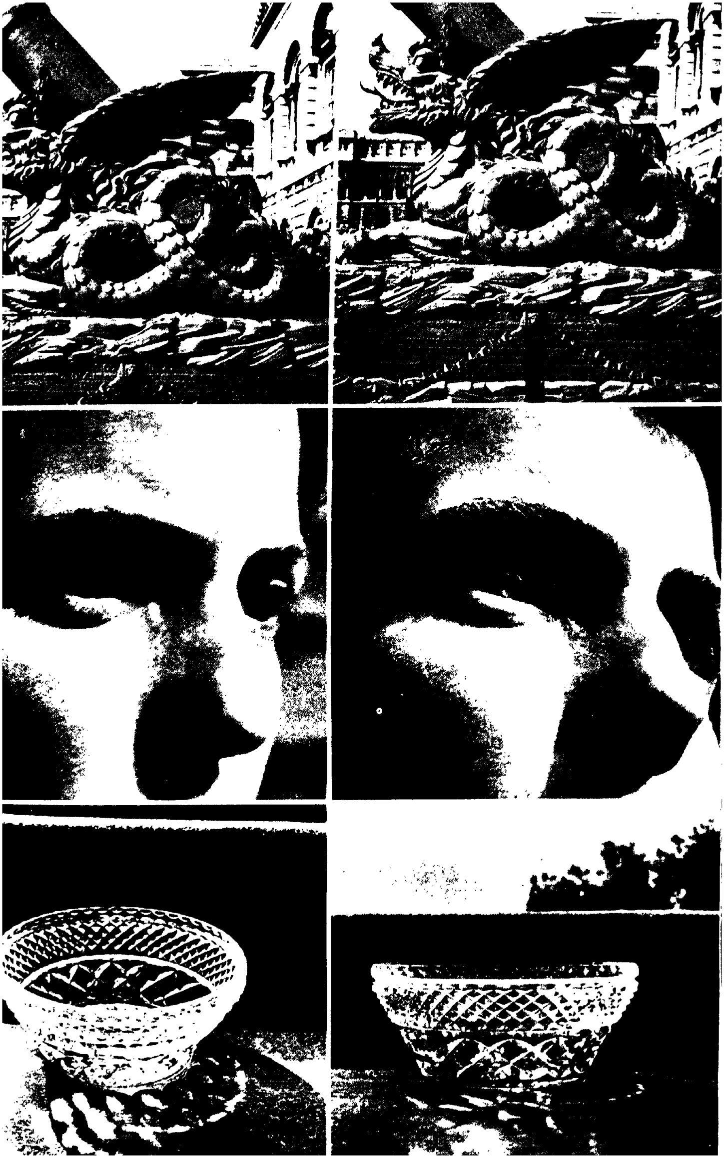
The face (page 57 *centre*) illustrates that if the camera is held too low, one is bound to photograph into the nostrils of the sitter (*right*), although this may not be so obvious on the screen (*left*).—See also p. 31.

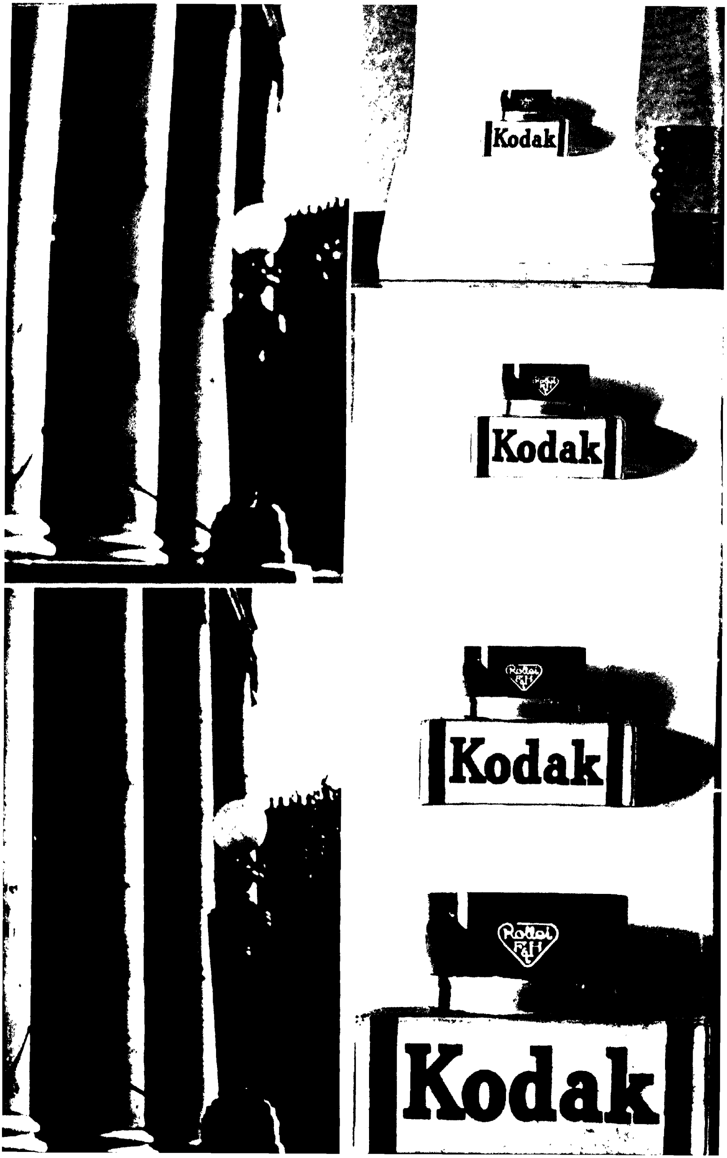
The glass bowl (page 57 *bottom*) taken at very close range again shows that while the viewing lens may seem to look down into the bowl (*left*), the taking lens from its lower position may record a view straight at it (*right*).—See also p. 42.

THE PROBLEM OF FOCUSING is illustrated on the next page. A large aperture means sharpness only in one plane (page 58 *top left*) ; a small stop embraces sharpness over several planes (*bottom left*).—See also p. 62.

Let us now see just how close we can get to a small subject with our twin-lens camera. The *top right* shot is taken at the normal closest focusing distance of 3½ feet. The *next lower* image is taken at 20 inches with a No. 1 Proxar lens added. The *next* image is taken at 13 inches with a No. 2 Proxar. The *bottom* image is obtained at 8 inches by two No. 2 Proxars superimposed on the taking lens of the camera.—See also p. 109.

(*Continued on p.* 61)

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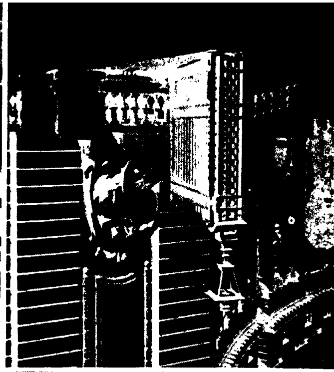


not quite correct, these corresponding points will no longer be points, but will have become definite blurs.

There is a definite size of such a blur which the eye will still perceive as a point, while if the blur gets larger, the eye will recognise it as a blur. In other words, if these points are small enough, then to the eye the whole image will appear sharp, but if the points are blurs larger than our limiting size, the image will not appear sharp.

The permissible limiting size of our blur—it is called the *circle of confusion*—is usually taken as about 1/1,000 to 1/1,500 of the focal length. For small negatives taken with a lens of short focal length the circle of confusion will have to be much smaller than for larger negatives taken with a lens of longer focal length. A small negative will have to be enlarged more than a large one to give a print of the same size. Therefore a small negative has to be correspondingly sharper than a larger one to give a print of the same degree of sharpness at a given picture size.

As we have seen, only one plane of the subject is reproduced absolutely sharp; everything nearer or further away from the camera will be a little blurred. The greater our tolerance in the size of our circle of confusion, or in other words the more blurred the image is allowed to become before we call it unsharp, the more we will be able to place our object in front of, or behind, the plane of maximum sharpness. Thus our depth of field, i.e., the distance of sharp reproduction in front of, or behind, the

EXPOSURE is illustrated on the following page. On the left (page 59) we have an under-exposed (*top*), a correctly exposed (*centre*) and an over-exposed (*bottom*) negative.—See also p. 76.

The greatest dangers to the exposure are unscreened light glaring into the camera used without a lens-hood, causing reflections within the elements of the lens and sometimes also halation on the film. Here we have an example (page 59 *right*).—See also p. 81.

THE USE OF FILTER and choice of materials is illustrated next.

Panchromatic film with a medium yellow filter gives a dramatic sky (page 60 *top*). The same landscape on orthochromatic film and without a filter seems barren of life (*bottom*).—See also pp. 97-8.

object focused on, is very directly connected with the size of the circle of confusion. This, incidentally, is the reason why depth of focus tables obtained from different sources for lenses of the same focal length are not always identical. The transition between sharp and unsharp is gradual and not sudden ; if a slightly different value is accepted for the circle of confusion, the exact distances for the depth of focus will be slightly different.

Even when the circle of confusion has been taken into account, the depth of focus varies with two other factors: the focal length of the lens and its aperture. Since the aperture is really the diameter of the lens relative to its focal length, we can say that the depth of focus varies with the diameter of the lens.

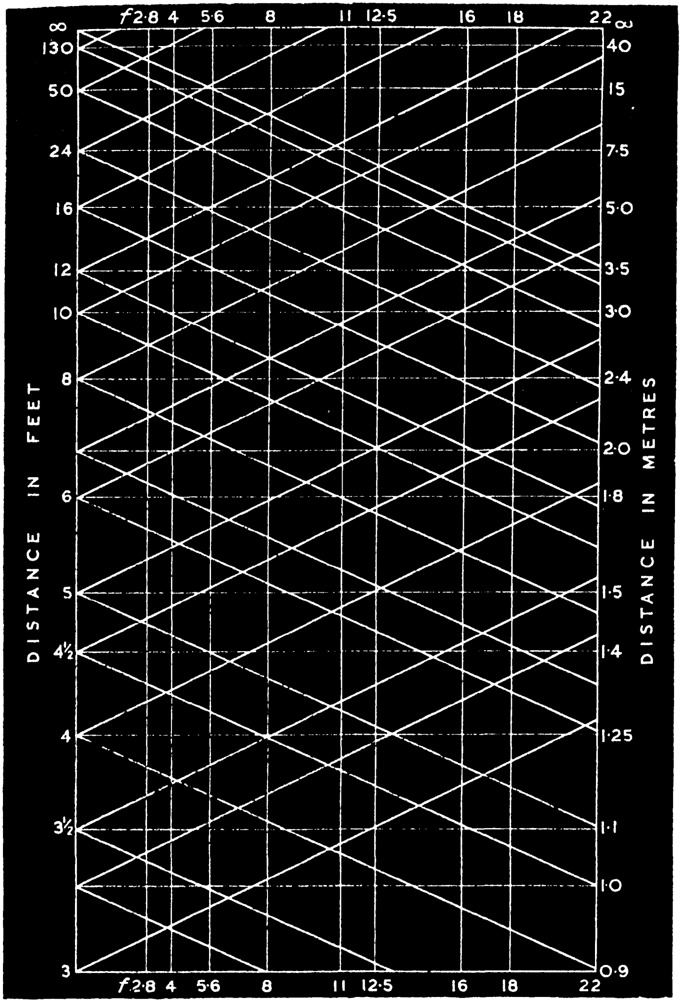
With a lens of wide diameter (large aperture for a given focal length) the rays converge rapidly beyond it. The circle of confusion will therefore reach its permissible size near the film. If we reduce the diameter of the lens (by " stopping down ") the rays coming from its edge will converge less rapidly in front of the focal plane and diverge less beyond it. The limiting size of our blur will therefore be reached more slowly and the depth of focus is greater.

Lenses of short focal length have a larger relative aperture (*f* number) for a given lens diameter. A twin-lens reflex camera therefore can be used with its lens at a larger aperture than a big camera with a lens of a greater focal length, and the depth of focus will still be similar.

The chart on page 63 shows how much will be sharp with lenses of focal lengths of 75–80 mm. (3–3⅙ inches) as used on most twin-lens reflex cameras.

Most twin-lens cameras are fitted with a *depth of focus indicator*. In some models this takes the form of engraved stop markings on the front of the shutter on either side of the pointer against which the focusing distances on the lens are read. In others a system is employed where the scale surrounds the knob by which the camera is focused. Both systems are used in the same way.

Suppose that we have focused on an object 24 feet distant. At full aperture there will be only a little latitude



For depth of focus follow diagonal lines from the focused distance on the left, and read off near and far distances on vertical stop lines, e.g., diagonal lines from the 5 feet mark cut the *f* 8 line at 4½ and 6 feet. Therefore depth at 5 feet and *f* 8 is 4½ to 6 feet.

either way. If we stop down the lens to *f* 5.6 and refer to the depth scale, we may find, say, the 15 feet and the 48 feet markings (on the focusing scale) are approximately adjacent to the two *f* 5.6 markings on the depth scale.

This indicates that at that particular aperture (*f* 5.6) any object beyond 15 feet and closer than 48 feet will be sufficiently sharp to come within our required limits. If we stop down our lens to *f* 11 (while still focused on 24 feet) the scale indicates that sharpness then exists from 12 feet right up to infinity.

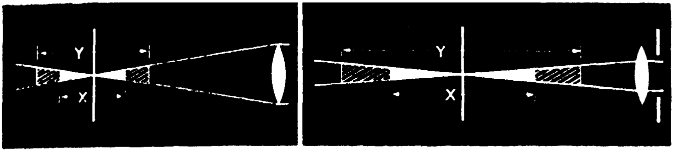
I consider that the depth of focus scale is one of the most useful features on any miniature camera. Many owners, however, do not derive anything like their full value from it. Travel pictures, street scenes, sports shots and similar subjects are frequently something of a problem simply because the photographer does not know on what object to focus accurately in order to achieve the best all-over sharpness.

There is a system to overcome this difficulty known as "two point" or "zone" focusing, which is quite simple and ingenious.

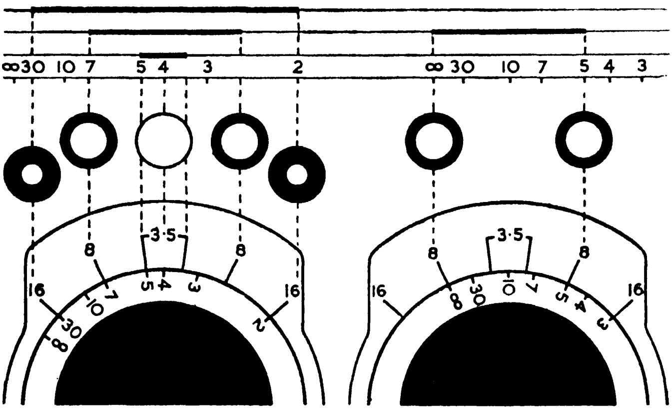
ZONE FOCUSING

BY SETTING the stop to a certain aperture (usually *f* 11) and the focus to a certain other point (usually about 15–20 feet, or 5–6 metres), any object further away than about 12 feet (4 metres) will be reasonably sharp. On many cameras these two settings of aperture and focusing are clearly marked—often in red figures or by red dots—hence the name "two point" focusing. Such settings are quite practicable under good lighting conditions.

In effect this system is really a greatly simplified depth of focus scale. We can express it in the following form :

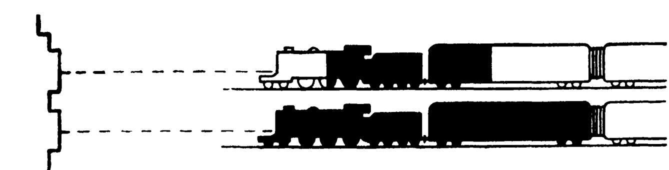


Small aperture gives greater depth of focus (*right*) than a large one (*left*). Since rays converge and diverge less with small aperture, the film can be moved appreciably before a " point " exceeds the circle of confusion. Large circle of confusion (Y) means more depth than a small circle (X).—See p. 61.



A typical depth of focus scale (*left*). Focused on 4 metres, at *f* 3.5 there is little depth (say 3.5 to 5 metres) while at *f* 16 depth extends from 2 metres to 30 metres.—See p. 62.

The hyperfocal distance (*right*) at *f* 8 is about 10 metres. At this setting objects are sharp from 5 metres to infinity.—See p. 68.



The taking lens usually has a smaller aperture than the finder lens and so has greater depth of focus.—See p. 30.

CONVENIENT TWO-POINT SETTINGS

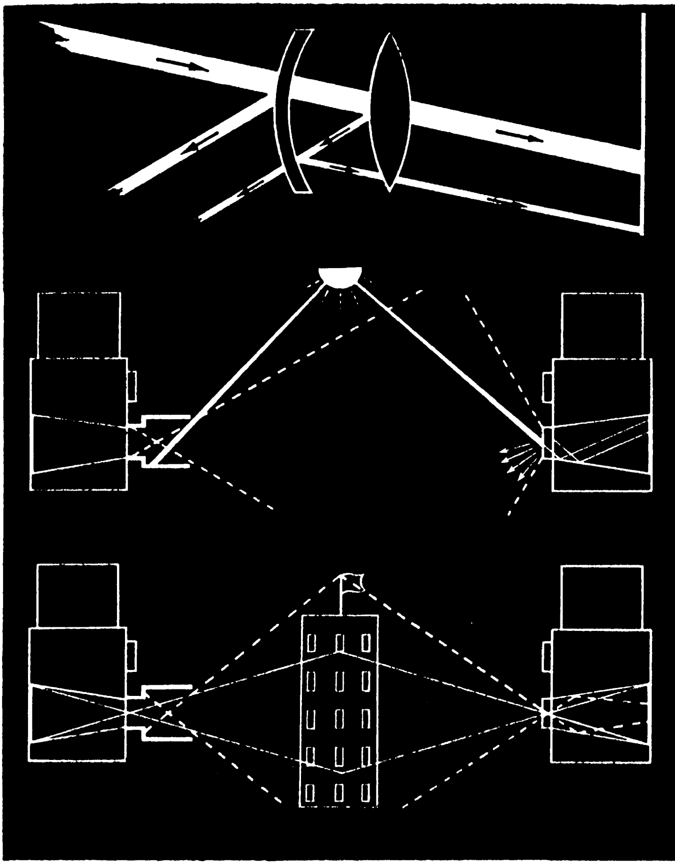
Distance focused on		*Stop*	*Range of sharpness* *From*		*To*	
Metres	*Feet*		*Metres*	*Feet*	*Metres*	*Feet*
4	13	*f*8–9	2.8	9	6.5	21
6.5	21	*f*8–9	4	13	15	50
10	33	*f*8–9	5	16½	∞	
4	13	*f*11–12.5	2.4	8	13	43
6.5	21	*f*11–12.5	3.3	11	∞	

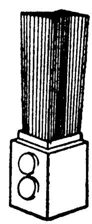
The outdoor photographer frequently requires sharp focus simultaneously on objects close to the camera and in the extreme distance. As will be appreciated from the foregoing, there are definite optical limitations to the extent to which this is possible, imposed by the aperture of the lens that can be employed.

In brilliant weather, adequate depth of focus can usually be secured by stopping down to the smallest aperture available—but under other conditions this may be impracticable for a variety of reasons, e.g., the necessity for a very short exposure to arrest movement.

Many distant landscapes are exposed with the camera set at infinity. While this ensures that the extreme distance will be sharp, without regard to the lens aperture employed, there may be other closer objects to be rendered sharply which will be outside the limits of the depth available at an infinity setting for the particular aperture used. We have seen that depth of focus extends on both sides of the distance focused on. We are therefore necessarily *wasting* some of this available depth by focusing on infinity itself, as no object can be *more* distant. If we desire to secure the maximum possible depth (including infinity). we may safely set the camera to some intermediate distance, which will vary according to the actual lens aperture that we employ.

The depth of focus scale on the camera enables us to select the correct setting without the need for optical





Top : How " ghost " images are produced by lens surface reflection.—See p. 70.

Centre : A lens hood protects the lens from strong light outside the picture area.—See p. 70.

Bottom : A suitable lens hood reduces the cone of light, and so cuts out internal reflections from the camera body.

An extension hood (*bottom right*) can be used to make focusing and composition easy in bright light.—See p. 69.

knowledge or complicated calculations. Provided that the camera is set so that the mark on the depth scale corresponding to the lens aperture to be used is opposite the infinity mark on the focusing scale, adequately sharp definition will be secured at infinity. Definition which will at least be equal to this will extend down to objects not closer than the distance adjacent to the similar stop marking at the other end of the depth scale. The point of *accurate* focus, will lie somewhere between these two points, but the actual distance in fact does not concern us, as we know that everything will be reasonably sharp, from the near object right through to infinity. At the same time we must remember that this is a compromise, since the point of accurate focus is still sharpest, with definition decreasing slightly on both sides of it.

The above principle is known as the *hyperfocal distance* setting. The hyperfocal distance is the distance on which we must focus to get the maximum depth of focus reaching to infinity. It varies with the aperture at which the lens is used, and it is, in fact, the nearest focusing distance at which the depth of focus still extends to infinity. If an object at the hyperfocal distance is focused on, the depth of focus will extend altogether from infinity to *half* the hyperfocal distance. Incidentally, if we set the focus to infinity, the depth of focus goes down only to the hyperfocal distance itself.

From our discussion on sharpness and focus we have seen that our standard of sharpness or our circle of confusion has much to do with the depth of focus. Similarly it also affects the hyperfocal distance. In the same way the aperture and focal length of the lens also affect the value of hyperfocal distance. This is, therefore, not a fixed entity, but depends on several factors, including the arbitrary standard of what we are to call sharp or unsharp.

Though calculation of the hyperfocal distance is possible, we can find it far more easily on our depth of focus indicator in the way we have already described. We set the infinity mark on the focusing scale opposite the required aperture mark on the depth of focus indicator. The point focused on will then be the approximate hyperfocal distance for that aperture.

This application of the depth of focus scale is, I think, one of its most valuable aids to landscape work. A little practice in the use of the focusing scale along these lines will considerably increase the percentage of good results.

FOCUSING HOOD AND LENS HOOD

THE USER of any miniature reflex will, at some time or other, find it difficult to focus and compose his picture because the metal hood is so short that it does not adequately exclude outside light. Some camera makers provide a collapsible light leather extension to fit over the metal hood lengthening it to about 8 or 9 inches. This is a considerable aid and if your camera dealer cannot supply one, a substitute can easily be made from stiff black paper or thin cardboard. It takes up little room in the pocket.

Just as extraneous light is a nuisance on the screen when focusing, so is unwanted light in or around the optical system of the camera itself, and to my mind a lens hood is by far the most important accessory available to any camera user.

In America the photographer refers to his "sunshade" in describing this article. I rather deplore that name for it, as it suggests that unless the sun is shining there is no need for such protection. I admit that then a hood is more necessary than at other times, but I would like to emphasise that it does a lot of good, and cannot do any harm, whatever the conditions of weather may be.

Consider its purposes. Have you ever been unable to see through the windscreen of your car because of the rays of the sun shining across it? I expect you have—well, your film has just as much difficulty in recording a clear image of what is in front of the lens when the sunshine glints on the front glass.

Furthermore, that same glint is starting a series of reflections between the several glasses of which the lens is composed, and one or more of these will probably throw an image of some of these reflections on to the surface of the film—causing possibly a circular or other design of greater density on the developed film. This we call a *flare-spot*.

As any ray of unscreened light which reaches the front of the lens is liable to cause this trouble, a " danger angle " exists—from both sides and in front of the camera—of 170 to 180 degrees. If the sun is within this arc, its effect may well ruin the negative. A lens hood will shield the lens considerably so that side light cannot reach it and we can then safely point the camera much closer to the source of light than we could otherwise. As many of the most attractive pictures are secured when facing more or less into the light, the use of a hood is important.

A further advantage of a lens hood, whether the sun is shining or not, lies in minimising internal light reflections from the inside of the camera body itself. Because a lens is required to cover the whole of the film equally well, and because its illumination must also be uniform over the whole picture, all lenses are made so that they pass a cone of light substantially wider than is needed for the size of the negative itself. This cone naturally impinges on the inside of the camera body, and in most cases a certain amount of the light is reflected on to the edges of the film, which are fogged to some slight extent. Different camera makers limit this trouble in various ways by internal masks or tubes ; but the use of an external lens hood, particularly a square one, will reduce the trouble to a point where it can be ignored.

If the hood is square in shape, it limits the cone of light to the shape required to form the image, and it can be made longer, proportionally, than could a round one. It thus allows us to work with a still narrower danger angle than would be possible with a cylindrical or conical hood.

We can find the danger angle for any particular hood quite simply if we mount the camera on a tripod, and carry a lighted lamp across in front of it with the hood in position. We carefully watch the front of the lens; if we note the two extreme positions of the lamp where the hood casts a shadow over the *whole* of the glass of the front lens cell, and we then remember the position or the direction of the lamp in relation to the camera, we can estimate fairly easily whether the hood is providing the necessary protection on a sunny day in the field.

Often the most attractive of these *contre-jour* pictures are taken looking almost directly into the sun; in this position obviously no hood will afford protection without cutting off some of the image. In such cases it is sometimes possible to find a tree, hanging branch, an inn sign; or even a lamp post which may be part of the intended picture or can be placed at the extreme edge of it. We can then take up such a camera position that the sun itself is actually obscured by this object. In other words we move so that the camera lens is in the shadow of the tree (or whatever it may be). We can easily observe the effect on the focusing screen, and it is a very practical lesson in the value of a lens hood to note how the image on the screen clears up and improves in contrast when the viewing lens is moved into such a shadow.

A lens hood is also a very valuable accessory when making pictures in the rain—it keeps the lens dry and avoids unsharp or misty pictures resulting from rain drops on the surface of the lens itself.

THE FILM

SO FAR, we have considered the apparatus itself and the best methods of handling it. We must now turn to the characteristics of the materials that we can use, and how they should best be employed to produce the result that we require.

At the outset, I would impress on the reader that there are no intrinsically good or bad films, as long as the products of reputable manufacturers are used. Certain films have characteristics that make them particulary suited to specific tasks, and here I hope to give some guidance. At the same time I do warn against the tendency to chop and change from one make to another simply because—as the old lady is reputed to have said: " even the advertisements speak well of it".

With this in mind, there is not much to choose between different *makes* of film, but there is quite an appreciable difference between film *types.*

Principally, film types differ in two respects, their colour sensitivity, and their speed.

What we reckon to be white daylight is actually the combination of light of all the colours of the spectrum—as can be proved by allowing a ray of sunshine to pass through a glass prism, which splits it up into its components.

Now the human eye is sensitive to all these visible colours, and if asked to translate them into terms of grey would indicate the yellow as a very light shade, the red appreciably darker, and, say, the violet quite dark. The film, however, does not necessarily see the colours as completely or in the same way as we do. In fact some of the earlier films were practically blind to all colours except blue, violet and the invisible ultra violet rays.

The films that we use come under several headings:

Non colour-sensitive films: these, as mentioned above, are sensitive only to ultra-violet, violet, blue, and blue-green.

Orthochromatic films (Ortho for short): these are sensitive to the same colours as the non-colour sensitive emulsions, and in addition to green and yellow.

Panchromatic films (Pan for short): are sensitive to all visible colours of the spectrum.

Normally all films are relatively much more sensitive to blue and violet than the eye, which is most sensitive to yellow. The colour sensitivity of films, therefore, decreases from violet to yellow, while that of the eye increases over the same range of the spectrum.

In addition all films, pan and ortho, are made in a variety of speeds. The only basic difference between fast and slow films is that the latter require a longer exposure under any given conditions to produce a properly exposed negative. With a few exceptions we can use any or all of these types of material for the majority of the subjects that we shall be taking.

Almost all the makers now offer a range of roll films which includes something like the following :

A rapid highly orthochromatic film (usually called 'chrome).

A slow fine grain panchromatic film.

A fast panchromatic film.

For most of our ordinary work—landscape, travel, holiday pictures, etc., the lack of red-sensitivity in ortho films is of no great importance.

For taking pictures of flowers, or for anything which includes red objects, pan film should be chosen, as on any other material the reds will be recorded very dark (or even black).

A fast film is desirable whenever we require pictures in poor light; or use brief exposures (thereby arresting movement). Fast films are, unfortunately, unable to resolve very fine detail, or to enlarge quite as well as slower emulsions, and are inclined to be relatively more *grainy*.

What is grain? The sensitive surface of any film consists of an emulsion of a complex mixture of silver salts suspended in gelatine. When a film is developed, these silver salts blacken in proportion to the extent to which they have been affected by light, and the individual grains that are then formed tend to amalgamate, and clump together until they become visible to the eye at relatively low magnification. These clumps, so often mistaken for the silver grains themselves (which are far too small to be individually discernible even under a microscope) are the cause of the mottled graininess visible in extreme enlargements.

Other things being equal, the larger the individual particles of silver salts in the emulsion, the more rapid the film will be. While film speed depends not only on the grain size, it is usually true to say that faster films tend to be more grainy than slow ones. So, when a negative should enlarge considerably without objectionable grain appearing in the print, it is best to choose one of the slower films. This granularity can, however, be largely minimised by suitable processing methods. We shall discuss these when we come to deal with development.

FILM CHARACTERISTICS

Film	*Grain*	*Relative speed to daylight*	*Colour sensitivity*	*Film gradation*
Agfa				
Isopan I.S.S.	Medium	80	Pan	Medium
Ansco				
Plenachrome	Fine	50	Ortho	Medium
Superpan Supreme	Fine	50	Pan	Medium
Superpan Press	Medium	100	Pan	Soft
Ensign				
Ultrachrome	Medium	30	Ortho	Medium
F.G. Pan	Very Fine	20	Pan	Medium
Ultrapan	Medium	70	Pan	Soft
Gevaert				
Superchrome	Medium	24	Ortho	Hard
Panchromosa	Medium	60	Pan	Medium
Kodak				
Verichrome	Medium	48	Ortho	Medium
Panatomic X	Very Fine	24	Pan	Med. Hard
Plux X	Fine	40	Pan	Medium
Super XX	Medium	80	Pan	Soft
Selo (Ilford)				
Selochrome	Fine	40	Ortho	Medium
H.P. 3	Medium Fine	80	Pan	Soft

For general purposes then, my preference is for the slow fine grain panchromatic material. I find that it is adequately rapid for all normal work, and its full colour sensitivity is useful in allowing me to get the best value from my colour filters.

For indoor work—portraits, etc., or for use at the theatre, I choose one of the most rapid panchromatic films. Although this has a somewhat coarser grain than my usual choice, I find that it will still produce satisfactory enlargements to most sizes that I am likely to want.

Chrome (rapid ortho) film I find very useful in winter. Although not as fast as the super rapid pan films, ortho material possesses more " snap "—a very useful quality for securing bright clear pictures when the light is dull and there is little or no contrast in the subject itself.

For pictures on the water or against the light—a type of subject that I cannot resist—the slow pan and the more rapid ortho are both excellent, as they can usually cope adequately with high contrasts.

FILM GRADATION

WHEN WE make an exposure, we open the shutter for a certain predetermined length of time. This depends on the speed of the film in use, the colour and strength of the light, the size of the lens aperture, the nature and colour of the subject itself, and the type of result desired.

To secure a really satisfactory negative, all these variables have to be taken into account. I am intentionally at this stage ignoring subject movement, as I shall deal with that later, and in any case it has no connection with our present problem—the amount of light which is required to affect the film in such a way as to produce a "perfect" negative.

What is a perfect negative? I would say one that has been affected by the light just sufficiently to produce on development a facsimile, in reverse, of all the tones in the original subject; a negative in which an intensely white object is depicted as an almost opaque black, and in which a dead black object is recorded as almost clear celluloid, with all other tones in the original rendered as inversely proportional steps of light or dark grey.

Such a theoretically perfect negative is somewhat rare, because few normal subjects embrace the whole gamut of tones from black to white, and it is by no means every film that could record them faithfully.

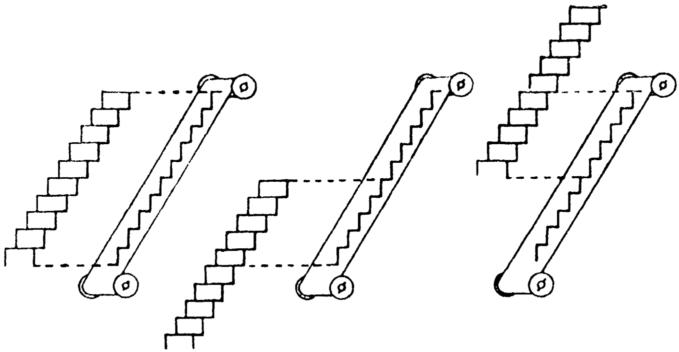
If the subject is one with a long range of tones from light to dark, and if the film is just capable of dealing with that range, it can only do so successfully, if the exposure given is correct. If you imagine, for a moment, that the film has the ability to record 100 different tones, and that the subject is one in which these 100 tones exist, it will be realised that they can only be recorded on the film if the exposure *exactly* suits the film and the amount of light reflected from the subject.

If too little exposure is given, some of the darker parts of the subject will not record on the film at all, while the top end of the film scale will not be utilised to record the highest lights of the subject. Similarly—if too long an exposure is given, the lowest tone in the subject will be recorded some way up the film scale, and there will be no differentiation between the various lighter tones of the subject, because they are overexposed to an extent which places them outside the receptive capacity of the film.

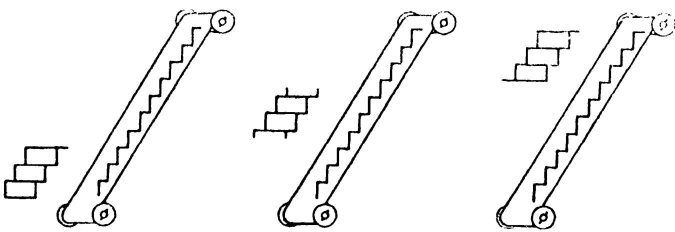
For purely illustrative purposes, we can imagine the density producing capacity of the film as a staircase of uniform gradient. In actual practice the *curve* of a film (as it is called) does not follow quite so straight a line as this. If a representative film is given a series of exposures from zero to the maximum that it can accommodate, and if the resulting densities are carefully measured after development, it will be found that when plotted against the logarithm of the exposure, they produce an S-shaped curve, rather than a straight line. (The logarithm of the exposure essentially means that for each step on the horizontal scale of the graph the exposure is that of the previous step multiplied by a given factor.)

Let us assume that there are again 100 steps of different exposures represented in this curve. There is a greater difference in density between, say exposures 50 and 60, than there is between (at the low end) 10 and 20, or (at the other end of the scale) between 80 and 90 or 90 and 100.

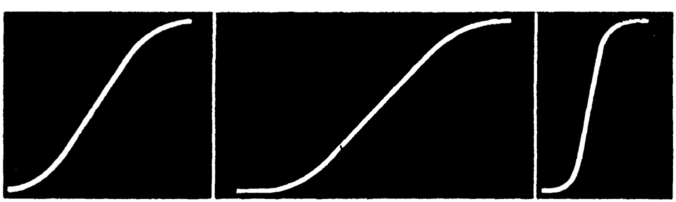
This is because the film curve tends to flatten out somewhat at the starting "toe" and again at the top "shoulder" which causes insufficient separation of tones



A contrasty subject here shown as a staircase, should be accurately exposed to "fit" it into the film scale (*left*). By under-exposure (*centre*) or over-exposure (*right*) tones will be lost.—See p. 76.



A short scale subject can satisfactorily be reproduced with several different exposures, so long as they are within the film scale. The negative density will vary with the exposure.—See p. 79.



Left : Curve of normal film. *Centre :* Curve of "soft" film. This requires more additional exposure to produce maximum density. *Right :* Curve of "contrasty" film. This reaches maximum density quickly, has a short scale, and exaggerates tone differences.—See p. 79.

(or difference between the rendering of any tones that fall on this part of the curve).

Practically every film curve has this same characteristic. As the majority of normal photographic subjects do not offer as wide a range of contrast as the average film is capable of recording, we are able by accurately calculating the exposure to place the subject matter on the film curve, so that the bulk of the desired tones range over the straight line portion of the curve. There, the different tones will be adequately spaced out, and recorded with a reasonable degree of truth.

If we underexpose, much of the picture will fall on the toe of the curve, where the tone separation will be depressed to an unnatural extent, and only the brighter parts of the subject will be recorded on the straight line portion. If, on the other hand, we overexpose, the shadow parts of the subject will be well up the straight line, and will be satisfactorily recorded, but the brighter parts will all fall on (or even above) the flattening shoulder. This will in turn compress these tones, so that there is insufficient separation between them, and the resulting print from this negative will lack high-light detail and contrast, although its shadow areas will be well rendered.

With any long scale subject in which tones range from very light down to very dark, the exposure must therefore be accurate, so as to use the straight line portion of the curve for the bulk of the picture, allowing only the very lightest tones to get on to the shoulder and the darkest shadows to occupy the toe.

LATITUDE

IF THE subject has a fairly short scale composed of light tones only, or a short range of the darker tones, then the need for extreme accuracy is not so vital. If, for example, the tone range covers only 20 such steps we can expose so as to place this range between say, 30 and 50, 40 and 60, or even 50 and 70 on the scale without getting outside the straight line portion. We thus have a certain latitude in the exact placing of the tone range of the subject on the straight line portion of the curve of the film.

This is precisely what exposure latitude, so often mentioned in connection with films, means. It represents the amount by which we can vary exposure, and still get a satisfactory negative with the tones correctly separated. Exposure latitude is sometimes quoted in terms of the proportions of minimum and maximum correct exposure. In our case above, if we call the minimum exposure 1 unit, then 5 times this exposure will still accommodate the tone range of 20 steps of our subject on the straight line part of 100 steps of the film. The exposure latitude is 1:5; it is the contrast range the film can deal with, divided by the contrast range of the subject it is actually recording.

The exposure latitude is, therefore, not a fixed entity. If we give our subject a contrast range of, say, 40 steps, the latitude will only be 1:2.5. The latitude therefore depends on the contrast of the subject, and is, in fact inversely proportional to it. If the contrast of the subject becomes the same as the maximum contrast range of the film, there is only one correct exposure with no latitude; if the contrast of the subject is still higher, it cannot be reproduced correctly at all in its entirety.

Up to now we have assumed that our film can deal with a contrast range of 100 steps. This however, is not a fixed factor, either. Some films are inherently *contrasty*—some are inclined to be *soft*. By this I mean that if one were to photograph a monochrome scale of grey steps on the two films, the resulting negative would show in one case a greater contrast between the respective steps than in the original, while in the other case the difference would be less marked.

In terms of our staircase or film curve we can say that for contrasty films the gradient is steeper than for soft-working ones. That is, for equal exposure increases the difference in density is greater with the contrasty film than with the other. It also means that the top of the staircase is reached rather quickly, and in relatively few steps, by the contrasty film, while it is reached slowly, requiring many small steps, with the soft-working emulsion. Because of the few steps with contrasty films the subject contrast the film can accommodate is rather limited. Thus the harder or more contrasty a film is, the greater the contrast of a subject reproduced on the film, but the smaller the contrast range the film can handle.

While speed is itself not dependant on contrast, the slower films on the market are usually made comparatively contrasty, while the fast ones are made soft and so they can deal with a long range of contrasts.

Disregarding the question of speed as such, a soft film can usefully be employed on any subject with a considerable range of tones, while a hard film can be used for a subject which is in itself flat or lacking in contrast.

The extent to which any negative increases or decreases the contrast scale of the original subject is also largely governed, as we shall see later, by development; but as normal full development is necessary to secure the full working speed of any film, we must for the moment assume this. We then find that some films regularly produce contrasty negatives, while other types are inclined to be soft.

We have already seen that exposure latitude is the ratio of the subject contrast to the contrast range the film can cope with. Since the latter factor is also a variable one, the exposure latitude depends on the film contrast range. The two are in fact proportional. If we go back to our staircase and the subject with twenty steps, it is obvious that if the staircase has 200 instead of 100 steps, there is much more room for the subject to move up and down. In other words, the latitude has increased; to be exact, it is now twice as much as before.

We can then say that the lower the subject contrast, the greater the latitude. Also, the larger the available contrast range of the film (i.e., the softer working the film), the greater the latitude.

To secure exceptional latitude some films are *double coated.* That is to say, they have two emulsions superimposed on the celluloid base. The top (outside) emulsion is a rapid type, and this is backed up by a considerably slower emulsion. The underlying idea is that the fast emulsion will secure a satisfactory picture with the minimum exposure. If by accident, or as a safety measure, considerably more exposure is given, much of the rapid layer will be used up, while the slow layer behind it will build up a good printable image even if the appearance of the negative as a whole is somewhat dense. In principle, this is nothing more than an extension of the available contrast range of the film. The provision of two emulsions means that the maximum density obtainable with the negative material is increased. While the actual steepness of the contrast staircase is not greatly changed, this extra density is equivalent to an extra bit built on to the top, thus increasing the available number of steps.

STRAY LIGHT

WITH SUCH apparently great advantages of double coating one may be excused for asking why all films are not so constructed. There is unfortunately one objection against this type of material when the results have to be considerably enlarged. All film emulsions have a measureable thickness (although it is measured in 1/1,000ths of a millimetre), and the thinner an emulsion is, the sharper will be the image of anything it portrays.

When a ray of light enters the face of the film it affects those silver bromide grains immediately in its path; and as it penetrates the emulsion it becomes reflected and scattered by the grains on which it impinges. This scatter effect is largely proportional to the thickness of the gelatine film, and a relatively thick double-coated film is necessarily at a disadvantage compared with one with a thin emulsion. As the ray of light is scattered, it creates a diffused blob of affected silver instead of a more or less sharply defined point. For this reason, therefore, the thinner the emulsion of a film can be, the sharper will be the resulting print.

This scattering of light is known as *irradiation*, and its degree to some extent also depends on the brightness of the image. The maximum sharpness of an image that can be recorded by a film, is its resolving power. Irradiation is thus reduced, and resolving power increased, by a thin emulsion, while with comparatively thick layers, as found in double-coated films, both these are more unfavourable.

Apart from irradiation, there is also another similar phenomenon, known as *halation*. When a ray of bright light penetrates a film, as for example, from an unscreened lamp in an interior photograph, it is probably strong enough to penetrate the emulsion and the celluloid base. There, some of it will go straight on while a proportion will be reflected back from the outer celluloid surface into the emulsion where it will again affect the light sensitive grains. In passing twice through this somewhat turgid medium it will probably reproduce a sharp point of light as a black dot surrounded by another concentric ring of lesser density. To overcome this fault of halation, film makers interpose a soluble coloured "backing" between the film and the celluloid or coat the back of the base with a gelatine film containing a soluble dye; or even employ celluloid of a grey or mauve colour. All these methods are efficient, particularly when combined with a double-coated emulsion, but my preference is for the soluble backing which disappears in the developer, and thus leaves a cleaner looking negative than one on a tinted base.

CORRECT EXPOSURE

WE HAVE seen that reasonably correct exposure is necessary to obtain good results, and that applies to all photography, irrespective of the camera used.

There are various ways of determining the exposure needed to produce a good negative. A very popular one is the use of exposure tables. Here the various factors affecting the exposure needed (strength of light in terms of day and year, weather, type of subject, film speed, aperture, etc.), are tabulated, and each is given a series of values, according to how favourable these factors are. The exposure is then calculated, usually by adding up the appropriate values, and seeing what exposure time (in another part of the table) corresponds to the sum of these added numbers.

No tables are given in this book, as the exposure is generally calculated on the spot, and the reader will not usually wish to carry a book on photography with him when he goes out taking pictures. There are, however, such tables and exposure charts (where much of the adding of values is eliminated) on the market. These can easily be carried with the camera and are available for quick reference when required.

Apart from calculating the exposure time, it can be determined by *measuring* the strength of light. Again, several methods are available. The older types of exposure meter relied on measuring the time taken for a piece of sensitised paper to darken to a definite tint, while others depend on visual examination by transmitted light of a series of increasingly opaque numbers. The former were uncomfortably slow, while the latter were apt to be inaccurate owing to the personal factor involved in estimating the opacity of the numbers.

As a quick and independent measurement of the strength of the light is desirable, most exposure meters in common use nowadays are of the *photo-electric* type. There are many such instruments on the market, and although they are found in a variety of shapes and sizes, they all employ the same fundamental principle. Basically these meters consist of a photo-electric cell (usually of the selenium type) which has the property of generating a very minute electric current when exposed to the action of light. The amount of electricity generated is in direct proportion to the strength of the light acting on the cell, and its effect is made visible by the extent to which the indicating needle of a micro-ammeter is deflected.

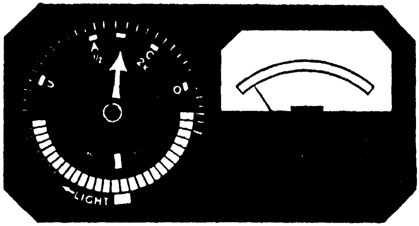
In use, the meter is generally held so that it points towards the subject to be photographed, when the needle is more or less deflected over a calibrated scale, according to the brightness of the subject under examination. The extent to which the needle has moved is then read off in terms of exposure at various stops; this is done either directly, or by means of an easily adjusted sliding or rotating scale.

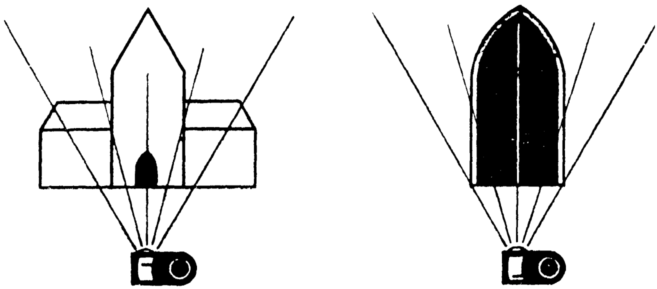
There is a tendency to suppose that pointing the meter more or less in the direction of the subject is all that is required to find the exact exposure. Unfortunately it is not quite as simple as that, for the meter is affected by *all the light that reaches it*, and that may be very different from the light reflected by that particular part of the field of view that we wish to photograph.

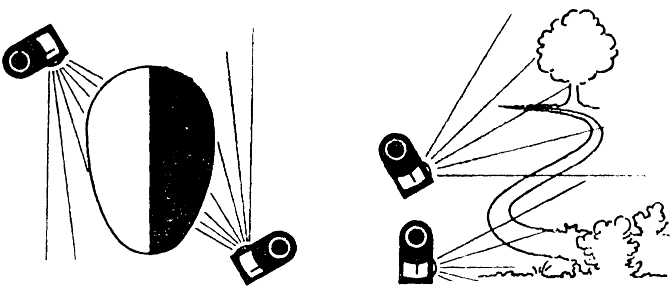
Meters record all the light reflected by what is in front of their cell; but all meters have a definite *acceptance angle* and will be influenced only by reflected light within this angle. In the case of the majority of the better meters this angle is in the vicinity of 60 degrees, but some meters can "see" over very nearly 100 degrees and others are so designed that their vision is limited to only about 25–30 degrees. The makers' instruction books usually give accurate information on this point.

To use a meter satisfactorily, it must only see that part of the subject which is to be photographed. To ensure this we should approach the subject until we are certain that the meter can only record the light from the desired area. This means approaching the subject to a distance corresponding approximately to the *width of the subject itself*. If, for example, the correct exposure for a standing figure is required, most meters will record it if used at a distance of *not more than two feet from the figure*.

Provided that there is not much difference in the







Top : Weston meter showing the " U " and " O " scale markings.
Centre : The meter reacts to what it " sees " For a church door shot, the meter should only measure the door. So hold it close to the door (*right*) to avoid the influence of light surroundings.—See p. 84.
Bottom left : Reading both highlights and shadows to determine best average exposure.—See p. 86.
Bottom right : When unable to measure light from a distant object, a nearby substitute of similar tone can be used.

brilliance of the various parts of the subject, a meter used in this way will always show a satisfactorily correct exposure. It must, however, be borne in mind that not every subject is quite so accommodating. Suppose, for example, that we wish to photograph a person in dark clothes, seated in front of a white wall. At a distance of, say, 15 feet the meter may tell us that the exposure required is 1/100 second at *f* 11. If, however, we approach to say 7 feet we shall very likely find that the exposure recommended is about 1/25 second at *f* 11.

Obviously, the light reflected by the *figure* is the same in both cases, but the fact that the figure is only a small part of the picture has allowed the meter to be unduly influenced by the reflection from the relatively large expanse of white wall. *In either of these cases the exposure is inadequate for the figure, and the meter is striving to tell us what compromise exposure is required for a subject comprising in one case perhaps* 10 *per cent black and* 90 *per cent white, and in the other, about* 40 *per cent black and only* 60 *per cent light tone.*

Clearly this is a case where, if we are concerned with exposing the *figure* correctly, we must approach it to a point which entirely excludes the misleading background. The correct exposure may then prove to be about 1/25 second at *f* 5.6. If, however, we require to expose correctly for *both* the white wall *and* some other dark object, we shall be forced to compromise by giving what is really a little too short an exposure for the dark parts of the picture, but what at the same time is really too long an exposure for the white wall, relying on the latitude of the film to make the best of a difficult job. In such circumstances, instead of taking a general reading it is wise to take *two* separate measurements; one of the darkest parts in which detail is required, the other of the lightest parts in which we desire tone differentiation. If these indicate, for example, exposures of 1/25 second at *f* 2.8 and 1/25 second at *f* 22 respectively, the safest plan is then to expose at (say) 1/25 second at *f* 8, i.e., about midway between these two extremes.

If the areas of bright and dark parts of the subjects are more or less equal, a single reading with the meter for the whole subject will give this integration automatically. It is chiefly with subjects where the relative amounts of highlights and shadows are greatly different that this method of separate readings gives the better result.

In this way the extreme highlights may be right up to the flat shoulder of the film curve, and the darker shadows down in the toe region, but you will have done the best that you can to get them both, and the other intermediate tones all on the film at the same time.

If we take separate readings of the highlights and shadows, we can also fix the amount to which we want to compromise in either direction. Thus we may want to give the shadows more exposure so that we obtain good rendering of detail there, even at the expense of blank highlights. In a case like this we only go by the shadow reading. Conversely, we can neglect the shadows completely, but concentrate on the highlights only.

The meter that I most generally use, the Weston Master, is calibrated in a particularly convenient way for use with such extreme subjects. Its scale is marked in candles per square foot from 0.2 up to 1,600. Its moving dial has, in addition to the normal arrow, two pointers marked U. and O. respectively. These are designed to show the limits of under- and over-exposure that average present-day films can accommodate under normal conditions.

These pointers are used when faced with extreme contrasts of the type just described. Suppose that the white wall records a light value of 400, and the dark figure only 6.5 This represents (with a film speed of Weston 24) exposures of 1/25 second at *f* 22 and 1/25 at *f* 2.8 respectively. By adjusting the moving scale until the pointers U. and O. embrace 6.5 and 400 respectively, we can be sure that with the exposure indicated an object reflecting light equivalent to the 6.5 reading will not be utterly under exposed, and an object whose brilliance corresponds to the 400 mark will not have gone right off the end of the shoulder of over-exposure.

If, as in this example, we wish to favour one end of the scale, we can do so by moving the dial so that the O. pointer is opposite 400 (exposure 1/25 at *f* 8). So we ensure that the darker tones are well within the available limits.

By placing the U. pointer against 6.5 (exposure 1/25 at f 11), we take good care that the white wall is well rendered.

In these examples we are exposing as though the normal reading of the meter were between 50 and 100, which it might or might not be according to the proportion of white to black in the part under observation, if we use the meter in the direct normal way.

For those using other makes of exposure meter, it is worth noting that the O. position is about 8 times the reading of the normal arrow, while the U. pointer is about 1/16 of the normal reading. This assumes a film capacity ratio between lights and darks of about 120:1.

Several other makes of meter could be marked to read in this way with advantage. The pointers U. and O. can also be separately employed by what are called the *darkest object* and *lightest object* methods. In the latter case the brightest possible light in the picture is measured. I carry a piece of white xylonite about 4 × 2 inches in my meter case, and measure the reflected brilliance of this when held close up to the meter. If the O. pointer is then set to this reading, I can be sure that there is no brighter tone which can be overexposed, and all other tones will fall into place below it. Similarly, if I am concerned primarily in ensuring detail in the darkest parts of the subject, these are measured, and the U. pointer set to this reading, when whatever happens to the extreme highlights, at least the shadows will be satisfactorily recorded. This is a case of the arbitrary adjustment of exposures I have already mentioned to fit that part of the subject which is to be rendered in its correct tones.

The method of measuring the brightest part of the subject—also known as the highlight meter system—is much used in colour photography where correct exposure for the highlights is perhaps more essential than for the shadows. In a colour photograph the highlights often attract even more attention than in black and white photography, while the contrast capacity is not very great. In monochrome it is usually safer to use the measurements for the shadow detail ; the rule of exposing for the shadows and leaving the highlights to take care of themselves, is still sound for most cases.

FILM SPEEDS

DIFFERENT MAKERS have used different methods in describing the speed of their products.

Widely differing methods of calculating film speeds make it almost impossible accurately to reconcile all the various figures and to provide any *exact* translation from one system to another, but in the following table I have attempted to give an approximate basis for comparison between the different systems.

In Europe, the Scheiner method held sway for a long time, but has latterly become supplanted by the DIN system. Very roughly, these assess the speed of a film by the minimum amount of exposure (to a standard light source), which gives a visible darkening on strictly controlled standard development. As this reading is necessarily right down on the extreme toe of the characteristic curve, it is not a dependable index of what happens higher up the curve.

The H. & D. system (Hurter and Driffield) is an old established English method which is based on measurements on the straight line part of the curve, and its figures are consequently more strictly comparable.

Kodak a few years ago carried out an exhaustive series of practical tests to determine and nominate the speeds of their own products, and as these speeds are the result of practical exposures made *in the field*—as opposed to the other laboratory methods—they would

COMPARISON SCALE FOR FILM SPEED RATINGS

B.S. and A.S.A. Index	*B.S. Log Index*	*Weston*	*G.E.*	*H.&D.*	*European Scheiner*	*American Scheiner*	*DIN*
10	21°	8	12	400	23°	19°	12/10
16	23°	12	18	660	25°	21°	14/10
20	24°	16	24	800	26°	22°	15/10
32	26°	24	36	1300	27°	24°	17/10
40	27°	32	48	1600	29°	25°	18/10
64	29°	48	64	2400	30°	27°	19/10
80	30°	64	96	3000	32°	28°	21/10
125	32°	96	130	4800	33°	30°	22/10
160	33°	128	190	6400	35°	32°	24/10

seem to be reasonably dependable in all conditions of use.

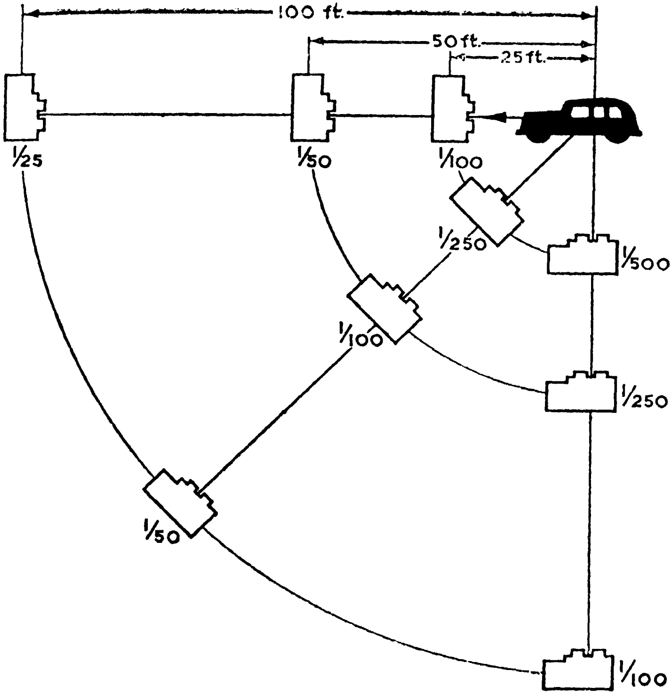
The Weston scale designed for use with meters of that make is also based on practical experiment by the manufacturers of the meter. The welcome introduction of A.S.A. (American Standards Association) and B.S. (British Standards) exposure index numbers is a more recent addition to the range. These figures which approximate to a mean between Weston and G.E. ratings, can satisfactorily be employed with all meters using these scalings, and they may be depended upon for accuracy.

SHUTTER SPEEDS AND MOVEMENT

THE LENGTH of time for which the shutter is opened, together with the lens aperture, controls the amount of light that reaches the film, or in other words, the exposure. From the point of view of the density of the image produced on the film, it is immaterial whether we give a short exposure at a large aperture or a long one with the lens stopped down. On the other hand, both the aperture and the shutter speed also control other factors. We have already seen that the sharpness of several objects at different distances, or the depth of field obtained, depends on our choice of the lens aperture. Similarly the shutter speed chosen has the other function of controlling the sharpness of objects moving in front of the camera.

We have come across one example of such movement, namely, when the camera is not held still enough during exposure. Thus a certain minimum exposure is necessary to avoid the effects of camera shake, and in pictures taken with the camera held in hand we should not expose for longer than about 1/50 second under normal conditions.

In addition there is the problem of moving objects in an otherwise stationary scene. This is where the higher shutter speeds of 1/100 to 1/500 second come in. They



The image of every moving object moves slightly on the film during exposure, no matter how fast the exposure. The extent to which we can allow it to move is governed by what the eye will accept as " sharp." The actual amount of movement during any given exposure is defined by the speed of the object, its distance from the camera, and by the angular direction of the movement in relation to the camera. The diagram indicates how these factors affect the exposure required to ensure a sharp negative, and gives suggested minimum shutter speeds needed to deal with a car travelling at 25 m.p.h. at different distances from the camera. The shutter speed needed for subjects at other speeds and distances will be in proportion.—See p. 92.

are needed to catch and arrest movement of the subject and secure sharp pictures of more or less rapidly moving objects.

In a given time, say 1/100 second, an object like a car travelling across our field of view will move through a certain distance. Thus the picture of the car on the film will also move a proportionate distance, and the image, instead of being formed in one particular spot, will be spread out; the car will be slightly blurred. It is obvious that if the car is travelling fast, it will go further during that 1/100 second than if it were moving along slowly, and consequently the image will be more blurred. To get a sharp image we must therefore use a shorter exposure time. During, for instance, 1/500 second the car will have moved through only one-fifth of the distance, and similarly, the image will only have spread one-fifth as much on the film. In fact, this spread of any one point may have become too small to be noticeable, as it may have become smaller than the circle of confusion for that lens (see page 61), and the car would then appear sharp.

So we have our first rule: The faster the object moves, the higher must our shutter speed be.

But this is not the only side of the question. The size of the image of our car on the film will depend on how far the car is away from the camera. The further away the car is, the smaller it will be. Consequently the smaller will also be the blurring due to the spread of the image during the exposure time. We thus have an alternative way of getting a sharp picture of the car; keep away from it. The shutter speed needed to get a sharp image therefore depends also on how far we are from the moving object we want to photograph. This then is our second rule.

So far we have been assuming that the car travelled *across* our field of vision. It might also be coming obliquely or even directly towards us. In that case the amount of movement of the image across the film will be considerably reduced, and might disappear entirely. There would still be a certain amount of spreading of the image when the car is moving fast, for it appears to become larger as it comes towards us. The blur which results from this is, however, considerably less than when the image of the car is moving across the film, and the shutter speed needed to arrest this movement will be much less. So our third rule is: Objects moving across our field of view need faster shutter speeds than objects moving obliquely, while movement directly towards us or away from us can be arrested by slower shutter speeds.

The table on page 94 gives some guidance as to the slowest exposure needed to arrest movement in a number of common cases. There is not much point in using too fast a speed ; many people seem to employ unnecessarily rapid shutter speeds for far too many subjects. Consequently they risk underexposure, or else lack of focal depth because of the large lens aperture needed to make such short exposures possible.

In this connection it is advisable when using the highest shutter speeds to increase the lens aperture even more than would appear necessary from exposure calculations. The reason for this is the low efficiency of between-lens shutters when used at high speeds. The amount of light that actually reaches the film is much less than what it should be at that nominal shutter speed, and opening the lens aperture (by about half a stop) will compensate for this.

When using the table we must take into account the fact that not all parts of a moving object move at the same speed. Thus the wheels of the car would move faster than the car itself. In this particular case it is not very important to get the details of the wheels sharp, as long as the car itself is not blurred. With subjects like running people; sports like football, tennis, etc., blurred arms and legs are much more objectionable, so we must expose for the speed of movement *of these extremities* rather than for the figure itself.

When it is impracticable to use fast shutter speeds because of poor lighting conditions, certain types of subjects can be caught in a different way. The camera is steadily swung round to follow the moving object, and the exposure made during this swinging action. This ensures that the image remains more or less stationary on the film, though the background will now be blurred. This is not a disadvantage, as it increases the impression of speed. This method is most suitable for objects like racing cars or

SHUTTER SPEEDS NEEDED TO ARREST MOVEMENT

Distance	*Pedestrians, groups, slow animals, slow moving boats*	*Running people cyclist, tram, slow car trotting horse, waves*	*Race horse, train, fast cyclist, heavy waves, motor car, sports (to stop movement of arms or legs)*	*Fast car, fast train, flying birds*	*Aero-plane*
			Speed m.p.h.		
	3–6	10–15	30	55–80	200
10 ft. 3 m.	$\frac{1}{100}$–$\frac{1}{150}$	$\frac{1}{500}$	—	—	—
15 ft. 4½ m.	$\frac{1}{100}$	$\frac{1}{400}$	—	—	—
20 ft. 6 m.	$\frac{1}{50}$–$\frac{1}{75}$	$\frac{1}{250}$	—	—	—
33 ft. 10 m.	$\frac{1}{50}$	$\frac{1}{200}$	$\frac{1}{500}$	—	—
50 ft. 15 m.	$\frac{1}{25}$–$\frac{1}{50}$	$\frac{1}{150}$	$\frac{1}{300}$	$\frac{1}{400}$	—
100 ft. 30 m.	$\frac{1}{25}$	$\frac{1}{75}$	$\frac{1}{250}$–$\frac{1}{300}$	$\frac{1}{500}$	$\frac{1}{500}$

These shutter speeds apply to movement of the subject across the line of vision of the camera. If the objects move directly towards, or away from, the camera, the shutter speeds can be three to four times as long, while for oblique motion intermediate speeds should be used.

motor cycles which have no important independently moving parts. It is not so good for athletics, sports, etc., as there is quite a lot of stray movement. Even there, however, in certain cases good pictures can be obtained by making use of moments when subject movement is more or less at a standstill, e.g., at the top of a jump.

COLOUR FILTERS

BEFORE WE leave the subject of the apparatus and materials that we must use, there is one further item for consideration. The use—and misuse—of colour filters.

As long as there are photographers—so long will there be friendly arguments as to the merits and demerits of various colour filters. These exquisitely finished and superbly mounted discs of coloured glass, which manufacturers produce in such profusion, appeal perhaps more than any other accessory to the acquisitive streak in every camera user. Many workers seem imbued with the idea that good pictures cannot be expected unless they own a set of these filters.

Now a " set " varies according to the ideas of the manufacturer, and may easily amount to 6 or even 10 different filters. Confronted with such a galaxy of colours, who can blame the poor camera owner for suffering from a species of mental indigestion which manifests itself in the inability to make up his mind which filter (if any) he should use.

I would like to emphasise at the start that *far too many people own far too many filters*! I will try to reduce the subject to its basic problems. Let us see what these are.

The films that we use are, as we have seen, fundamentally of two types, orthochromatic and panchromatic. The latter, is sensitive to some degree to *all* visible colours, while the orthochromatic film is sensitive to some of the visible colours, but is relatively blind to red and orange light. This is, of course, why ortho films can be developed by a dark red safelight, while pan material has to be handled in complete darkness.

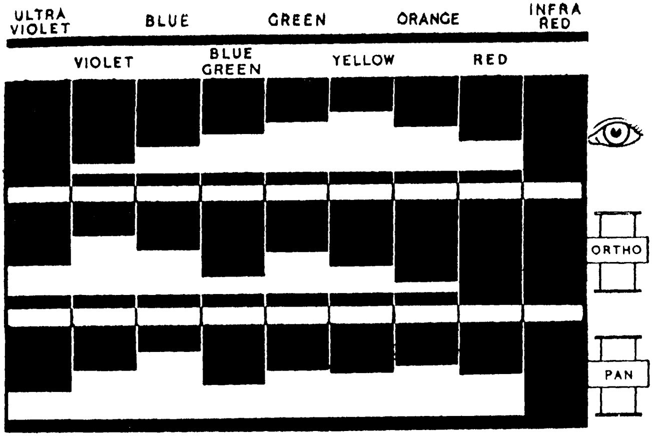
Now while both these films are sensitive to some colours, they are not necessarily sensitive in the same proportion as is the eye. A particular red cigarette carton may appear to us to be more brilliant than the blue tablecloth on which it is lying. A picture on pan film is likely to show them of approximately the same tone (brilliance), but had we used an ortho film, the blue cloth would have registered considerably lighter than the red box, which to us would appear hopelessly false.

Now the principal purpose of colour filters is to modify the natural colour rendering of any particular film so that it conforms to what we regard as the correct brilliance of any colour when translated into a shade of grey. In addition we may at times want to *change* the tones deliberately, either to obtain special dramatic effects, or to obtain separation in tone between objects which would normally register as fairly similar shades of grey. The most frequently met examples of the former kind are the over-emphasised sky tones which we see at times in landscapes, where, by the use of a suitable filter, we can make a pale sky look like an approaching thunderstorm.

How does a filter work? *Any coloured transparent filter has the ability to pass light of its own colour, and to stop, partially or wholly, light of the complementary colour.*

Complementary colours, are those which are opposite in character. These are usually represented by a colour circle, which has the principal colours of the spectrum (red, orange, yellow, green, blue, violet) disposed round it. On this circle each colour is approximately the complementary of the one diametrically opposite: red and green, yellow and violet, orange and blue.

What is the photographic significance of this? By the choice of a suitable filter, we can make those objects which resemble the filter in colour, appear *lighter* than they otherwise would, and at the same time render objects of the complementary colour as a *darker* tone of grey than they would be if photographed without a filter. Because all films are inclined to be *over*sensitive to blue



Top : To the human eye yellow objects appear light in tone, while blue and violet of a similar intensity appear less brilliant. All normal films are over-sensitive to blue and violet, and consequently reproduce objects of these colours in a lighter shade of grey than appears satisfactory to the eye.—See p. 96.

Centre : Orthochromatic film is moderately sensitive to all colours between violet and yellow, but then falls off and is practically blind to the red end of the spectrum.—See p. 95.

Bottom : Panchromatic film is sensitive to all visible colours although not in quite the same way as the eye.—See p. 95.

The diagrams show the approximate relative sensitivity of these materials. These diagrams have been derived from wedge spectrograms of ortho and pan film, and do not show the full sensitivity in the ultra-violet region. In actual fact the sensitivity of the film to ultra-violet light is even greater than shown here.

The use of suitable colour filters enables us to modify the rendering given by the film, so that it conforms more closely to what appears correct to the eye. The red-blindness of ortho film cannot, however, be cured by filtering.—See p. 98.

and blue-violet and the invisible ultra-violet, photographers have long suffered skies which while a strong blue in nature, appeared almost white in the print. Billowing cloud shapes which probably enticed the photographer to make the exposure are largely lost, as there is no adequately dark sky tone with which they can contrast.

Pan films generally give a better colour translation of such subjects than do ortho; but even so both films frequently require assistance to produce what we consider to be a satisfactory rendering. This assistance usually takes the form of a light *yellow filter* which passes all the yellow light that the white clouds reflect, and allows it to act strongly on the film. As the blue sky furnishes very little yellow light (but principally light of a colour which the filter cannot pass), the blue sky on the negative becomes relatively *under*exposed and consequently thin in density, so that it reproduces as a dark tone on the finished print, in contrast to the clouds which still print white. It is for this reason that filters (frequently irrespective of their colour) are often colloquially referred to as "sky filters".

The use, which I have described is I suppose the one for which nine out of ten camera users require a filter. Why, then, do the makers provide such a variety of colours and shades? I think this can best be answered by a table (pages 100-101) showing the function for which a number of the more popular filters have been designed.

It will be seen from this table that there are, for example, several densities of yellow filters commonly obtainable, and I know many photographers who habitually carry two or three of this colour alone.

From my own experience this is entirely unnecessary—the difference in the final result from using a No. 0 instead of a No. 1—or a No. 1 in place of a No. 2—is far too small to be easily noticed; provided, of course, that each has been given its correct additional exposure.

Because the purpose of a filter is to prevent some component part of the white light from reaching the film, it is always necessary to increase the normal exposure to some extent when a filter is used, and the degree of increase necessary is indicated by the maker in his catalogue and in the following table. It varies slightly with different makes of films on account of their own differences of sensitivity to various colours.

The maker's figures can be relied upon for their own products, but latterly there has been a tendency to quote these with superfluous exactitude. I refer particularly to those tables in which filter factors are quoted to decimal places. I am sure none of us can determine the normal correct exposure with sufficient accuracy for it to matter whether we increase it 1.9 or 2.1 times when some particular filter is used. The factors in the following table are adequately accurate for all normal purposes; they are at least as accurate as our determination of exposures is ever likely to be.

In passing, it is worth remembering that when a filter requires an increase of, say 2 times; this can be secured by either giving double the exposure (1/25 second instead of 1/50), or by giving the same exposure and opening the lens aperture by one stop—using an aperture of, say, *f* 8 instead of *f* 11 (or *f* 9 instead of *f* 12.5, etc.). Altering the aperture involves less calculation, and can be done more speedily. Opening half a stop, i.e., from *f* 11 to half-way between *f* 11 and *f* 8, is equivalent to increasing the exposure by 50 per cent ($1\frac{1}{2}$ times). Similarly to open it a stop and a half gives 3 times increase; two stops = 4 times, and so on. This is the method that I generally employ.

As you will have seen from the table, we are not concerned only with yellow filters. *Green filters* were at one time necessary to secure correct colour rendering with over red-sensitive pan films. Nowadays where most pan films provide reasonably correct red-sensitivity, they are seldom required for this purpose, but are still very useful for two particular subjects on pan films.

Male portraiture out of doors in sunshine is one of these. A green filter, because it resists the passage of red light, contrives to make the most of the tone and texture of sunburned skin, and is for this reason valuable on such a subject where it is desired to emphasise the character of the model. It will also improve pictures with white clouds against blue sky, although its degree of correction is

Type of Filter	*Daylight Factor* *Ortho*	*Pan*	*Effect*
Light yellow	2	1½	Lightens yellow, darkens blue
Medium yellow	2½	2	Lightens yellow, darkens blue
Deep yellow	4	2½	Lightens yellow, darkens blue
Yellow green	3	2½	As above, also absorbs some red
Light green	5	3	Lightens green, darkens blue and red
Medium green	Not used	4	Lightens green, darkens blue and red
Orange	Not used	4–5	Darkens blue considerably ; lightens yellow and red tones
Light red	Not used	4-6	Blue almost black, green dark. Reds very light
Medium red	Not used	6–8	Blue almost black, green dark. Reds very light
Blue	Not used	1½ (artificial light)	Darkens reds, lightens blue
U.V.	1	1	Slightly darkens sky

General Purposes	*Examples*
Increases sky and cloud contrast	Wratten K1, K 1½, Ilford Alpha Rolleiflex 0, Zeiss G 1, Spectron Y 0
Increases sky and cloud contrast	Wratten K2, Ilford Delta, Rolleiflex 1, Zeiss G 2, Spectron Y 1
Stronger contrast differentiation	Wratten K 3, Ilford Minus Blue, Rolleiflex 2, Zeiss G 3, Spectron Y 2
Better colour correction, particularly on pan film	Ensign Light Green, Zeiss GR 55 Spectron Y G
Landscape work. Also for outdoor male portraits	Wratten X 1, Ilford Beta, Rolleiflex Grün, Zeiss GR 10, Spectron G
Landscape work. Also for outdoor male portraits	Wratten B, Ilford Gamma, Ensign Med. Green
Considerable sky and cloud contrast	Wratten G, Ilford Micro 5, Zeiss G 4, Spectron MB
Greatly exaggerated skies, clear rendering of distant landscapes	Ilford Tri-colour Red, Rolleiflex Hellrot, Zeiss R 10, Spectron R
Greatly exaggerated skies, clear rendering of distant landscapes	Wratten F, Ensign Red, Rolleiflex Rot-Dunkel, Zeiss R 15
Artificial light portraiture with fast pan film	Ilford H.S., Zeiss B 5, Spectron B
Used above 6,000 ft. altitude	Wratten Aero 1, Ilford Aviol, Rolleiflex U.V., Zeiss G 0

somewhat less than that of a plain yellow glass of similar density.

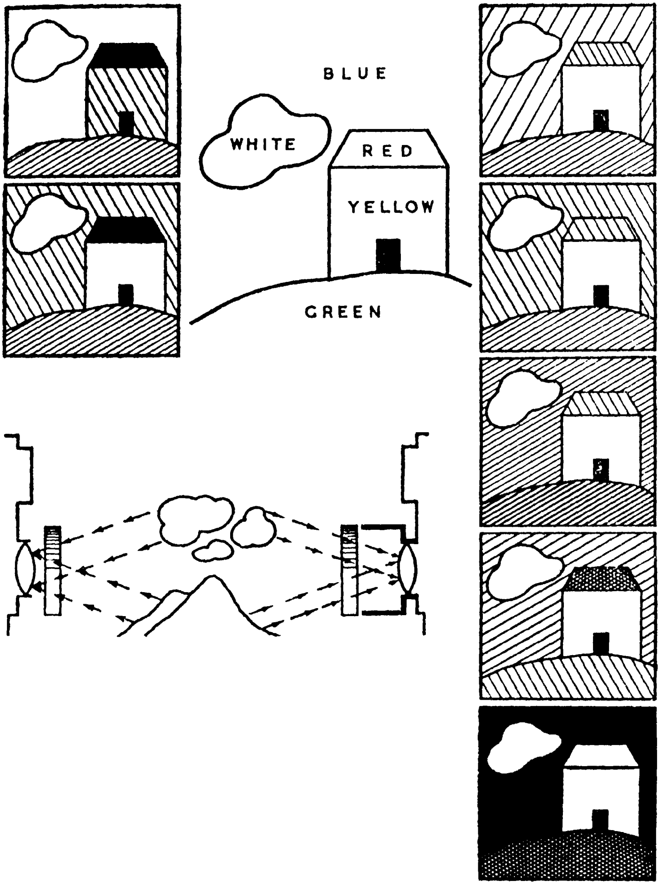
The other purpose for which I find a green filter most useful, is for spring landscapes where I want to differentiate between the yellow-green of the young foliage and the darker green of a more mature growth. For this particular purpose a yellow-green filter is even better, but for my own work I hardly think it worth while carrying it in addition to the plain green which does both jobs well enough.

The orange filter can be considered as a very strong version of the yellow. Its principal use is to darken blue skies to a considerable degree so that they print in an appreciably lower tone than is strictly correct. It is used with panchromatic films only. A secondary use, is in taking long distance views. Such a filter will often clarify the distance and do much to eliminate haze (but not fog!).

From orange is but a step to the lightest of the true reds. This filter has similar but stronger characteristics compared with the orange. The *red filter* will render a midsummer blue sky as almost black. Such use of a filter savours of stunt photography, but it can be extremely valuable to the pictorial worker. By accentuating the depth of tone of the blue sky or sea, he can bring other light-toned objects out in very strong contrast to it, and can show dazzlingly white sunlit sails, or a white house against an overpoweringly dark sky background. This is an example of the use of a filter for special effects.

At the other end of the scale is the so-called *U.V. filter*, which is almost colourless. It is used only at high altitudes, say above 6,000 feet, where there is a superabundance of ultra-violet light, and where the use of a stronger yellow filter would result in unnecessarily dark skies. It should be noted that the higher one goes, the more correction a yellow filter produces. For Alpine work only the lightest shades are ever likely to be required.

The *pale blue filter* is hardly ever used out of doors. Its purpose is to depress red and orange when taking portraits by artificial light, to ensure that the negative shall have some evidence of flesh colour and to avoid the very anaemic looking lips that so often spoil indoor portraits on panchromatic film.



Effect of colour filters, reading from top to bottom. *Left :* Ortho film, no filter ; ortho film, yellow filter. *Right :* Pan film, no filter ; pan film, yellow filter ; pan film, orange filter ; pan film, green filter ; pan film, red filter.—See p. 100.

Bottom left : A graduated filter should be mounted some distance in front of the lens so that the top of the filter passes light only from the sky, and the bottom only from the foreground.—See p. 104.

Only one other colour filter remains to be mentioned, the *graduated filter.* This usually consists of a glass, half of which is a medium yellow colour and the other half colourless. Sometimes the transition is abrupt, sometimes, as the name suggests, gradual. This filter is mounted in front of the lens so that the coloured portion is uppermost and the line of demarcation horizontal across the lens.

Because it is an optical fact that every portion of the lens does its share to producing every part of the image, a "half and half" filter of this sort is not of much use *close* to the lens; it must be mounted $\frac{1}{2}$–$\frac{3}{4}$ of an inch in front. Its purpose is to hold back the sky portion of a landscape with the upper (yellow) part, while the foreground image is exposed normally through the lower (clear) glass.

If faced by a landscape where the horizon is more or less across the centre of the picture, and where a somewhat dark and strong foreground is backed up by a light sky, it can be extremely useful. In the case of the Rolleiflex, the filter is made of such size that it fits on to the front of the lens hood, where it is about $1\frac{1}{4}$ inches from the lens itself. This filter is rectangular in shape and can be adjusted up and down in a metal mount, so that the dividing line can be placed high or low according to whether the picture is mostly foreground or one in which the sky predominates. The exact placing required can be ascertained by putting the hood and filter assembly over the viewing lens, and examining the result on the screen. Graduated filters when used in this way, do *not* require any increase in exposure, as they serve only to hold back excess of light from the sky.

POLARISING SCREENS

THERE IS also a type of attachment which, although a filter, has an entirely different effect. This is the polarising screen. It does not depend on holding back light of a certain colour, but on the elimination of polarised light.

An ordinary colour filter cuts out (absorbs) light of certain wavelengths, while letting the rest pass through. The various wavelengths of light are responsible for the colours. Waves of light like most other waves, also have another property, namely, amplitude. That is to say, a wave moves up and down or left and right, as well as forward. In the case of a ray of light the individual waves will move (vibrate) up and down vertically, crosswise horizontally, to and fro obliquely, in fact in an infinite number of planes around the direction of the whole ray. Now the polarising screen acts as a sort of grid or grille, cutting out all the waves except those which vibrate in one particular plane parallel to the direction of this grid. Thus when the ray emerges from the other side of the polarising screen, it will consist of waves vibrating in one direction only, say up and down. Such light is known as *plane polarised*, or just simply *polarised*.

A polarising screen is not the only means by which light can be polarised. Under certain circumstances light reflected obliquely from the surface of transparent materials also acquires these special properties. If we have a ray of polarised light with the waves vibrating up and down, and then put another screen in its path, turned so that it will only let through waves vibrating crosswise horizontally, it is obvious that *all* the light is stopped. In this way a polarising filter can be used to eliminate light which is already polarised. We can thus get rid of reflections (which chiefly consist of polarised light) when we photograph objects behind glass, etc.

To determine how the filter is to be used, it should be held up in front of the eye, or placed over the camera viewing lens, and slowly turned through 180 degrees while the subject to be photographed is carefully watched. As the filter is revolved, the subject will not alter ; but the various reflections will vary in intensity, and two positions at 90 degrees to each other will quickly be noticed. One, where the reflections are very obvious, and the other, where they have almost entirely disappeared. When the latter position is found, the filter must be attached to the taking lens of the camera in precisely the same relative position. The exposure is then made in the usual way.

Partly because polarising filters hold back some light (without however, changing its colour), and partly because the material from which they are made is usually of a definite neutral tint, some increase in exposure is necessary, usually 4× or 5×. This depends on the make of the filter, and the makers generally supply precise information.

It will be obvious that polarising filters can only be employed usefully on some subjects, where oblique reflections detract from the picture ; such examples will at once suggest themselves to anyone who has ever tried to take a halfside-face portrait of a sitter wearing spectacles. Surface reflections on roads—water—ice; reflections in shop windows, on china, glass ware, motor cars, etc., can all frequently be removed or reduced by its use. The polarising screen has, however, no effect on reflections from a metallic surface.

It has also a different function of value to the landscape and outdoor portrait photographer. A plain blue sky emits polarised light at certain angles, and this is most pronounced at an angle of 90 degrees from the sun. The greatest effect if the sun is (say) due south is to be found by pointing the camera exactly east or west. If the sky (and it must be a blue sky, not cloudy) is examined through the filter, it will be found that the tone of sky can be considerably darkened as the filter is rotated, without in any way affecting the tone of the foreground objects. In this way we can control the *depth* of sky tone, without affecting the *colour* balance of the subject. The extent to which the tone can be lowered depends on the colour of the sky, and on how near the required 90 degrees we are from the sun itself. The maximum degree of darkening approximates very closely to that which can be secured with a red filter. For pseudo night pictures a strong red filter (6×) plus a polarising screen (say 4×) will make a suitable blue sky almost black. This can occasionally be useful, but remember that your exposure must be increased 24 times (6 × 4) in the above case.

The fact that a polarising filter holds back light under certain circumstances also makes it useful in colour photography, particularly where blue skies are to be darkened without affecting the rest of the picture. The drawback is the extra exposure required; colour films are comparatively slow at the best of times, and using a polarising filter reduces the speed still further.

DIFFUSING SCREENS

ALTHOUGH OUR lens designers are continually striving to make their objectives produce sharper and still sharper definition, there are some subjects where the utmost crispness of detail is definitely undesirable. Large portrait heads, against-the-light studies, broad landscape effects, to mention but a few, are frequently more true in appearance, and possess greater artistic appeal, if rendered without the biting sharpness of the modern anastigmat lens.

To overcome the necessity of carrying (or, in many cases, the impossibility of fitting) special "soft-focus" lenses, lens makers produce *diffusion attachments* which can be employed on almost any camera. A typical example is the British made Modulo, which is supplied in metal mounts to fit most popular cameras. This disc is available in two strengths, No. 0 slightly softening the image, and No. 1 which is somewhat stronger in its action. Again the reflex user has the advantage of being able to see the effect of the diffusion attachment on the screen, and to choose the appropriate disc according to the extent of softening required. As a guide, however, it has generally been found best to confine the use of the strong diffusion attachment to subjects which are rather flat in contrast, and those in which the sun is behind the camera, or where considerable diffusion is desired. The moderate diffuser is the correct one to use for subjects which are inherently contrasty, and for pictures taken facing into the source of light, or at other times when only a slight degree of softening is required.

The disc has a centre which is clear glass, and the diffusing pattern is arranged to surround this plain area. For this reason the degree of diffusion is largely controllable by the aperture at which the exposure is made. If the lens is used at its largest stop most of the image is formed by rays which have passed through the "ringed" part of the glass, while if the lens aperture is small the image will be almost sharp, as the bulk of the image forming rays will be those which have passed through the clear glass and have not been diffused. For the maximum diffusion, a relatively large lens aperture should consequently be used. Such an attachment does not need any alteration in exposure.

Such diffusion discs can also be used when making enlargements, but the effect is rather different.

The main effect of a diffusion disc consists of spreading some of the light which forms the dense parts of the image, so that the edges are not so clearly defined. A little blackening of the sensitive material takes place in the less dense parts of the image next to the high densities. In this way the blacks are surrounded with a sort of halo (not to be confused with either halation or an out-of-focus image!). In the negative the black parts are the highlights, so when the negative is printed, the highlights will appear to overflow into the shadows, giving a characteristic luminous effect. This can be particularly pleasing in photographs against the light, provided it is not overdone.

If the diffusion disc is used during enlarging, the effect of the spreading of light is not reversed at a later stage, and it will be the shadows which appear to overflow into the highlights. The general effect is therefore one of toning down, and the use of diffusion under these circumstances particularly helps to accentuate the effect of low-key or gloomy subjects.

While in sensible hands the skilled use of such diffusion discs has many artistic possibilities, it is as well to avoid the tendencies which resulted in such a craze for fuzzy pictures when these attachments were first introduced. Diffusion for the sake of artistic improvement can be very useful, but diffusion for the sake of diffusion can be a nightmare.

SUPPLEMENTARY LENSES

WE HAVE seen that the distance between the lens and the film must be increased if we wish to get sharp images of comparatively near objects. This is what happens when we are focusing. If the objects are no nearer than about 3–4 feet, the amount by which the lens must be extended is not very great. When we get nearer to our subject, however, the distance necessary between lens and film becomes very much greater, and for really close work the camera extension may have to be twice as long as the focal length of the lens, or even longer. With the double extension plate camera this is quite simple, the lens is racked out as required. The twin-lens reflex has a rather limited extension, which is chiefly due to the design of the camera itself, and so under normal circumstances we cannot photograph objects nearer than about 3 feet from the camera.

When we wish to get nearer we must therefore modify the lens system of our camera. This is done by using supplementary lenses. These lenses—low power magnifiers not unlike spectacle lenses in appearance—are used in pairs, and are simply clipped over the normal taking and viewing lenses, and a fresh range of distances—closer than the customary near focusing limit becomes available. Each maker provides his own supplementary lenses, but there is no reason why makes should not be interchanged, as long as they fit the camera, and as long as they are kept in their pairs. Both the lenses must be of the same focal length.

Proprietary lenses of this type such as the Zeiss Proxar to name but one make, are manufactured by a number of optical firms. They must be well mounted in a mount which fits the camera lenses, as they must be fixed exactly over the centre of the lens on which they are used. The majority of lenses made specially for this purpose are supplied with tables indicating their effect on the focusing distance; but on a focusing camera such as ours the effect is clearly visible on the screen.

It is, however, an advantage to know what strength of attachment lens is required in order to bring a particular range into focus.

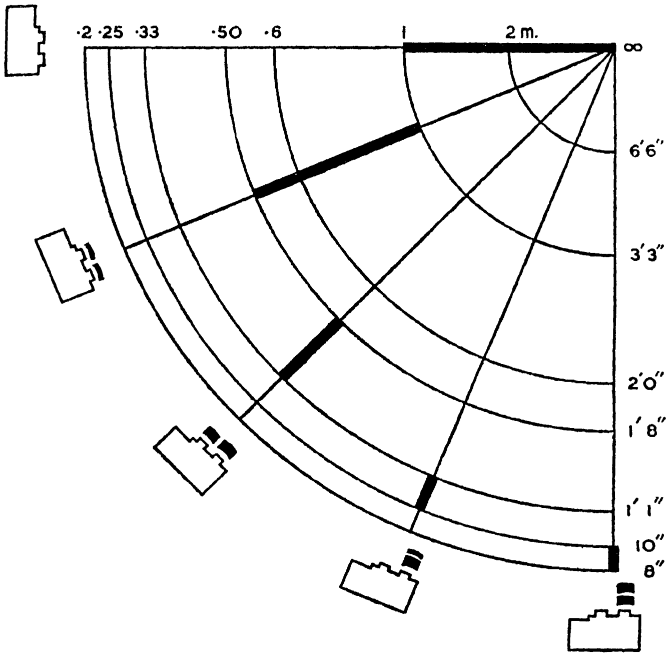
The focal length of any magnifying lens of this type represents also the distance of the object that will be in sharp focus when the attachment is used with the normal camera lens set at infinity. The focal length of these attachments is usually quoted in *dioptres* in the same way as spectacles (for example, 1 D or 2 D). 1 D is approximately 40 inches (100 cm.); thus a 1 D lens has a focal length of 40 inches and will bring objects at this distance into sharp focus when fitted to a camera set at infinity. A 2 D lens is, however, not twice as long, but only *half*—a 4 D one *quarter*, and so on. Thus the focus of a 2 D lens is about 20 inches (50 cm.) and a 4 D about 10 inches (25 cm.).

On a camera with the normal range from infinity down to 3½ feet, a 1 D lens set will bring into focus a range of approximately 40 to 20 inches (100 to 50 cm.), while a 2 D set, at the same settings will cover, roughly, 20 to 13 inches (50 to 32 cm.).

There is of course a limit beyond which it is impracticable to employ this method. When the attachment lens is of very short focus, it is inclined to destroy the good definition of the taking lens, particularly round the edges of the picture. This can be overcome to some extent by stopping down the taking lens; and although there is no hard and fast rule, I would suggest using an aperture of say *f* 6.3 with a 1 D set, and possibly *f* 9 with a 2 D attachment, or even smaller if employing anything stronger. As a guide I think that anything stronger than 2 D is undesirable if the best results are required.

The actual technique of making pictures with these lenses in no way differs from straight camera work. Exposures need not be increased, and the exact effect can be seen on the screen, as two identical supplementary lenses are used, one on the taking lens, and the other on the finder. The camera focuses down progressively throughout its new range as the knob or other focusing mechanism is adjusted.

The magnification obtainable by a 2 D lens and the camera focused at say 3 feet 6 inches is quite considerable ; about three times (linear), which means that the small



Most twin-lens models cover distances from infinity (∞) down to about 3½ feet by focusing in the normal way.

The addition of a pair of No. 1 Proxar lenses, one over the finder lens, and one over the taking lens, enables the same camera to cover distances from about 40 to 20 inches.—See p. 110.

A pair of No. 2 Proxar lenses embraces the range from 20 to 13 inches.—See p. 110.

For still closer work it is possible to use two Proxars in front of the taking lens—a No. 1 and No. 2 covers distances 13 inches to 10 inches while two No. 2 lenses bring objects from 10 inches to 8 inches into sharp focus.—See p. 110.

When using " doubled " Proxars in this way, it is necessary first to focus with them on the viewing lens, and then to transfer them to the lower lens. Great care must be taken to avoid parallax errors at these very close distances.—See p. 112.

object is now occupying about *nine* times the area on the negative, compared with what it would cover if taken with the camera in the normal way. So the twin lens is becoming a competitor to the larger double extension cameras that were once necessary for any really close-up work.

When using supplementary lenses of the Proxar type, increased magnification can also be obtained by placing *two* of these lenses over the taking lens. Focusing is carried out by first putting the two supplementaries over the finder lens, and then moving them into the taking position.

The one difficulty about taking extremely close pictures with a twin-lens camera is that of parallax. The viewing lens, which is about 1½ inches above the taking lens, will necessarily see just that amount higher than the lens that makes the picture.

To take care of this parallax error when front lenses are used, the Rolleiflex makers, for example, supply two glass prisms called Rolleipar No. 1 and No. 2. The appropriate Rolleipar, attached on top of the Proxar *over the viewing lens* diverts the line of sight, so that the screen shows what is in front of the taking lens, rather than what is actually in front of the viewing lens itself. In the absence of such a fitting much can be done by careful measurement of the amount included or by composing and focusing the image carefully on the screen. The camera is then raised *bodily* prior to the exposure so that the taking lens is in the position previously occupied by the viewing lens.

There is an essential difference between the use of prisms of the Rolleipar type and camera movement as a whole. While both eliminate parallax, the use of the prism does not change the fact that the viewing lens is in a different position from the taking lens, and even when both point at the same part of the subject, their points of view will be different. Thus the images in the finder and on the film are not identical when a Rolleipar prism is used at a close distance. Movement of the camera as a whole will, however, give identical pictures in both the finder (before raising the camera) and on the film (after raising the camera).

Large images on a negative can be obtained by long-focus lenses, but in the case of the twin-lens reflex this is impracticable, because the lens cannot easily be changed. The makers of the Rolleiflex have, however, evolved an alternative.

A specially mounted Zeiss Magnar telephoto attachment can be fitted on to the *front* of the lens to give a magnified image. Although ingenious to a degree, I consider that this contrivance is somewhat clumsy in use, and not one with which I would care to be bothered. Because there are two lenses on the camera, it is necessary to mount the instrument rigidly on a tripod, and then to attach the Magnar to the viewing lens in order to compose and focus the picture. When this has been done, the Magnar is transferred to the taking lens for the exposure. With stationary objects—architectural subjects and the like, the system undoubtedly functions satisfactorily; but in the vast majority of cases a long-focus lens is most required when taking snapshots, and for this purpose the Magnar is impracticable.

It is one of the limitations of the twin-lens camera, but it must be accepted.

THE PLATE BACK

THE BASIC twin-lens reflex camera is an adequately versatile instrument, but there are still some specialised tasks for which it was not originally designed. The makers of one camera, the Rolleiflex, have therefore produced special accessories for their camera, which still further extend its range.

There are occasions when the old-fashioned plate camera has advantages. Occasions when it is desired to make one exposure, and to develop it without delay. The makers of the Rolleiflex have therefore provided a *plate back* for the camera. This consists of a duplicate back, attaching in the same way as the normal back, but pierced with a hole corresponding to the picture area, and carrying two light-trapped metal side runners in which single metal plate holders can be fitted. These carry ordinary plates 3½ × 2½ inches (6 × 6 cm. or 2¼ inch square is not a standard plate size), and the holders are fitted with a device which allows the plate itself to be moved forward into the camera body after the slide is in position, and the safety sheath withdrawn. This is very necessary, as otherwise the plate would not occupy the same plane as would a roll film, owing to the position of the holder and the intervening sheath. The empty spool in the camera must also be removed, as it would be in the way when the plates are moved into the taking position. Cut film (with special film sheaths) can also be used in these plate holders.

There is also a holder carrying a focusing screen which is inserted in a similar way, and allows the camera to be used like any plate camera with a back focusing screen.

As explained above the plate has to be moved forward bodily into the focal plane before exposure. If, however, this is purposely avoided, the camera extension is increased by the distance through which the plate is normally moved. This means that objects closer than the usual 3½ feet may be photographed. Under these circumstances the finder screen cannot be used; the focusing back (again without moving the ground glass screen into the focal plane) is needed to focus the camera. This technique can also be followed when supplementary lenses are employed.

When roll film and plates are to be used alternately, it may be inconvenient to carry both camera backs about. A special pressure plate slide is therefore also provided, and this is inserted instead of a plate holder. The plate back with the pressure plate then acts in the same way as the normal roll film back.

Although used relatively infrequently, these plate backs have very definite advantages for the specialist who wishes to make successive exposures on different materials.

THE CINE ADAPTER

TO INCREASE the versatility of the Rolleiflex further, more particularly so that colour films or any other material available only in 35 mm. size could be used, the Rolleikin attachment was introduced. This consists of a complete camera back with film counting mechanism, two spool adaptors to accommodate the customary 35 mm. film cartridge, and the take-up spool.

The picture format is arranged vertically and suitable masks for the camera back aperture and for the focusing screen are provided. It will be appreciated that the customary 75 mm. lens is rather long in focal length for this smaller negative size, but this is occasionally an advantage particularly where portraiture is concerned.

MORE GADGETS

ANOTHER ROLLEI gadget of some use at times is the *right-angle mirror* device. This attachment, a silver surfaced mirror, is attached to the camera front at an angle of 45 degrees so that the two lenses have a clear view of what is at right angles to the direction in which the camera is pointed. The demand for such an attachment is necessarily limited, but it is occasionally useful when trying to secure pictures of people without their being aware of the fact.

Panoram pictures will be considered elsewhere (page 161), but another tripod head attachment for the Rollei cameras is available for the man who wishes to take occasional stereoscopic pictures. This is in the form of a metal slide, easily attached to the normal tripod, and carrying a movable camera holder which enables two exposures to be made in rapid succession, separated by the customary stereo displacement. Obviously this device can only be used on still life subjects or landscapes, etc., where there is no movement nor alteration in the subject itself between the two successive exposures.

While the stereo head was designed by the makers of the Rollei cameras for their own models, there is no constructional or other reason (as there is in the case of the plate or cine film backs) why the stereo slide should not be used with any other twin-lens reflex, as long as its dimensions are similar to those of the Rollei models.

FLASHLAMPS

THE FULL significance of flash as a lighting medium for the most expressive pictures is still not fully realised in this country. The careless and hasty photographer has taken up flash with avidity because of the extraordinary ease with which reliable, if unenterprising, photographs can be made. This class of work has tended to blind the public to the possibilities of the medium. Actually, any lighting effect obtainable with half watt lights can be duplicated in flash with the added advantage of brief snapshot exposures. As we shall see later, the use of guide lamps makes possible the most appropriate arrangement of light and shade. The sitter is not harrassed and made self-conscious by over bright light except for the brief instant of the flash. Flash can also be used in combination with daylight and other continuous lighting to produce a wide variety of useful effects.

It is of the utmost importance, particularly when first using flash to be able to study the subject just as the camera sees it. At first thought it may appear that any reflex camera would be suitable but it must be remembered that the extreme brilliance of flash makes possible the use of quite small apertures such as *f* 11 or *f* 16, even with fast exposures. It is next to impossible to focus a single lens reflex at this sort of aperture. Of course we can open the lens and stop down immediately before making the exposure but if as is probable, the camera is held in the hand, it will be found only too easy to lose the composition in the aggravating darkness of a focusing screen at *f* 16. We can also resort to a tripod but this is very crippling because flash is a medium for living subject matter. The real answer is the twin-lens reflex where the taking lens can be stopped down in advance and focusing done through the finder lens. (There is also a technical point in connection with synchronisation that also tends to rule out the single lens reflex, but this we shall come back to later, after reviewing the manner in which flashlight is created.)

There are now two well established methods of producing a flash of adequate brilliance for photography. The older and better known instrument is the flash bulb, but during recent years the speed flash, or " stroboscopic " flash as it is sometimes rather loosely termed, has grown in popularity. Choice between these two will depend partly on subject matter and partly on expense. Flash bulbs are light and the equipment readily portable. Although the initial outlay is slight the fact that the bulbs are usable only once, means that maintenance is fairly high. Thus money saved in initial outlay may be absorbed in cost of bulbs if flash is used a lot.

Unfortunately even the most up-to-date speed-flash equipment is decidedly bulky, and seldom weighs much less than 12 lb., but the scope of subject matter that can be handled satisfactorily is somewhat increased by the remarkable brevity of the speed flash which is usually about 1/10,000 second. Thus subjects whose speed approaches that of rifle bullets can be photographed with adequate detail. In any case, both methods of producing a flash are equally suitable for the twin-lens camera, and the choice must remain largely a personal one.

Nowadays almost all flash pictures are taken by means of synchronising equipment ; which means that the flash is by various methods made to coincide with the opening of the shutter. In the case of speed flash the user will purchase the synchronising mechanism as part of his new outfit but if he decides to use flash bulbs there is a considerable choice of equipment. We shall therefore dwell in more detail on flash bulb timing and relevant equipment.

The flash bulb filling consists of finely divided aluminium sometimes foil, sometimes wire, sealed in oxygen. In the centre of the bulb is an electric filament and surrounding this filament, an explosive paste. Electric current from a torch battery is used to heat this filament and thus explode the paste. Once ignited, the foil burns with explosive brilliance and is consumed as we say " in a flash."

However brief this conflagration may appear to the eye, there is still a time element to be considered. For instance, if we study the flash from an average bulb by means of an oscilloscope we shall find that about 1/50 second elapses before the flash gains full intensity ; that its period of full brilliance amounts to perhaps 1/100 second ; and that the last metallic ember flickers out after about 1/25 second. So a shutter set at a fast speed could open and close before the bulb had time to reach any considerable illuminating power.

Having this in mind, we shall readily see how synchronising equipment suitable for twin-lens cameras can fall into two groups. These are classified as *simultaneous release synchronisers* and *timed release synchronisers.*

The former are comparatively simple, usually comprising a casing tapered to screw into the cable release socket. Within this casing is a timing switch and a plunger for operating the shutter. Adjustment is allowed so that the switch can close the bulb circuit, thereby igniting the bulb, at the same instant the plunger releases the shutter. As previously pointed out, it will be seen that if a very short exposure such as 1/200 second is made with this type of synchroniser, the shutter will have closed again before the bulb is properly ignited. Shutter settings usually recommended are 1/25 or 1/50 second.

This limitation of rather slow shutter settings with simultaneous release synchronisers can be overcome by use of special bulbs such as the speed Midget made by the General Electric Co. These bulbs employ an explosive mixture in a vacuum bulb which ignites very rapidly. Exposures as short as 1/200 second are thus made practical. As a matter of fact the slower shutter settings are not really the disadvantage one might expect, because the period of really bright light emitted by the flash is quite short, e.g., 1/80 second for a Baby Sasha bulb, and unless there is a considerable other light present this limits the extent to which subject movement can harm the picture. These simple synchronising units are extremely reliable, and there is an added advantage in that the unit has no spring which needs to be set before taking the picture.

However, for some types of work fast shutter settings are necessary and in such cases we shall need a timed release synchroniser. These instruments fall into two groups, *magnetic*, where the shutter is released by a solenoid magnet, and *mechanical*, when the shutter is released by a spring which also operates the timing switch. Choice between these two is a personal one.

Press photographers tend to prefer the magnetic type such as the American made Graflex or Heiland synchronisers because there is no spring which has to be pre-set, an operation easily omitted when in haste. The drawback is that the magnet takes considerable toll of the battery, so that some workers prefer the mechanical type such as the Kalart or Forster Gun. Both types are similar in that allowance is made for releasing the shutter a fraction of a second after current is applied to the bulb. Thus shutter timings such as 1/300 can be synchronised to coincide with the *peak* of the flash. A few bulbs should be set on one side for adjusting the gun to the correct setting and some care is necessary to see that this accurate adjustment is maintained. The work, however is not difficult and merely needs care.

Twin-lens reflexes also work extremely well with speed flash equipment. Despite the high speed of the flash, synchronising in this case is very simple. Equipment such as the Megaflash or Portaflash is provided with its own synchronising unit, and adjustment is effected by simply observing the shutter blades as the flash goes off. So brief is the duration of the flash that the rapidly moving blades appear quite stationary in its fleeting rays and they may be observed as more or less half closed, if synchronisation is incorrect. A screw adjustment is provided for correcting this type of error.

We mentioned before an advantage possessed by the twin lens reflex for synchronised flash photography and we can now explain this point. Other modern small cameras mostly depend on the use of focal plane shutters which consist of a roller blind with a slit, exposing the film a section at a time. Although this slit may cross any individual *point* on the film in as short a time as 1/100 second, probably 1/25 second elapses during the entire transit. Unless the flash maintains a fairly even illumination during this entire period, an uneven negative results. Special *long flash* bulbs are made for this purpose, but since they burn more slowly, they cannot reach the same intense illumination as the normal bulb. Complete lack of standardisation in focal plane shutter design makes synchronisation even more difficult. In fact, the twin-lens is the best camera for successful flash photography.

EXPOSURE WITH FLASH

ONCE WE have made our decision, and purchased a flash-gun, the technique of picture taking will require consideration. As in other branches of photography, we still think first of exposure control. This familiar bugbear of photographers has been substantially simplified by the introduction of flash, indeed the ready acceptance of flash by hasty cameramen who place reliability before subtlety, can be attributed to the ease with which good negatives can be obtained under widely varying circumstances.

Because the flash is so brief, we depend on *aperture setting* for control of negative density. The flash is of constant intensity, and subject illumination therefore depends on the flash-to-subject distance. This diminishes in relation to the square of the distance, i.e., it diminishes very rapidly ; twice the distance, one quarter of the light.

Probably the simplest way to adjust the aperture in relation to flash-to-subject distance is by means of an exposure chart. These charts have rotating dials with scales to take into account all the factors, including type of flash bulb, film speed and shutter setting. When these scales are correctly set, the last pointer is turned to the flash-to-subject distance, and the aperture read off on the opposite scale.

Another accurate method of relating aperture and distance settings is provided by the use of flash factors, or guide numbers, as they are sometimes called. These numbers are arrived at by multiplying together an aperture setting and a distance known to give good results with a particular combination of film, shutter setting and bulb. If we divide any other distance into this multiple, the quotient will be the aperture setting required. Flash factors are published by bulb manufacturers and are also found in standard works on flash photography. They are usually presented in a table of approximately this form, one table for each bulb. Flash factors vary with different bulbs. The figures are therefore quoted only to illustrate the principle. The term "open flash" in the first column means any shutter speed longer than the duration of the flash.

FLASH FACTORS FOR A TYPICAL BULB

Exposure	*Weston Rating of Film*					
	4	8	16	32	64	125
Open Flash	70	100	150	210	295	415
1/100	55	80	125	180	255	355
1/200–1/250	35	65	105	150	210	295
1/400–1/500	—	—	75	105	150	210

To use the table, divide the flash-to-subject distance into the flash factor found opposite the appropriate film speed and shutter setting. For example, if using film with Weston rating 32 and a shutter setting of 1/100, the flash factor given in the table is 180. If the distance from flash to subject is 9 feet, we divide 9 into 180 so that an aperture setting of *f* 20 is indicated. As is usually the case, *f* 20 does not appear on the standard aperture ring, and we approximate to the nearest calibrated aperture—*f* 22.

LIGHTING PROBLEMS met in flash photography are usually discussed under three headings, single flash photography, multiple flash, and flash in combination with daylight or half watt lighting.

When one bulb is used, it is most commonly mounted on the camera. This of course, is a particularly convenient arrangement. Besides the advantage of portability, exposure calculation is simplified since flash-to-subject distance is the same as camera-to-subject distance. This, on most twin-lens reflexes, can be read from the focusing scale.

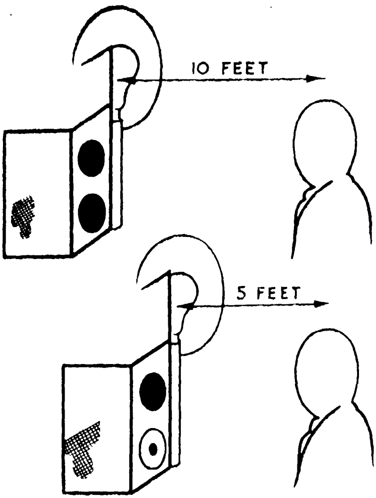
Flash on camera unfortunately provides a rather flat lighting with insufficient modelling, but despite this drawback, striking pictures can be made if we understand the limitations properly. When flat lighting is used, emphasis tends to fall on detail.

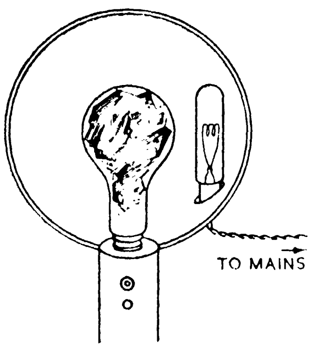
The most obvious method of adding richness to the modelling is to detach the flash from the camera so that it can bear on the subject from an angle. Usually the battery case and reflector unit of a flashgun can be detached from the camera and connected with the synchronising unit by a length of flex. The battery case with its flash bulb can thus be held at arms length, mounted on a tripod, or held by an assistant and so allow a wide variety of lighting effects.

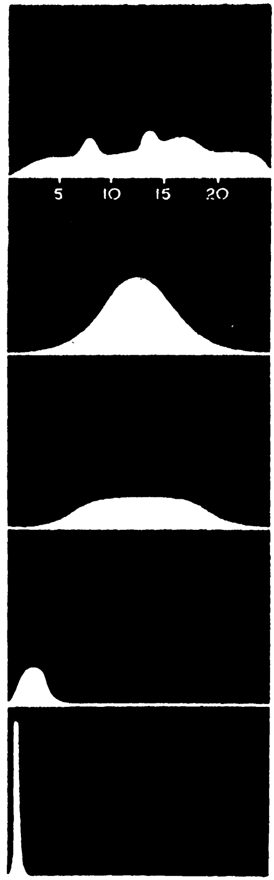
For portrait studies, the detached flash is usually best placed in the top forward position, i.e., bearing down on the subject at about 45° and perhaps set somewhat to one side. This should not be regarded as a hard and fast rule, however, but rather as a suggestion for a first attempt.

All well designed flashguns have plug sockets for connecting up additional bulbs held in separate holders. This facility makes possible the technique of *multiple flash* when two or more bulbs are fired in synchronisation with the shutter and large areas can be illuminated in this way.

Setting up and focusing for multiple flash work is best conducted by means of guide lights, or pilot lights, as they are sometimes called. Ideally these take the form of a half-watt lamp mounted in the same reflector as the flash, but the photographer will have to have this sort of equipment







Top left : Flash distance varies inversely with the stop number needed. At half the distance double the stop number.

Bottom left : Miniature bulb as guide lamp in reflector.—See p. 122.

Right : Duration of a flash in milliseconds. (*Top*) flashpowder. (*Upper centre*) normal flashbulbs. (*Centre*) long peak flashbulbs (for focal plane shutters). (*Lower centre*) paste type flashbulbs. (*Bottom*) instantaneous discharge of a " speedflash " tube.—See p. 120.

made to order. Alternatively the extension flash unit is simply clipped to an ordinary lamp standard as near to the lamp as possible. Another alternative is to use flash bulbs of the type suited for ignition from the mains and simply unscrew the bulbs from ordinary lamps used for focusing, and replace them by flash bulbs. These can be fired by simply switching on the mains, but the method proves cumbersome. Some types of speed flash equipment, particularly those sold for studio work, have a continuous burning filament mounted in the same glass container as the discharge tube. This provides an ideal pilot light.

The simplest multiple flash set-up employs only two bulbs. Although we wish to avoid laying down hard and fast rules, there is a standard arrangement so widely used that it should certainly be mastered before the reader attempts his own systems. This arrangement consists of one flash on a stand to provide high-lights, and a second flash on the camera, which is sometimes spoken of as the "fill-in" flash, because it is used to add detail to the shadows. It must be remembered that if the high-lights are to be effective the high-light flash must be considerably nearer the subject than the fill-in flash. As a general rule for black and white photography, we can recommend 2/3 the distance of the fill-in flash, thereby causing high-light illumination to be nearly three times as powerful as shadow illumination. For colour photography only very mild contrasts can be employed, and for this work the two flashes can be at the same distance from the subject.

When we come to calculate the correct aperture, it will be realized at once that we have two bulbs to consider, and that flash factor or exposure chart methods cannot be applied in a direct manner. The usual method is to use the high-light flash-to-subject distance and obtain the correct aperture for this, disregarding the second bulb. A correction can then be made to allow for the additional light of the second bulb. In the arrangement suggested with the high-light flash 2/3 of the fill-in flash distance, the aperture must be reduced by half a stop. When the flashes are equidistant, the reduction required is one stop, while at half the distance the effect of the fill-in flash can be neglected.

Perhaps the most interesting and varied branch of flash photography is the technique of combining the new brilliance of flash with more familiar forms of lighting. Such is the case with scenes that would make good pictures except for lack of sufficient light for an animated subject. For example, an effective subject is provided by a model standing in a doorway with the camera directed from within the building. Unfortunately the lighting contrast between the model and the scene beyond will make it impossible to render both on the same negative by the older methods. Flash can add lighting to the model and establish a suitable balance.

The exposure problem is handled in the following way. First take a meter reading of the scene to ascertain the exposure necessary for a full negative at a small enough aperture to give sufficient depth of focus. This is not necessarily the exposure to use, because the natural lighting we are measuring is only used to illuminate background material and this can probably be subdued. The scene beyond a doorway would probably need to be fully exposed, whereas the flashlit model might be slightly under-exposed so as not to lose the illusion of distance. Clearly this relationship is one that the photographer must decide for himself on the spot.

The flashlit part of the picture is easily controlled by altering the flash-to-subject distance, or subduing the bulb with tissue paper or a handkerchief. To ascertain the correct flash-to-subject distance, take the aperture value already decided, and divide this into the flash factor. The quotient will be the distance at which the flash will give a fully exposed negative. If the flash is mounted on a camera, it may be difficult to alter the flash-to-subject distance, and it will therefore be easier to screen the bulb with tissue paper or a handkerchief. The addition of tissue paper is equivalent to increasing the flash-to-subject distance to half as much again, while the handkerchief is equivalent to doubling it.

FLASH IN SUNLIGHT

ANOTHER INTERESTING branch of combination of flash for which the twin-lens reflex is particularly satisfactory is the so-called *synchro-sunlight*. This technique, which is primarily a means of softening hard shadows, has had enormous popularity in America where over-bright lighting conditions are more often an obstacle to good photography than in this country. Synchro-sunlight is of particular value in colour photography where exact adjustment of contrast is a primary requirement. The technique is also often used by press photographers to make the subject stand out from a complex background.

There are two technical problems which must be solved in order to apply the method properly—firstly to decide whether the contrast really is excessive ; second to know how powerful the flash should be to give a reasonable contrast. With regard to the first problem some writers have suggested that an exposure meter can be used to assess the shadows under the eyes and chin of the sitter, but this does not appear to be a practical proceeding. Probably there is no substitute for practical experience in sunshine work. Such experience enables the photographer to tell at a glance if the subject will yield sufficient shadow detail. If not, he must fit up his flash gun.

The contrast of the picture will depend on how bright the sun is, and how far the flash is from the subject. We first read off the shutter speed and lens aperture required without the flash, from an exposure meter ; then divide the lens aperture into the flash factor. The resulting flash-to-subject distance spoken of as the *critical distance*, is that at which flash and sunlight will have equal illuminating power. It will be found to give good results with colour film and can be used when it is desired to make a subject stand out from an over complex background. For normal work, however, such an arrangement gives far too flat a picture. The flash must therefore be further away or else subdued by a screen.

Control of the flash-to-subject distance is again complicated by the fact that the photographer will probably want to use his flash mounted on the camera. Since the lens of a twin-lens reflex tends to be of rather short focus, he will continually find that camera and flash are too close to the subject unless this is a large group or other extensive subject. A reduction in intensity will therefore be needed, and as previously suggested, the bulb should be shaded either with a handkerchief or with tissue paper.

Just how great the subject contrast should be is largely a matter of taste. A good average result, however, can be obtained by using the flash at one and a half times the critical distance. Naturally the flash has the effect of increasing negative density and this should be compensated for by reducing the aperture half a stop below that indicated by the meter.

In practice, provided the photographer has fairly established habits with regard to flash-bulbs, films and shutter speeds, means of controlling contrast will boil down to a simple rule. Sunlight, at least brilliant sunlight, is a fairly constant factor not varying sufficiently to need any particular change in flash-bulb settings. Thus the rule may be : *head and shoulder shots—cover bulb with handkerchief* ; *full length—use tissue paper* ; *groups—use bare bulb.* Of course the photographer can only work out such a rule for himself, having in mind the characteristics of his favourite bulb and film.

COLOUR

IN THE last few years there has been a great advance in the production of transparencies and prints in natural colour. Although at the time of writing not all materials are available in our size everywhere, it is well worth while to catalogue the various processes in regular use, and to consider their respective merits and the principles on which they depend for their results.

All forms of colour photography are based on the fact that what we call " white " light is actually composed of all the colours of the rainbow : red, orange, yellow, green, blue, indigo, and violet. From this list we can select *three* suitable *primary* colours (certain shades of blue, green and red) and by combining light of these three colours in the appropriate proportions we can again re-constitute white light.

This applies to combining coloured *lights*, but not to mixing coloured pigments on paper, which is a very different thing. If in a darkened room we had three projection lanterns emitting light of these three colours, we should find that by superimposing the three beams on, say, a white card, we could produce at will any of the rainbow colours according to the proportion of light of each of the three respective primaries that was allowed to fall on the card. (The light-sensation yellow for instance, is produced by the mixture of red and green lights.)

In this case the colours are produced by the *addition* of coloured lights (or, in the last resort, by the addition of colour impulses on the eye), and such a process is known as an *additive process*.

There is also another way of producing colour, namely by taking away specific colours from white light. This can be done by filtering white light (when it passes through coloured glass or the like), or by reflection from coloured objects. Colour in this way is produced by *subtractive* means, and depends on the presence of light containing all colours (white light) from which individual colours can be subtracted.

When talking of objects which do not emit light of their own we are all apt to describe them as being of so and so colour, as though the object *possessed* this colour, whereas, in fact, objects only *appear* to the eye to be coloured because they have the property of partly or wholly absorbing one or more components of the white light by which we see them.

In a darkened room even a yellow sunflower is *black*, consequently it is invisible. In sunshine, however, our sunflower appears to the eye to be yellow because it *absorbs the blue light rays*, reflecting only the red and green which as we have seen above, combine to create the " yellow " sensation. Similarly its green leaves are only green because they contain a substance which absorbs the red and some of the blue rays. If we were to view the flower by artificial light, or in fact *any* light in which the relative proportions of red, green and blue were appreciably different from white daylight, then it and/or its leaves would assume a different hue. This again confirms that most objects only *assume* colour according to the light by which they are viewed, and that without such light of which they can reflect at least a part, they cannot be coloured.

The colours which are produced when the primary colours we have mentioned are taken away from white light, are known as complementary colours, for in a way they are opposites to the primaries. Addition of a primary and its corresponding complementary colour produces white, subtraction produces black. The complementary colour to blue is yellow, to red it is a certain greenish blue called cyan, and to green it is magenta.

COLOUR BY REFLECTION

Colour of Object	*Object Absorbs*	*Object Reflects*
Blue	Green and Red	Blue
Green	Blue and Red	Green
Red	Blue and Green	Red
Yellow	Blue	Green and Red
Magenta	Green	Blue and Red
Cyan	Red	Blue and Green

So we see that a colour, for instance yellow, can be produced in two ways : either additively by combining red and green, or subtractively by taking away the colour to which it is complementary (blue) from white.

HOW DOES all this tie up with colour photography as we know it today ?

Well—there are fundamentally two basic systems of producing transparencies in full natural colour. They are described respectively as the additive and the subtractive methods.

In the additive method (the most commonly used example of which is the British made Dufaycolor film) the three primary colours are mixed (added) together in various proportions to form the required colour sensations.

In the Dufaycolor process the exposure is made *through* the film base. Between this and the panchromatic emulsion is a mosaic screen consisting of coloured squares separated by red lines. These squares—there are a million of them to the square inch—are dyed green and blue, with the red lines running through them. If a photograph of a green object is taken, the green light from the object will pass through the green coloured squares and affect the panchromatic emulsion. The red lines and blue squares, however, will not pass much of the green light, and when the film is developed, only those portions immediately behind the *green* squares will prove to have been affected by light. If we were to fix, wash, and dry such a film at this stage, we should find that the image appeared a *magenta* colour because the emulsion behind each of the green squares would now be opaque, while light would pass freely through the red and blue areas.

If we want to see such a film in *natural* colours, it must be *reversed* after development and before fixation, so that the silver deposit behind the green squares is dissolved away, and the unexposed silver lying behind the red and blue areas is darkened to stop the passage of light through these colours.

The film maker's instructions cover this process in detail, but in principle it is accomplished by dissolving away the silver image formed in the first development, and then exposing the residue of unaffected silver to light or further chemical treatment, and then re-developing. Such films are capable of recording colours very faithfully ; but *because* they rely on *obscuring* a portion of the mosaic (often two-thirds of it) in order to pass any one particular colour ; they are inevitably somewhat dense and will not give very brilliant coloured images by lantern projection except when a really powerful light is employed. Further, although the red lines are only 1/1000 inch apart, the mosaic effect is often visible on the screen.

For these reasons most of the more recent development in direct colour transparency processes has been based on the subtractive method, such as used in Agfacolor, Ansco Color, and Kodachrome, and one or two others. In the subtractive method, as we recall, the three primary colours are subtracted from white light in varying amounts to produce all colour sensations.

In this process the makers give us a film consisting of the usual celluloid support on which *three* separate emulsions are coated—each of these is specially sensitized so as to react to light of a particular colour. Usually the first emulsion layer which the light reaches is sensitive only to blue light, but of course *transmits* all colours. Below this is a yellow filter layer to prevent blue light from affecting any of the subsequent emulsions. The second emulsion is sensitized to green light, and the third layer to red. Each layer therefore forms its own image according to the colour of the light reaching it, and if the light is other than of a pure " primary " colour the image will be formed proportionately in any two—or even to some extent in all three of the layers.

When this film is processed (generally by the makers) a negative silver image is first formed by development after which the film is reversed and redeveloped. During this process coloured dye images are formed by the interaction of the developer and colour forming agents contained usually in the various emulsion layers.

In each layer the dye image thus formed is in the *complementary* colour to that to which the layer was originally sensitive. Thus the blue sensitive layer now carries a yellow image, the green layer—magenta, and so on.

After all this, the original silver image formed in development is dissolved away so that the final coloured image consists only of pure dye stained gelatine layers which are virtually grainless and free from colour " fringing."

Such films are of course eminently suited to showing by projection and yield very brilliant screen images entirely free from grain or mechanical reseau.

Latterly transparency processes which employ the subtractive method and are yet simple enough for home processing have been introduced. The following table will help to clarify the position.

The materials in the table will mostly give colour transparencies. Colour prints on paper are usually made by more roundabout methods. Usually three so-called *separation negatives* are made of the subject (or sometimes even of a transparency), each through a filter of the primary colours red, green and blue. From these three separate coloured prints are made in the three complementary colours, usually by one of the gelatine pigment processes (Carbro, etc.). The coloured transparent images are transferred and superimposed on a white paper support, thus eventually giving a full colour print.

Except where special cameras are used, the production three colour-separation negatives by successive exposures on the subject means that the range of subjects is confined with this method to static ones. Otherwise the process is effective in skilled hands, but apt to be rather laborious ;

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[1] *A number of the materials in this table are at present only made in cut (flat) film, or 35 mm. film. They have been mentioned for the sake of completeness, and because certain twin-lens reflex cameras (e.g., Rolleiflex,* *see pp. 113–115**) can be adapted for these materials.*

[2] *Study of the table will show the basis for the Kodak nomenclature of all their colour materials. All those with the prefix Koda- are materials processed only by the makers, while those prefixed Ekta- can be processed by the user at home. Further, colour films ending in -chrome are of the reversal type, producing single transparencies, while those ending in -color are negative processes producing a colour negative from which any number of colour prints can be made. Thus Ektachrome is a reversal material for home processing, Kodacolor is a negative colour film processed only by Kodak, etc. This of course does not apply to materials made by other firms.*

[3] *This is a negative process for the production of colour prints only.*

[4] *The only colour roll film currently obtainable in England through normal channels.*

COLOUR ROLL FILMS FOR TWIN-LENS CAMERAS

Maker	*Name*	*Type*	*Use*	*BS and ASA Index*	*Processing*
Ansco	Ansco Color	Daylight	Outdoors	12	Home or trade
	Ansco Color	Tunsgten	Artificial light	12	Home or trade
Kodak	Ektachrome	Daylight	Outdoors	8	Home or trade
	Kodachrome 35 mm.[1]	Daylight	Outdoors	10	By Kodak only
	Kodachrome 35 mm.[1]	Type "A"	Photoflood light	16	By Kodak only
	Kodacolor[3]	Daylight	Outdoors	25	By Kodak only
Lumière	Lumicolor	Daylight	Outdoors	12	Home or trade
	Filmcolor flat film[1]	Daylight	Outdoors	12	Home or trade
Dufay	Dufaycolor[4]	D.1	Outdoors or by artificial light with special filter	10	Home or trade

however, recent processes have brought us considerably nearer the day when we shall expect the coloured album print as a matter of course.

In the preceeding table reference is made to Kodacolor—a process in which a *negative transparency* is produced, and from which in turn positive prints on white celluloid are made by what is substantially a repetition of the process. The Kodacolor negative is only an intermediate like any black and white negative. In addition to its negative characteristics its colours also are reversed, and appear as the complementaries of the actual colours in the subject. Thus a red flower appears bluish green, a blue sky orange-yellow, and so on. Prints by this process are relatively inexpensive, but they are at present produced by the film manufacturer only.

COLOUR PRINTING FOR AMATEURS

TO CATER for the worker who has already produced his positive colour transparencies by the various processes outlined above, we have latterly seen the introduction of various colour printing processes, notable among which is Ansco Color Printon—a material on which full natural colour contact prints or enlargements by direct projection from any suitable colour transparency can be made in one single exposure. Processing is simple enough to be carried out by any careful amateur in his home darkroom.

Printon resembles the Ansco Color film itself in its employment of three separate emulsion layers which are coated on an opaque white celluloid base. A variant of this material is found in Ansco Color Paper. Again there are three emulsion layers, but this time on a suitable paper base support. A considerable difference exists, however, in that Printon is a *reversal* process, i.e., produces a positive print direct from positive transparency ; but Ansco Color

Paper is a *positive* printing process, and demands printing from a colour *negative* ; or, as is more often the case, from a set of three tri-colour separation negatives.

Kodak Dye Transfer paper is yet a third alternative for direct colour prints. This method involves more laborious darkroom work and a high degree of skill and care throughout the process. It includes the production of three tri-colour matrices from which superimposed dye images are transferred to a prepared paper support. The keen worker who is willing to spend the time and learn the technique will find this method infinitely controllable as regards colour balance. This is lacking in the more automatic processes, the latter are, however, likely to prove more popular in amateur hands when supplies are freely available.

COLOUR PRINT PROCESSES*

Maker	*Product*	*Contact Prints*	*Enlargements*	*Processing*	*Made from*
Kodak	Kodacolor Print	No	Fixed size, slightly larger than film	Trade or Eastman Kodak direct	Kodacolor negatives
Kodak	Kodachrome Print	No	2×, 3×, 5× and 8× normal size	Trade or Eastman Kodak direct	Kodachrome transparencies size 35 mm.
Ansco	Printon	Yes	3¼″ × 2¼″ 4″ × 3″ 7″ × 5″ 10″ × 8″	Home or Trade	Any colour *positive* transparency
Ansco	Ansco Color Paper	Yes	4¼″ × 3¼″ 4″ × 5″ 7″ × 5″ 10″ × 8″	Home or Trade	Any colour *negative* or set of tri-color separation negatives

* *These processes are at present not available in Great Britain.*

Manufacturers processing instructions are very detailed, and there is no point in trying to include them here, but it is important that they are accurately followed. Colour printing is an exact and an exacting process if good results are to be obtained.

HINTS FOR COLOUR PRACTICE

WHATEVER SYSTEM you employ—whether the result is required as a transparency or print—there are a few basic rules to be observed when taking colour photographs :

Exposure *must* be accurate, for colour film has a very limited exposure latitude. Therefore use a dependable exposure meter with the maker's speed rating.

Because of the small latitude extremes of contrast must also be avoided. Best results are obtained when principal light and dark tones do not differ by much more than 4 : 1 in brilliance.

Remember your pictorial contrast exists in the *colour* differences. Extremes of light and shade are unnecessary and are undesirable.

Every beginner tries to crowd as many and as varied brilliant colours into his picture as possible. Avoid this, often the best slides are made of subjects which at first sight appear far from colourful.

If in doubt choose flat lighting.

Remember that films designed for daylight are entirely different from those for artificial light, and must not be used by light other than that for which they are designed—except when a suitable correction filter (obtainable from the film maker) is used. When using such a filter, consult the maker's instructions as to alteration in film speed. Sometimes this is considerable.

Over-exposure results in thin " washed-out " transparencies lacking in brilliance of colour. Under-exposure causes transparencies to be dark and over-dense, and tends (in moderation) to strengthen colours.

If in doubt about exposure—make three pictures at half-a-stop intervals above and below the estimated correct stop.

If making transparencies, remember that unlike prints they cannot easily be trimmed. Compose the picture with care, so that it satisfactorily fills the film area.

Remember also that colour film records only what it sees. You may *know* that your model is wearing a white dress, but if she is standing on a bright green lawn, her dress is actually a light shade of green by virtue of the coloured reflection from the lawn. Your film will record it as such ; it possesses neither knowledge nor imagination.

Given a modicum of care and attention to such details, however, colour photography is one of the most fascinating forms of our art, and no photographer has experienced the full joy of this hobby until he has experimented with colour.

PICTURE TAKING

COMPOSING THE PICTURE

ONE OF the greatest advantages afforded by the twin-lens camera is the ease with which any subject can be isolated and critically examined. The full size upright image of just what will appear on the film can be studied without the observer finding his task complicated by other extraneous items. The camera can be moved about so that each separate part of a potential subject can separately be examined and its merits assessed. With a camera of this type it is not necessary to allow something of a safety margin, as is generally desirable with folding roll film cameras employing a small and possibly only approximately accurate viewfinder. The whole of the visible image will appear on the film and the picture may therefore safely be composed up to the limits of the screen itself.

"Composing" a picture always sounds a very skilled business, and I am by no means sure that the word—as applied to photography—is well chosen. Our task is rather that of *selection*—choosing a subject in which the component parts are already pleasantly arranged in relation to each other. I write obviously of normal outdoor subjects; the studio photographer can of course compose by suitably arranging his model and accessories.

This selection or arrangement is something which is largely dictated by good taste, and a sense of balance. From time to time various formulae have been propounded as a means of calculating precisely the position the principal object should occupy in the picture space. These calculations appear so complex that the photographer cannot hope to consider them adequately, and still have some thought left for the picture itself. To my mind this is all somewhat futile. Composition of a photograph should be a spontaneous affair. The photographer must arrange the various parts of this picture in the space of his negative, so that they appear to possess some reasonable degree of balance, concentration of interest, and dramatic, intriguing, or pleasing shape.

Before going on to discuss so-called "rules" of composition, I would like to say that these are no more than guiding principles towards making pictures. They are derived not from any geometrical or other laws, but are merely traditional conventions which have been used for a long time in painting. But while some painters may have made conscious use of them others have completely disregarded them, and have produced masterpieces in doing so. There can be no hard and fast rules for an art; the artist, whether painter or photographer, must be a law unto himself. His initial aim should be to produce a picture pleasing to *him*, in the belief that it will also please others of similar taste.

I have a firm conviction that it is the picture itself that really matters; and, whatever rules are followed—or broken—in its production, if the final picture *looks* right, it *is* right. It is with this proviso that I am writing the following lines on composition.

PROPORTIONS AND SHAPES

IF WE divide the picture space into three equal strips horizontally, and similarly vertically, the intersections of the dividing lines are what is known as the *intersections of thirds*. These are said to be the strongest position in any picture space. The principal object in a picture can well be placed in one of these positions, or along one of the lines dividing the picture into the three strips.

In most cases it is desirable that there shall be an altogether smaller secondary object to provide a degree of balance situated on the opposite side of the picture; probably on the opposite corner. For example, a picture of a tree placed so that the principal mass is at one of the intersection points is likely to be best balanced by a small mass (e.g., a bush) placed at an opposite intersection point. The horizon line also is usually best placed along one of the horizontal dividing lines, rather than allowing it to lie across the exact centre of the space.

Concentration of interest is largely a matter of concentration of tones. "Strength" in a picture lies in the close juxtaposition of the brightest highlights and the deepest shadows, which gives the picture a dynamic character, and by contrast emphasises the brilliance of the lights and the strength of the shadows at the same time.

The direction of lines governs a picture's appeal to a considerable extent. A preponderance of verticals conveys the effect of strength and dignity. Horizontal lines suggest repose. Lines from one corner to the others convey the idea of movement.

"Shape" has a direct bearing on the extent to which the onlooker will be arrested or attracted by the picture. A triangular or pyramid composition is one of the strongest shapes that can be used. It should not be too symmetrical. An off-centre arrangement is usually to be preferred.

Hogarth's "Line of Beauty" so often quoted, which is usually a fairly pronounced S-shape, can usefully be employed to lead the eye into the picture to its point of greatest strength.

Lines radiating from the centre of interest are inclined to draw the interest away from the object itself, but may, by their pattern effect, make a very arresting study.

I have said that rules, so far as pictorial composition is concerned, are made to be broken, and they often are. I have urged the desirability of avoiding horizon lines which lie across the centre of the picture space and of avoiding placing the principal object in the exact centre of the picture, but some most successful exhibition pictures transgress both these precepts, and employ the most barefaced cruciform arrangement. Similarly, there are other unconventional shapes which have succeeded.

A camera position a few feet one way or the other can make an incredible difference to the final picture. In the interest of taking any photograph, there is a great tendency to concentrate on the principal object itself, and to overlook or to ignore its background and surroundings. So much depends on the way in which the lines of the background lead up to, or are complementary to, the main subject, that it should come in for at least as careful consideration as the subject itself.

VIEWPOINT

THOSE OF us who use cameras fitted with a 75 or 80 mm. lens are almost certain to have heard criticism at some time or other that such a lens is of so short a focus (wide-angle) that it is sure to produce poor perspective. What exactly is meant by that? What is this perpective, and what makes it poor or good?

Perspective is really the rendering of a three-dimensional subject in front of our camera on the two dimensional surface of the film. If we look at any scene, we shall see that the nearer an object is, the larger it appears to us in comparison with more distant ones. It is this appearance of objects at different distances in different sizes that we usually refer to as the perspective in our reproduction.

The relative sizes of the objects in our picture depend only on how far we are from them when we make the exposure. Thus if we take a row of trees as seen by the camera from a position close to the nearest trees, these will appear large and tower above the more distant ones.

If, however, we retire some distance along the road, when *all* the trees will be recorded on a much smaller scale, the *relative* difference in their height which is somewhat exaggerated in the first case, will be considerably lessened, and we shall obtain a result which to us looks more reasonable.

By enlarging the appropriate portion of this negative, we can produce a print in which the extreme foreshortening of the first picture is absent, and what appears to the eye to be a much more truthful and natural result is obtained.

The rule, derived from this experiment is that *to make distant objects appear large in comparison with nearer objects we must move the camera back*, so that the near objects are themselves relatively distant, and the distance between the objects (near and distant) is proportionally less as compared with their distance from the camera. To increase the apparent size of a foreground object in comparison with its background, the reverse rule must be applied, and the camera position chosen as close to the foreground object as its size permits. In this way the background is made relatively more distant, and will be recorded on a smaller scale than if we choose a normal viewpoint. With objects of dissimilar size it is often actually possible to choose a camera position which will favour one or the other object.

With a twin-lens camera and its relatively short focal length of lens (compared with the negative size used with it) we tend to approach the subject rather closely, and so get great differences in size of the near and distant objects. This is what is really meant when people talk about the poor perspective of a lens of short focal length.

A high or low camera viewpoint can also have a very considerable influence on the picture. A shot from near ground level will virtually enable the photographer to eliminate many landscape backgrounds while a picture made from eye level, or even with the camera at arms-length above the head (as can be done with a twin-lens reflex), will bring up the background until it becomes a very important part of the picture. This is an important aspect of composition as I understand the term, and is worth considerable study and practice, until its various possibilities have been fully appreciated.

We must, however, distinguish between *lateral* changes of viewpoint, i.e., moving the camera from side to side or up and down, and changes in the *distance* between the camera and the object.

We have already discussed the latter question, and have seen that it affects the relative sizes of foreground and background objects. Moving the camera up or down will *not* change the relative sizes of near and far objects, though it may change their importance in the picture area.

If we hold the camera high up (at eye level, or even above the head) the foreground will be comparatively low, and will come near the bottom edge of the picture while some of the nearest parts may fall outside the picture area altogether.

If we hold the camera at a lower level near the waist or even lower down, the foreground will be comparatively higher, occupy more of the picture space, and obscure part of the background. The latter will thus considerably decrease in importance.

There again the nearness or otherwise of the camera to the subject determines the amount of such apparent movement of the objects the picture space. The nearer the foreground to the camera, the more it will seem to fall out of the picture when we lift the camera to a higher level. With distant views the relative movement of one object in front of another is very much less.

Besides moving the camera up or down (which, unless we have a ladder or something of the kind to stand on, is limited by our own height) we can also move sideways to select a better viewpoint. While we do this, we can observe on our focusing screen how objects move across the field of vision, and we shall see again that the nearer objects move much more quickly than the distant ones. In this way we can, for instance, eliminate a disturbing foreground object, such as a telegraph pole, by walking a few paces to the left or right, until it is outside the field of view, while hardly changing the background.

Fortunately it is not necessary to make innumerable exposures when carrying out such experiments, provided that the relative position and size of the various objects. as seen on the focusing screen, are noted and compared, but a few deliberate exposures from high and low—near and distant—viewpoints will afford a very illuminating guide to future work.

One peculiarity about using the twin-lens reflex is the standard viewing and taking position. While this has advantages from the point of view of camera drill which we have already mentioned, many photographers are rather prone to keep the camera at chest level four feet from the ground all the time, and to take anything and everything from this position. We have seen how a picture can look different from different points of view. So my advice is: Don't keep the camera in one place, it isn't rooted there. Get down to the ground if necessary, sit down altogether, climb on chairs and tables, and see whether the picture looks better on the focusing screen. That is what the screen is there for. Move about, and have a look at *all* the possibilities before making the exposure. The path to good composition lies that way.

GETTING ABOUT WITH A CAMERA

THE MODERN camera has become so much part of our very existence, that it is hard to find any other hobby, sport, or pastime to which it does not contribute its quota of additional pleasure. The fun of recording interesting happenings, things, people and places, is exceeded only by the pleasure derived from the subsequent possession of the pictorial reminder of days of interest and enjoyment. Ancillary to every form of recreation it becomes a vital necessity to those who spend their leisure hours in getting about, whatever their chosen means of locomotion.

The ideal camera for going places has to fill very special needs. It must be ready on the instant to pick up those transient but interesting happenings that are always cropping up away from one's own home. It must be small and light, so that it can easily be carried at all times, so that the owner may remain "a tourist with a camera" rather than "a photographer on tour".

Versatility is required—the ability to cope with almost any subject in sun or shower—and the instrument should be one for which sensitive materials are available in any part of the world. All these features are most easily found in the twin-lens reflex.

I have said that the twin-lens is probably the easiest camera to use. Let us see just how simple it is in actual practice.

I generally carry my own camera over one shoulder, in its ever-ready case. When what appears to be a suitable subject is discovered, it is but the work of a moment to swing the camera to the front, open the case, remove the lens caps, and snap open the focusing hood so that the subject can be examined in detail on the screen.

It is much easier to assess the photographic potentialities of a subject by inspecting it in this way, where one sees it on a relatively small scale completely isolated from its surroundings, than when one is looking at the subject itself consciously endeavouring to "compose" it within a purely imaginary rectangle or square.

When making this preliminary examination, I do not pay serious attention to focusing but am more concerned with the *arrangement* of the various parts of the picture within the square. I deliberately try to ignore *colour* and try to see the subject in terms of light and dark tones, remembering that this is how the film will record it, and that a satisfactory and pleasing arrangement of these areas of light and shade is the most important part of every picture.

If the arrangement seems satisfactory, and I decide that an exposure is to be made, I get down to the more technical matters. I assess the brilliance of light, usually by meter, and consider whether the picture will be best rendered with a large lens aperture with sharp focus on the principal object and other parts less well defined, or with a smaller stop which will give me sharp definition over a variety of different planes (see page 55). There can be no hard and fast rule on this matter—everything depends on the subject and the result desired. Having made this decision—I work out the exposure required and set the shutter and lens aperture accordingly.

Whatever the weather I attach my lenshood, and then focus carefully on the important part of the subject, usually using the magnifier in the focusing hood, and holding the camera close to my eye so as to eliminate extraneous light from the screen.

All of this takes only a fraction of the time required to describe it in print. . . .

Everything ready, I shorten up on the shoulder strap (or if no case is used, slip the camera neck sling over my head) and then—maintaining a steady downward pull against the support of the strap—compose the picture once more, and release the shutter with a slow, smooth movement preferably at a moment when my lungs are partly deflated.

In my Auto Rolleiflex the shutter was set automatically when I last wound the film on—with some other models I should have had to set the shutter before making the exposure.

Having made an exposure, my own practice is to wind on the film at once in readiness for anything else that may crop up ; but some workers leave this until immediately *before* taking a picture. It is all a matter of personal choice ; the important thing is to adopt a regular habit on such matters, so that there is no doubt in one's mind at any moment as to whether the shutter is set or not.

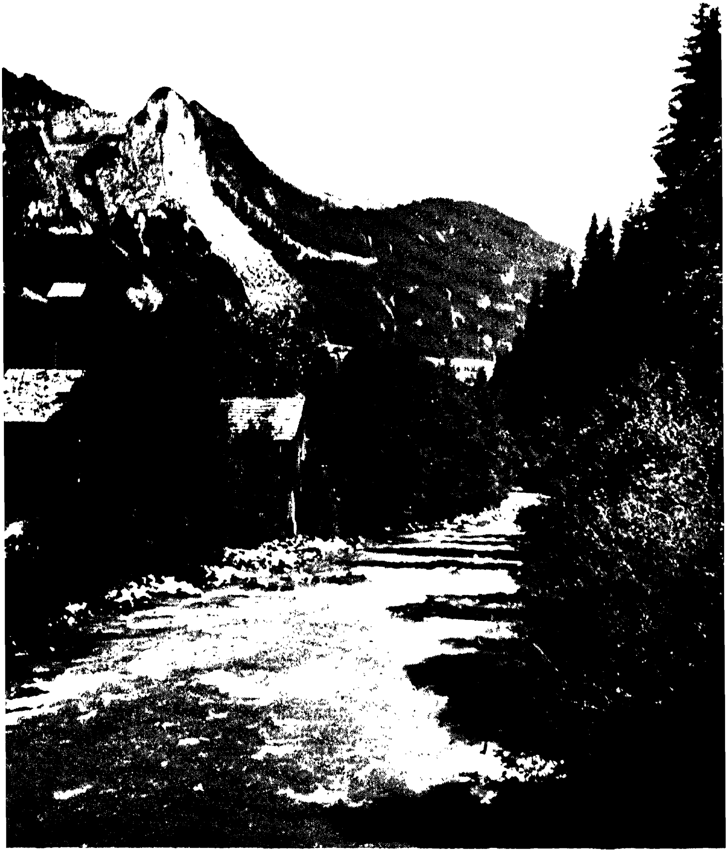
The actual use of the camera away from home deserves a little consideration. We may be in a foreign country where the light may differ considerably from that to which we are accustomed. The use of a dependable (and tried) exposure meter is therefore desirable. If our holiday takes us to the sub-tropical or tropical places we must beware of the *apparent* brilliance of the sunshine; and remember that with it come considerably blacker shadows than we are accustomed to find in more temperate climes. In such cases exposures will have to be a compromise between the desire to record some shadow detail, and the necessity of avoiding severe over-exposure in the highlights. So the meter will require *really* careful use.

Our choice of film should be that to which we are most accustomed—to change working conditions *and* material at the same time is asking for disappointment.

In bright light, or on the water, a lens hood is a "must". Whether or not filters are required will depend on the subject, but it is wise to bear in mind that even a pale yellow filter will over-darken a Mediterranean blue, and produce an unnaturally heavy sky tone in the print. Beware also of too much filtering at high altitudes.

What equipment should you take on a trip? My own

Spring Sunshine *by H. S. Newcombe*



Alpine River (Austria) *by H. S. Newcombe*

Stokesay Castle (Salop) *by H. S. Newcombe*

Low Tide, River Swale *by H. S. Newcombe*

Riverside London *by H. S. Newcombe*

Figurehead *by H. S. Newcombe*

Old Doorway, Rothenburg *by H. S. Newcombe*

Lilac Blossom *by H. S. Newcombe*

practice is to examine my outfit carefully, and to leave behind everything that is not essential. Remember this is to be a *tour*, rather than a camera excursion. If you aim to record architectural details, a tripod is probably desirable. This should be as light and compact as possible consistent with rigidity; if yours is not that type—leave it behind. I think the essentials are camera, meter, lens hood, pale yellow (and perhaps red) filters, and a flexible wire release. Front lenses are probably superfluous unless we are interested in natural history.

A ruled notebook in which to record every exposure *as soon as it is made* completes my list. It is all too easy to forget the exact location of a particularly attractive shot when the holiday is over, and we want to title the picture in the album.

Carrying the equipment is rather a personal choice. I prefer an ever-ready case for the camera alone, and the small gadgets in soft purses distributed in my pockets. The less one has to sling over the shoulder the better.

If away in a strange land, and luggage presents no problem (e.g., on a motoring tour) there is much to be said for carrying a developing tank, thermometer, and sufficient developer and fixer to develop at least one film on the spot. The comfort of *knowing* that our estimates of the required exposures are reasonably accurate, is well worth the trouble involved. We have to provide some sort of darkroom facilities, and this usually means employing the hotel bedroom after dark. With care, windows can usually be covered sufficiently to eliminate risk of fogging from street lamps during the short time required to insert the film into the tank. Washing in running water may not be practicable, but a dozen changes of water will suffice, if the film is allowed to stand (with occasional agitation) for about five minutes each time. Drying can usually be accomplished overnight by pinning the film to a shelf where it will not be disturbed nor unduly exposed to dust. A clothes closet is often a satisfactory darkroom—and drying cupboard.

What to take—on tour—is again a matter of personal choice—but it is well to try to cover the whole trip, so as to provide a complete record of our wanderings, and time is well spent examining the postcard shops to discover the usual views of objects of interest—with the express intention of *avoiding* them—so that our own record of the place is an entirely personal affair.

There is always so much to record that even the most ordinary happenings, which at home would not deserve a second glance, are of genuine interest because of their novelty. The difficulty is to decide what to leave out—not what to take.

One word more. Most people are tolerant of the obvious visitor from another country, and will take little exception to your camera recording their life and surroundings—but please bear in mind that, in another country, *you* are the "foreigner", and do all that is possible to avoid giving offence.

PICTURES OF PEOPLE

MANY PEOPLE positively dislike having any camera pointed at them, and even those who register no evident objection, are prone to become very camera-conscious—assuming unnatural expressions and poses; or to stare at the camera and its user in such a way as to ruin all chance of a natural picture.

The shape and design of the twin-lens camera helps us to overcome these difficulties to a large extent. It is quite easy to take pictures of persons without their knowledge, by facing at right angles to the direction of the subject, and holding the camera so that it still points at the desired group or victim. This simple subterfuge is astonishingly successful; almost everyone assumes that a photographer is taking a picture in the direction in which he is facing, and the square shape of our camera does not give away the truth except to the very observant.

There is no real difficulty in holding the camera. One must, of course, be careful not to obscure the taking lens with the hand, but if a lens hood is fitted this usually can easily be avoided. Levelling the camera, when held in this position, is a trifle difficult at first, but the knack is very quickly acquired, and of course, focusing presents no particular difficulty.

The makers of the Rolleiflex used to supply a surface-silvered mirror which clipped on to the camera front at an angle of 45 degrees so that such sideways pictures could be taken without even turning the camera. In my opinion it was not too satisfactory in practice, because the mirror necessarily reversed the subject laterally, so that negatives had to be printed through the reverse side to give a normal print. In any case, the camera can be turned sideways instantly—sometimes a matter of importance.

Holding the camera so that it "looks" backward under one's arm is another useful variant of the above when we deal with very shy subjects.

LANDSCAPES

WHILE RECORDS of people, their habits, and costumes, are always a prime favourite with the traveller, he will also be attracted by the places he sees, and by the scenery. Let us then turn from people to views and landscapes.

Landscapes are in many ways one of the easiest, and at the same time the most difficult of subjects for the camera. The apparent simplicity of satisfactorily recording a pleasing view is one of the traps that our enthralling hobby holds for the unwary. Landscape photography falls naturally into one or other of two distinct channels. Either an attempt to produce a factual *record* of a place, district, or type of scenery; or alternatively an endeavour to create a picture, using a certain landscape scene as its motif: a picture in which the place as such is of comparatively minor importance, and the artistic presentation is paramount.

In the case of the record, technique must obviously be irreproachable. The film must be perfectly sharp everywhere, exposure and development must be such as will secure all possible detail and tone separation, and the subject itself be shown with the utmost clarity.

The pictorial approach, however, will cause us to concern ourselves more with the *mood* of the subject that we are striving to portray. Composition will become at least as important as technical perfection. Our interest will be centred on securing a picture which is pleasing and well balanced, and we probably shall make use of differential focusing, to give emphasis to some prominent foreground object, and at the same time to improve the aerial perspective and recession of planes.

In either event, the twin-lens reflex is a most convenient and efficient instrument for our purpose. The square format allows us to concentrate on getting everything that we require on to the film. Therefore any such decision as to whether the picture shall ultimately be presented as an oblong or a square can be deferred, and need not seriously exercise our minds at the time the picture is taken.

The basic technicalities of landscape work do not differ seriously from those of other forms of photography, but as we are probably concerned with relatively small objects at a considerable distance, and may want to present our final enlargement on a sizeable scale as befits the subject, the choice of one of the slower fine-grain pan films is recommended. Exposure should be accurately assessed—preferably by the "lightest/darkest object" method—which will balance the tones of the subject with the available tone recording capacity of the film. Development should err, if anything, on the side of softness, again with a view to considerable enlargement; and for the same reason, a fine grain formula can well be employed.

Focusing must be done systematically, and the point of principal focus (probably foreground) selected with care. Thought should then be given to depth of field. In most cases we shall probably want the far distance to be sharp and therefore stop down accordingly. For a pictorial rendering a relatively shallow area of sharp definition may be adequate; for record purposes everything must be sharp.

Camera position, particularly height above ground level, has considerable influence on the picture. As we have already seen, a relatively high position accentuates the extent of the foreground, and also increases the apparent height of distant objects. A very low camera position on the other hand gives greater prominence to individual foreground objects, and reduces the apparent size of those in the background. By reducing surface visibility, it appears to reduce the actual physical extent of the foreground itself.

The sky forms an important part of the majority of landscapes. In recording it, it is of importance to ensure that it is reproduced in a sufficiently natural form, so that it does not compete with the actual landscape. Avoid too dark a filter, with its consequent exaggeration of sky tone-values; generally a pale yellow or yellow-green filter will provide adequate correction.

PANORAMS

THERE MAY even be occasions when we may want to portray what is *all round* us, instead of only the 40 odd degrees in front of the normal camera. There used to be special instruments for the production of such panoramic views, but we can also make them with our twin-lens reflex. For this we have to make a series of exposures which can subsequently be joined up to give the desired result. Although this method lacks something of the simplicity of panoram work with apparatus specially designed for this purpose, the results are, with careful manipulation, all that can be desired, and require neither considerable equipment, nor particular skill.

For taking panoram pictures with a camera like ours, we can use a special accessory, the *panoram head.* This device is attached between the camera base and the tripod top. It provides an *exact* means of measuring the extent that the camera must be turned so that each successive picture will accurately mate up with the preceding one. In this way a series of pictures can be taken to embrace the full 360 degrees from any given point. Shorter panorams involving two or three exposures can be made.

So that there shall be no difference in tone between adjoining pictures, all the negatives on a panoram must have the same exposure, even though in some of them the sun will be behind the camera, and in others the lens is looking at the shadow side of the landscape. Any attempt to correct this, either in negative or print exposure, will result in a difference of tonal scale between neighbouring prints, which cannot possibly be reconciled. Similarly, when making the prints or enlargements, they must all have the same exposure, and be developed for the same time ; or, better still, all be developed together in a large dish.

But the absence of a panoram head need deter no camera user from attempting this work. Even a tripod is by no means a necessity. A panoram is, after all, only a series of exposures which mate up, or can be made to join up accurately one with another. Any series of photographs taken from the same spot, which *overlap* each other to some extent can be cut and joined in this way.

I take many panorams without mechanical aid. Having selected my camera position, I study the landscape on the focusing screen, first to ascertain whether I can swing round to take the desired series without hindrance or embarrassment from prominent foreground objects, and also to ensure that the whole strip can be taken with the camera held level.

This last point is very important, the camera must not be pointed either up or down while the individual exposures are made. If this rule is not obeyed, we may find ourselves faced with a curved horizon when we come to join up the pictures. If a series is to join up into one long strip, the position of the horizon must, of course, remain more or less on the same line, except as may be dictated by the contours of the land itself. To leave a margin of safety I try, in such circumstances, to arrange for the horizon to lie just above the centre of the negative. I study what will be the *left* hand end of the series, and note *the last prominent object* which will be visible on the *right* hand side of that particular subject as a " guide point." I then expose, wind on the film, and swing round to my right for the next exposure and so on.

It is *important* to remember that with *any* twin-lens reflex camera the focusing screen image is *always reversed* left for right; this has to be taken into account when selecting the necessary guide points. The instructions for the reflex user then are:—Start with the left-hand end of panoram. Note the last prominent object on *left* side of reflex focusing screen. Then expose, wind film, etc., and swing round *to your right*, watching the focusing screen carefully. The *left*-hand object will move across the screen, as you turn the camera *in the same direction in which you are turning*. *Stop* just before it passes out of view on the *right* side of the focusing screen, and make exposure No. 2. Whatever object may be *now* just visible on the *left* of the screen is your next mark, and should in turn be followed across the screen almost to its point of exit, to take picture No. 3—and so on.

By ensuring this small overlap every time, I naturally use a trifle more film than would be the case with the mechanical head, but this is a small price to pay for a good panoram that would otherwise remain untaken.

When the prints (or enlargements) are made, it will be found necessary to cut something off the sides to make them join up accurately; and this is best accomplished by trimming approximately the same amount from *each* of any pair of prints. If all the amount to be cut away is removed from one print, so that it meets the edge of the adjoining print, it will be found that the two do not as a rule match up, either in tone or in accurate detail.

There are bound to be some irregularities in any hand held panoram, but by careful cutting and mounting, a well matched strip should emerge.

One method which is sometimes used for joining up panoram prints consists of cutting the edges in such a way that the outline of a prominent object such as a hill, tree, etc., is followed for the most part of the cut. In this way the joining edges will not be so apparent in the finished picture, as they will tend to be broken up. One point to remember, however, is the need for a definite overlap.

PHILIPPE HALSMAN ON TAKING PORTRAITS

PHILIPPE HALSMAN, acknowledged as one of the world's great portrait photographers, began his camera career in Paris, where he had gone to complete his studies in engineering. He literally taught himself photography—beginning with a 9 × 12 cm. camera which he had inherited from his father. His first step in using artificial light was to learn just what could be done with one hand-held photoflood lamp; once he understood all about the first lamp, he bought a second. With almost a mathematician's mind, he tried every conceivable kind of lighting to achieve desired moods and effects. This step-by-step, light-by-light knowledge forms the basis for the technique which has resulted in many covers for *Life*, innumerable pictures in *Good Housekeeping*, *Glamour*, *Esquire*, and other magazines. He has also photographed many authors for *Simon and Schuster*, New York publishers. He came to America in 1940. At first the struggle for recognition was difficult, but by now the hardships have paid off in great success. Proof of his standing in the professional world was his election as first president of the *American Society of Magazine Photographers* in 1945.

" When Wendell Willkie's famous book *One World* was being prepared for publication, I was assigned by his publishers to photograph him for the jacket of the book. He arrived at my studio with a friend, and was so engrossed in conversation with her that he seemed completely uninterested in having his portrait done. Every time I asked him to stop talking, an expression of annoyance would flash across his face. Obviously, annoyance was *not* the mood in which he should be photographed. I was desperate.

"Finally I said: 'You know, Mr. Willkie, I think you are not the youngest nor the oldest child in your family. You are probably the middle child.

"Willkie's interest switched to me, and since he could not see my eyes—my head was covered by the focusing hood, and I was watching him on the ground glass—his eyes went to their nearest counterpart, the lens of my camera.

" 'How the devil did you guess that'? he asked.

"So I talked to him—taking pictures all the time—about the well-known theory of the psychologist Alfred Adler, according to which the youngest child and the only child usually have the strongest feelings of inferiority. Older children tend to be overbearing, officious, protective. Willkie was neither insecure, nor overbearing, but seemed well adjusted.

"It took me ten minutes to tell the story—during that period I got all the pictures I wanted, and the famous American statesman looked like the warm, kindly person I had always thought him to be".

One of the pictures taken at this sitting appeared on the millions of copies of Willkie's book. The way in which through that picture Wendell Willkie looks straight into the eye of anybody who glances at it, is a demonstration of why Halsman always uses a twin-lens reflex. But he did not always use this type of camera. . . .

"When I began my career in Paris, I used a big studio camera, but soon I learned that so much time elapsed between the instant I had the pose right, and the time I could make the exposure, that all spontaneity was lost. I had to close the lens, cock the shutter, stop down the lens, pull out the glass, insert the filmholder, pull the slide, and by then the mood of my subject had changed.

"Since I had studied engineering, I decided to design my own camera, a 9 × 12 cm. twin-lens reflex, which was built for me by the grandson of the man who built cameras for Daguerre. It is constructed of mahogany and brass, and so it even looks like an old daguerreotype camera."

The camera is equipped with a 21 cm. f 4.5 Zeiss Tessar lens on which is mounted a long black metal tube lens hood. To reduce parallax to a minimum, the focusing lens is mounted very near the taking lens. The focusing lens is a Leitmeyr Sytar of the same focal length as the taking lens.

For the lighter type of portrait work, Halsman uses a Rolleiflex with synchronized multiple flash—i.e., more than one flashbulb coupled to the shutter but placed away from the camera in order to avoid the flat effect of a single light attached to the camera.

These two cameras serve his portrait work so well that he has no need for other lenses. Therefore, the fact that his lenses are not interchangeable does not bother him.

"Now this camera that I have constructed for myself is a very important part of my technique. Because of it the person I photograph very seldom sees my eyes. It is difficult enough to look into a camera without getting self-conscious, but it is much more difficult to look at the lens when the photographer is standing next to the camera watching you. With my camera, my head is covered by the focusing hood, and I am looking through the lens ; so its lifeless mechanism suddenly becomes almost alive."

In this way Halsman's subjects, while looking into the lens, know they are looking at him, which, he points out, is one of the reasons why the eyes in so many of his portraits are full of life and hook into direct contact with the eyes of those who look at the picture.

This same attribute is, of course, found in all twin-lens reflex cameras, and is an answer to the critics who do not like working bent over the camera. Part of Halsman's technique is hiding his own eyes, looking down, the psychological transference (in the subject's mind) of the photographer's eyes to the camera lens.

"This is especially important when you photograph women whom you wish to glamorize. It helps a woman to know that a live person is behind the camera, and this becomes for her more or less a symbol of the man she wants to please."

The most important element of a portrait is characterization. Halsman, who likes to compare photography to literature rather than to painting, points out that the problems faced by the writer and by the portrait photographer are largely psychological, and that each is searching for the instant which discloses character. Therefore the mechanical techniques of photography are important in so far as they aid or detract from the photographer's attempts at characterization.

"Just when very carefully composing some picture with an important foreground does parallax present a real difficulty. This is inevitable at near distance; the focusing lens sees from a markedly higher viewpoint than the taking lens. You may find in the picture taken that the foreground is higher than you intended it to be, and that it touches something in the background that it shouldn't. Or the taking lens may peer into the nostrils, while the focusing lens (which is about 2½ inches higher in my large twin-lens camera) does not. This may result in a picture that is not only aesthetically undesirable, but one which changes the whole characterisation of the subject.

"It is good to know how much distance there is between the lenses on your camera, as I do on mine, so that you may develop a system of automatic adjustment on your tripod. For example, I know that with my specially designed twin-lens reflex three turns of the tripod handle will automatically adjust the difference between my taking lens and my viewing lens, after I have checked the lighting, etc., in the viewing lens".

Halsman's lighting was not developed to achieve "drama" without purpose. Always he has in mind that Paris training, when he learned one-by-one what each light could do—not only to eliminate, but to aid in characterization. Any feature may be under-emphasized; any feature may be played up—according to how the person before the camera is best revealed.

When Halsman is looking into the ground glass, his mind is continually on the problem of establishing contact with his subject. Sometimes (as in the case of the Willkie portrait) he talks a great deal; at other times he is almost taciturn. The number of exposures is from 12 *to* 30, *and the sitting takes from one to two hours. He has no formula for procedure in either conversation or technique. He looks even at everyday technical facts with some initial healthy suspicion.*

"All sizes of negatives and printing papers are arbitrary, and determined by the manufacturer. The real shape is the circular image given by the lens. I have to compose within that circle. Therefore, the problem of square versus rectangle does not disturb me. It is easy to compose a horizontal or vertical image within a circle. It is possible to compose this either when taking the picture or later in the darkroom. Many times my final pictures are square. I do not allow the proportions of the paper to dictate my composition. I change the proportions if they do not fit my idea of what the picture should be.

"The laterally reversed image as presented by the ground glass screen does not bother me either. Every picture is reversible in composition. The reversed image is a problem only when you are shooting for some pre-conceived newspaper and magazine layout, and then it is a question of good memory that should warn you not to make the mistake of composing backwards."

Although Halsman is known for the relatively slow speeds with which he takes his studio portraits (common exposures are $\frac{1}{8}$ second at f 16, to $\frac{1}{10}$ second at f 11, depending on the subject's degree of relaxation), sometimes the problem of greater speed must be taken into consideration. . . .

"I use a Rolleiflex for my candid portrait work—for instance, I used it for a series of candid portraits of musicians which I did for *Life*. Naturally, there was movement in these pictures. For example, the portrait of a famous pianist showed him hitting the keyboard. One of his hands had a slight blur at 1/250 second. This blur is fine, since it indicates the fast rate at which his hands were moving. I definitely did *not* want the hands devoid of all movement".

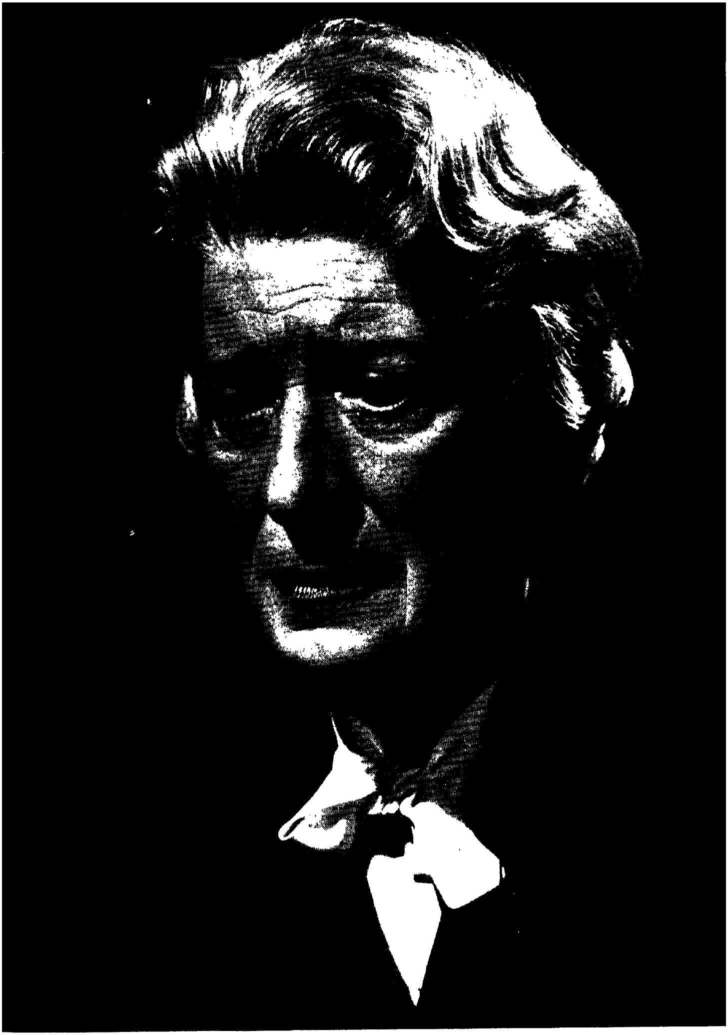
In everything, then, in lighting, speed, mood, Halsman's one aim is characterization. It is easy to see why he replied when asked to name his favourite subject, "the human face".

ROY PINNEY ON SNAPS OF CHILDREN

ROY PINNEY came to child photography by a very roundabout trail. His early ambition was to study natural history. He took courses in entomology, ethnology, and perpatology. In several of these courses he used the camera as a research tool, and soon found himself a little more interested in the camera than in natural history. In 1928 he became a "lugger" at some film studios in New York. This job consisted of carting the 65-pound camera to location and setting it up. He learned more about photography by talking about it with newsmen working at the nearby *Associated Press* office. Combining the early training in natural history with his new photographic talents, he made trips to South America, Central America, the West Indies, Labrador, and Iceland. He also accompanied William Beebe on his undersea

Wendell Wilkie *by Philippe Halsman*

Johnny by Philippe Halsman



The writer Janet Flanner *by Philippe Halsman*

Reflection *by Philippe Halsman*

exploration in the Bahamas. From this Pinney went into newspaper work to become the highest paid newspaper photographer in New York City. In 1938 he opened his own studio and worked for the picture magazines who pay better than newspapers. In 1944 he decided that the financial rewards of the commercial illustration field were even higher and so he quit magazine work. He never overlooked the prestige value of winning photographic contests. And in the contests his baby photographs always won. The highest reward was winning the New York Art Directors Award for the best black-and-white picture of the year. It was of a baby. And Pinney bowed to fate. Now he specialises in children's pictures—both indoors and outdoors.

"The picture on page 177 was shot for a magazine advertisement. It was supposed to convey the story of a child who did not want to eat. To do the assignment I used a professional model and shot the picture in my studio. My biggest problem was not one of technique, but one of approach, for I had to convince the child that he *was* a little boy who didn't want to eat. This photograph and its problem are typical of the children's photography I do for the key problem in every photograph of a child is always one of approach.

"As with all illustrations, the test of the success of a picture is: How well does it tell its story? For every photograph which you take tells a story, or at least it ought to tell one. And the success of the story will depend on how well you have planned in advance".

Pinney uses the twin-lens reflex for all of his work. He believes that it is definitely the best camera for snaps of children.

"The twin-lens reflex is a camera which combines speed of operation with versatility. It is an all-round instrument and in a way the field of child photography is an all-round field, for one must be able to shoot in a studio, outdoors, or in a home. One must be able to shoot in all kinds of lighting and from any position, for children's expressions are mercurial, and do not wait for tripods and view cameras.

"One must be able in particular to shoot from low positions—at the child's own level. Looking down to a child is bad in every sense of the word. It lands you with pictures of giant heads on dwarfed bodies. The perspective drawn by a camera held at a grown-up's eye level is all wrong for photographing children. The chest position of the twin lens is half-way to success. Lower down—down to your knees and sometimes as far down as the floor the view is even better. They are within easy reach of the twin-lens camera and much less comfortable with the range-finder type of photographic instrument—which incidentally is more conspicuous, too, and so again less suited to child photography.

"But the key to child photography is lighting—for lighting creates moods and effects, lighting tells a story. And each kind of lighting has its proper use and function.

"Let us assume that you want to take a photograph of a child which will recreate the mood of childhood—gaiety, laughter, purity. Your lighting will be high-key light all over. You will place your floodlights so that there will be no heavy, distracting shadows either on the child's face or in the background.

"If you are taking this picture outdoors, you will take it at a time of day when the sun is *not* directly overhead. In that way, it will be possible to give a sparkle and brightness to the child's eyes which would be lacking if the shot were taken at noon when heavy shadows would mar the face. The fact that the twin-lens reflex is so versatile that you can take pictures from any angle will aid you outdoors."

It is important that the lighting of a child's photograph should seem natural to the viewer.

"Lights must be used sparingly in child photography. Above all, the effect must never be artificial, must never be out of keeping with the subject material, which is light and airy. This is one of the reasons that natural light is the best possible illumination for photographing children. A few years ago I used flash and reflectors to fill in the shadows even in my outdoor work. But one day I discovered that I was stopping any chance for natural photographs since I had to worry so much about lights and reflectors—and then I noticed that the reflector made the child squint his eyes. So, I moved back to sunshine.

"Many people will tell you that sunlight makes very harsh face shadows—and that is why you should use sun-reflectors or flash; however, the trick is to pick a time of day when the sun comes from the side. The modelling of the face and head will be ideal. To catch the effect of the sunshine on a child, it is wise to overexpose slightly and then under-develop your film. This will make for more brightness, and will more nearly duplicate the effect of the sun."

Child photography presents some interesting problems in composition as well as lighting. . . .

"One of the indispensable attributes of the twin-lens reflex is that I can see the picture at the time I am taking it. Children move so fast and with such little apparent logic, that the most carefully composed shot in a camera of a different type will be gone in an instant.

"I believe that the square negative is a definite help to the child photographer, for it means that he can shoot any kind of shape—horizontal or vertical—and then trim later as required. This is possible when you do not work too close to the child, and the image does not fill the whole negative. There is no reason why it should anyhow, since the $2\frac{1}{4} \times 2\frac{1}{4}$ inch negative is capable of very sharp pictures which may be magnified several times over."

The mechanical speed of the twin-lens reflex also helps the child photographer. . . .

"Children's moods and expressions change almost as quickly as their positions, and if the child you are photographing is in the mood which you want, take as many shots as you can as fast as possible. The least expensive part of photography is the cost of film, and you should shoot as much as quickly as possible to get fine children's photographs.

"Children tire easily, and they are at their best only when they believe what they are doing is a game. If you can use the old game of Let's Pretend, you can coax whatever expression you want from the child—for fifteen minutes. After that period of time, the game has begun to pall. And if you try to scold him, or if his parents do, he will look like a child who is being scolded and that will be the end of the game. So, use the short period of time you have for picture taking, not for arranging lights and adjusting plateholders.

"One way to prevent your model from tiring before the pictures are taken is to plan everything ahead of time. First of all, you must decide the story of your picture, for it takes a real expert to do unposed, unplanned shots of children and make them look interesting.

"Generally, there are two categories of child pictures—those which depend on action, and those which depend upon expression. Action pictures are best shot outdoors, in terms of the mood of the lighting. Pictures which are studies of expression are best shot indoors, under such controlled conditions that all you must do is look in the ground glass and wait for the expression.

" When lights and setting and story are decided on, then bring in the child. It is not necessary as some people would have you believe, to gurgle and coo at children. The child appreciates being treated as a friend, and you must *enter* the child's world, not *patronize* it to gain his friendship. Don't look down on a child; neither with your camera nor otherwise."

YLLA ON ANIMALS AND THE CAMERA

YLLA is truly international. She was born of Hungarian-Yugoslavian parents, lived in Paris for many years, and has called New York her home since 1941. She had studied sculpture, and feeling herself a true "artist," decided to earn her living from photography and make sculpture in her spare time. This snobbish feeling towards photography has long since disappeared, along with the desire to sculpt which flew out of the window about the second year after Ylla became a photographer. But the start was hard enough; it took place in the darkroom. She gave it up one day after she had printed 200 copies of a photograph of a carpet. Soon after she became an apprentice of Ergy Landau, the Parisian child photographer. On a vacation in Normandy she whiled away the time taking pictures of the farm animals with a camera. Some of them were so good that they were published. So Ylla decided that animals would be the nicest clients, particularly as they would never ask to have their photograph retouched, or complain about what the camera did to their beauty. So she

Never Use 'Em *by Roy Pinney*

First Dip *by Roy Pinney*

Don't Drop Me *by Roy Pinney*

Assembly Line *by* Roy Pinney

opened a portrait studio for pets—and she still has one, only in New York, not Paris. Her photographs of animals filled four books and have appeared in magazines throughout the world. Her name has become synonymous with animal photography in Europe and America alike.

"Most of the pictures I take are done with a twin-lens reflex camera. The picture on page 185 of this book is a typical example of the kind of animal photography I do in my studio and demonstrates why I use a twin-lens reflex.

"My studio plan is a simple one. I have plain backdrops of various colours which provide an unobtrusive background for the animal. These can be pulled down to floor level. I always photograph animals on the floor as I believe they are frightened and uncomfortable when they are placed on tables or other sets off the ground and, of course, I want to take them at their own level.

"I set up one extension flash for this picture. Then I preset my Rolleiflex (equipped with Proxars) for an exposure of 1/100 second at *f* 22. Then I got down on the floor on my knees. With the help of the owner (I always need the owner or an assistant to help me handle the animal), I started the dog playing with the bone. Then I began shooting.

"Sometimes the animal moves so fast that it is all I can do to keep him interested and in the right confinement of space for proper lighting and background.

"The one thing my camera *must* be capable of is to permit me to see the animal at the time it is being photographed. With human beings, it is possible to direct an expression, to say 'Turn your head to the right' or something of the type. With an animal you must watch. With this little dog, I watched till he began to worry the bone and look to the camera as I talked to him. The result is my idea of a successful animal picture, and one reason it is successful is because I was able to see expression and picture at the instant of exposure."

In animal photography these two things are of prime importance: to know that the animal is within the space covered by your negative, and to know that the expression you want is on its face as you take the picture. The twin-lens reflex is the only camera with which Ylla has worked which provides these bits of information. . . .

"A good animal picture must show the characteristic pose or expression of the animal photographed. If the dog is a happy one, he must appear happy in the picture; if he is a sad one, he must be shown as a sad dog. Each animal has its own personality, its own characteristics. They must be shown in the picture. The successful animal picture will reveal the nature of the animal photographed.

"At the time when I first started taking pictures, I did pictures of dogs at shows. But soon I discovered that all I was supposed to do was to photograph the dog in a conventional pose, showing off his good points. This was not only dull for me, it was a complete reversal of everything I thought an animal picture should be. It may sound paradoxical, but I am interested in the human element in animal pictures—I want them to look like living individuals, not like statues. I try to take animal portraits, not text book illustrations."

Most of the pictures that Ylla takes are close ups, since she has discovered that most of her customers prefer to have head pictures of their animals.

"I was two or three feet away from the bulldog when I took his picture. If you get close to the animal, you have a better chance of getting a head large enough to magnify into a good size portrait. That is why many of my pictures are done with Proxars added to the regular lens of my camera. I use the Proxars both indoors and outdoors. Even at zoos I get as close to the animals as ever I can. The two lenses—one for full figures, leaping animals, and large animals like horses, and the added Proxars—are sufficient for any animal picture I might want to take. I feel no need for additional lenses."

Because the action of the animal must be followed exactly, Ylla never uses the camera on a tripod.

"I suppose that if I photographed something where the motion could be controlled, I might use a tripod. But it is necessary to get an animal in action. If you scold a dog to make him stand still, it will ruin the picture. He will look like an unhappy dog who has just been scolded, and the picture will be unsuccessful. Therefore, I get down on the floor and follow the motion of the animal in the ground glass. This approach does not allow for tripods."

Ylla finds that once you get really warmed up to the pet in front of your lens it is impossible not to lop off an ear, or a paw of a fast moving animal occasionally and she is not ashamed of it.

"I think that overcoming parallax is something than can be learned only by experience. Usually I have no difficulties at all. I have used a Rolleiflex since I first began taking pictures, so I am used to its eccentricities by now. I am sure that with some other camera which did not have the problem of parallax, there would be even more danger of chopping off ears and paws since it would be impossible to see the picture at the same time as it was being taken."

Working close up brings a problem of distortion.

"I realise that the feet of the Boston bulldog are slightly distorted, but that adds rather than detracts from the picture as far as I am concerned. After all, when you watch a dog chewing a bone or playing with a toy, his paws are most in evidence. They are in this photograph, too. And sometimes the distortion of a large head will give exactly the effect you want.

"To avoid distortion, it is necessary to hold the camera not too high and not too low. This advice is not particularly exact, I know—but animals are of all sizes, and it is best to learn through experience where to hold the camera. I believe that results are better when you get down on the floor with the animal, since it is easier to control the height of the camera, and avoid distortion in this manner. You can also see the distortion in the ground-glass, and easily avoid it."

It is important, too, to take advantage of depth of field. Naturally people want to see the whole animal in focus, for the hind legs are as important as the forelegs. Therefore, use a camera that will take care of this effect.

"I have never worked with a camera which permitted me to see the depth of focus on the ground glass. The fact that I cannot see it on the focusing screen of Rolleiflex never occurs to me. The only thing you worry about is something you have possessed. I have never possessed the convenience of working with a camera that had that advantage, so I do not miss it.

"I constantly focus when I am taking pictures of animals. I pre-set the opening and shutter speed and then I focus as the animal moves back and forth till it assumes an expression or pose which I want. Animals are so ever-changing in expression that it is a good idea to take as many pictures as possible. Usually I take as many as 36 in one sitting.

" The final selection is made once I have my sample contact prints. In many cases it would be impossible to predict how the final picture would turn out, since it depends upon the whims of the animal and I would be unable, because of the nature of my subject material, definitely to compose a picture on the ground glass screen. I never think about exact composition when I am taking the picture. I am far too busy following the animal so it matters but little what the theme of my negative is. All the composing proper—the final trimming of my work is done during enlarging."

On the other hand, the fact that the image on the ground glass is laterally reversed sometimes does present a problem.

"It occasionally slips my mind that the little figure in the ground glass is moving opposite from the way he appears before my eyes. However, this is the great exception. Usually, I accept the lateral reversal as part of the normal procedure of taking a photograph. And I think to myself that I am very lucky not to have a camera that has the image upside down."

Except for very special occasions, Ylla finds that the speeds of the Compur shutter is sufficient for her work. . . .

"Usually I take pictures at fast speeds. The minimum speed I use is 1/100 second, and in sunlight I shoot at up to 1/500 second. Many times I use a fill-in flash in sunlight (my camera is synchronized for flash work), but I always use the flash on an extension since I do not like the flat effect of flash fired from near the camera."

Animals are good subjects. They never complain about a picture—and they never become self-conscious. They are usually co-operative, especially if there is something to interest them. Two aids for good animal photographs are: ingenuity to call forth the desired expression or movement from your subject, and a camera which will permit you to see what happens.

Boston Bulldog *by Ylla*

Foal by *Ylla*

Gibbon *by Ylla*

Cat and Kitten *by Ylla*

W. EUGENE SMITH ON PHOTO JOURNALISM

W. EUGENE SMITH started his photographic career as a sideline. He wanted to be an airplane designer, and he collected photographs of planes. But there were many planes around that had never been photographed, so he bought a camera and started to work. He hasn't stopped since. At the age of fourteen he sold his first photograph to the *New York Times* : the picture was of the drought in Kansas. He was still in his 'teens when working as a photographer for two Wichita, Kansas, newspapers ; for two because he had frequent disagreements with the editors. Finally he decided to try a photographic school at New York. After that his first job was with *Newsweek*. He has worked for various other magazines and is now a staff photographer for the magazine, *Life*. Known as the young man who would do anything, climb or jump anywhere, he always came back with a story, no matter how difficult the assignment. The biggest of these was the war in the Pacific ; he nearly lost his life while trying to carry it out. He was badly wounded on Okinawa while shooting a story which was to be a " photo-essay " coverage of twenty-four hours in the life of an infantryman.

"The picture on page 193 of this book was taken with an Ikoflex early in the battle for Iwo Jima along a dusty road. There were marines walking up to the front which was from fifty to seventy-five yards away; there were marines walking back from the front. Some of those walking back were wounded; others merely wanted a few minutes' relief from the hard and dusty battle which had been going on for what seemed like forever.

"My eye was caught by one tired, worn-out marine, who stopped to take a drink of water. He was very dirty; he had a stubble beard; he didn't look at all like the Hollywood version of a fighter. To me, he looked like what a man in a war is. So, as he stopped to drink, and as another marine passed by on his way up to the front, I stepped up and took his picture. . . . No, it was not posed. One does not lie when one photographs a war."

This picture has become something of a classic in the few years since it was taken because, with it, Smith managed to tell the story of all tired foot-soldiers in the face of one of them.

"I think this picture is successful, if it is at all, not because of technical reasons, but because the technical reasons made it possible for me to say in this picture part of what I was trying to say about the war. I chose my tools in terms of what the picture should be. I used the Ikoflex as much as possible, since it has always been one of my favourite cameras."

Smith is a perfectionist. He takes along more than one camera, since he feels that there may be a special situation which one camera cannot cover. But he will never choose to use a camera which may result in a mediocre negative if there is a chance of using a camera, which will give him better quality pictures.

"No one thing makes a good picture. It is the orchestration of many of them. One should try to create a sustained emotion in a picture which is added to by all the elements in it. But at the end it is sincerity which marks a good picture, and not any conscious technical effort."

However, Smith found the twin-lens reflex an excellent camera to use because it did more things better than any other camera. The picture of that marine is sharp and detailed. The partially out-of-focus figure of the second marine would have been lost in a camera which did not have the same depth of field. With his camera, Smith was able to shoot from any and all angles—a factor of importance when one is climbing trees or squatting in foxholes. These same advantages hold for any type of news coverage—for news events cannot be restaged. They do not wait for the photographer to get in perfect shooting position. His camera must be able to work well from any spot.

"I carry other cameras to fill in a lens or two. It may sound ridiculous, but I will take along a camera and accessories just for one shot which will be used in the story because I believe that if I leave the shot out, I weaken the story. But the great majority of my pictures are taken with my twin-lens reflex. They were before the war, during the war, and they have been on my most recent assignment.

"You see, this camera presents fewer worries than any other one. It gets in my way least of all. And naturally in covering the war, I had to take a camera which was both portable and workable."

In any coverage of any subject by Smith, the people presented are of definite importance, and he has developed certain approaches which help him in photographing people.

"I believe in getting in close when photographing a full-size head. This means that because of the danger of distortion in photographing a close-up with a twin-lens reflex, I have to be most careful. The slightest movement may mean distortion. So, I watch the action of my subject closely in the ground glass. It is possible to keep out distortion by watching lighting and angle carefully.

"I don't use a tripod unless the speed is so slow that I must. I can liken them only to a ball and chains, as I feel they are so restrictive. To me, in a good picture you can lose everything in an inch, or gain everything in an inch. The minute you place the camera on a tripod, you become lazy. Psychologically, you feel some tremendous effort is involved in moving the tripod, you disregard the one inch, and you lose good pictures.

"It is sometimes necessary for me to restrain myself from filling up the whole of a square negative when I am supposed to be shooting for pictures of certain dimensions. Generally I feel that the square negative is a help since you lose no time in turning or adjusting the camera."

Smith's coverage of the war was much in the same spirit as his photo-essay coverage on other subjects for various magazines, with this one important difference: he was both reporter and photographer. This means that he thought up his own stories and his own treatment of the stories. In his approach he demonstrates clearly what the term "photo-journalist" means:

"I did not want nor try to cover the war with isolated, 'dramatic' shots. Early in the war I was assigned to cover the war from an aircraft carrier. This resulted in some pictures which couldn't help but make people think of glamour when they thought of war. Ships and planes are by their nature glamorous, and to photograph them in any other way is to distort the truth.

"It was my goal to try in my photographs to present a comprehensive story which would help to bridge the gap between the civilian at home and the soldier fighting in the

Pacific. Each picture I took was one more word of explanation in that attempt. I used every conceivable technical trick to tell my story. One shot, made in the dimly lit interior of the Cathedral at Leyte in the Philippines, which had been turned into a hospital, was a long-time exposure lit by flashlight. I ran from place to place, carrying the strong light with me while my shutter remained open.

"Another shot in a story on twenty-four hours in the life of an infantryman was taken by the light of a flare, dropped to illuminate the Japanese lines. This picture showed the silhouette of a soldier, resting on his rifle, partially out of a trench. But most pictures were shot in daylight and depended upon angle and composition to carry the story.

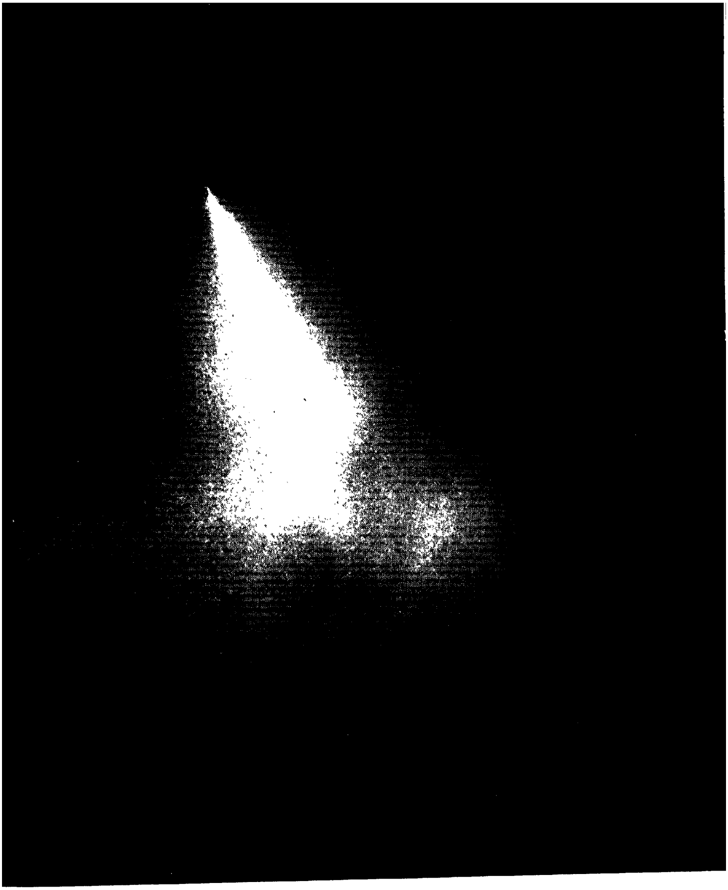
"I don't believe that the importance of the story ever justifies sloppy work. The more important the story, the better the photographer should try to tell it. I have worked many hours making one print—sometimes days—from my war negatives. The material is sufficiently important to make its impact regardless of the quality of my print. But the more powerful the picture, the more certain I am that people will have a chance to understand what I want to say."

The pictorial journalist is an artist who depends upon his own creative approach to make his story and his skill worth while. There are thousands of people who can snap a picture of a horse winning a race. There are only a handful who can interpret events, illuminate them for the readers of our many magazines.

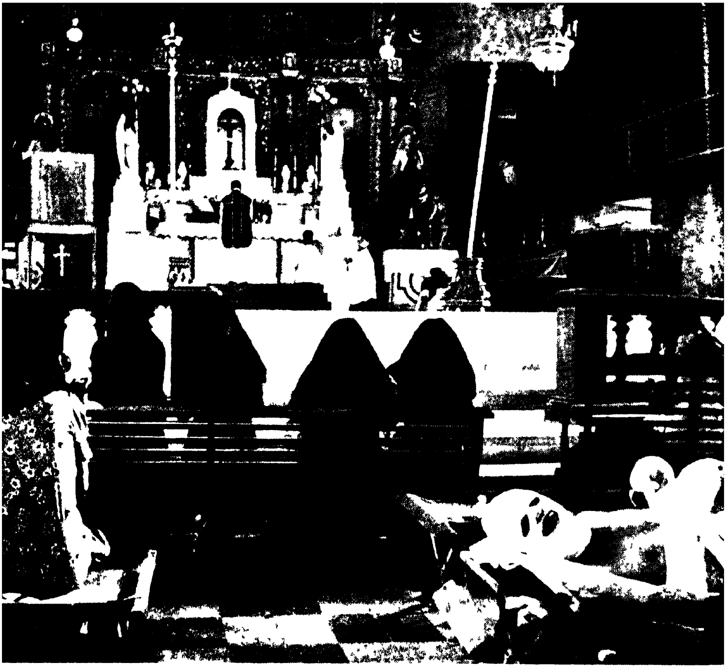
"The photographer who is a journalist owes a responsibility to the people who see his work. For that reason, once he has developed a clear-cut approach to a story—be it of a war, of musicians, of a certain geographical region—he should stick to that approach and fight for it. The reason is a pragmatic as well as an idealistic one—the photographer does his best work when he understands what he is trying to say. If he has nothing to say—or lacks the technical skill to say it—then he is not a good photojournalist."

Front Line *by W. Eugene Smith* (Courtesy *Life*)

Tear Gas *by W. Eugene Smith* (Courtesy *Life*)



Japanese Flare *by W. Eugene Smith* (Courtesy *Life*)



Wounded in Leyte Cathedral *by W. Eugene Smith* (Courtesy *Life*)

GEORGE KARGER ON STAGE WORK

GEORGE KARGER came to photography straight from a photographic contest. J. Walter Thompson, the advertising agency, conducted a competition in Europe during the 1920's and Karger won it. He promptly quit his bank job and ever since then has travelled throughout the world doing stories for magazines such as *Vogue* and *Life* and *Collier's*. His photography is essentially "dramatic," as he shoots not only plays and night club entertainers, but also recreates in the camera the stories of whole books. His pictorial interpretation of Richard Wright's book *Black Boy*, for which he travelled into the Southern United States to get the right backgrounds is looked upon by fellow photographers as a classic example of that particular kind of work. Karger usually shoots from a script as he believes that saves him a great deal of time. When shooting personalities, he sometimes goes into his magician's act—he is a famous amateur magician—to get the right kind of relaxed sparkle from them.

"One of the most discussed stage productions of American theatre history was the subject for the picture which appears on page 201 of this book. The production was the first attempt at an American folk opera : *Porgy and Bess* by George Gershwin. The scenes were full of action, and it was up to me to put the mood of the play across in a few pictures. That is the problem of the stage photographer, you know. It is comparatively easy to do a dramatic picture of the star of a play. It is not so easy to put three hours of action into a small set of pictures and retain the original mood of the production.

"This particular scene, as I remembered it, marked one of the high dramatic points in 'Porgy and Bess.' I had seen the production, had made a tentative shooting script, and the players were on hand to re-enact the drama for me. The first thing I did was to re-direct the scene for the camera. Usually it is not possible to keep either original stage positions or lighting if the photographer is to get the mood of the play across and keep his picture pictorially pleasing. I moved the people closer together and set up my lights using both baby spots and floods which had been carried along for the purpose. The actors re-enacted the scene for me. I shot at the proper moment, and obtained what I think is an example of good stage photography.

"Three quarters of all my work on the stage is done with a twin-lens reflex camera. I find it possible to get good, full scenes with it. I can see the picture exactly as it will turn out by merely looking into the ground glass. I can photograph many people in one scene and retain enough depth of field and sharpness to make the final picture photographically good.

"This particular picture is a favourite of mine because it resulted in every actor looking at the centre of interest. It is my belief that a picture must tell one story and tell it well. That one idea—with every eye, every movement, every bit of light centered on the one action comes across clearly in this picture—and comes across because I was able to direct and see it at the right moment in the groundglass of my camera."

Karger has strict ideas as to the qualities of a good theatre photograph.

"A good theatre photograph portrays the mood and action of the play. It is not confined to the staging as done by the original director. The best theatre photographs are those which condense action. Generally the staging by the director is not photogenic. For example, if there are three characters on stage, the director will generally place them in three widely separated areas so that the whole stage will be used. Obviously, the open spaces between the actors create dead spots for the photographer. The picture must be restaged for the reader. Move the actors closer together, close up the empty space and place the most important person, as far as the photograph is concerned, in the front."

The twin-lens reflex is a good camera for this type of photography since its depth of focus allows you to get both near and far characters sharp. Since usually more than one character is important to the picture, good depth of focus is a necessity whatever camera is used for theatre photography.

"Then it is important to record the facial expressions of the characters involved. To the person sitting in the balcony it may be action that will carry the mood. To the person seeing the photographs of a play, facial expression is of importance, and your camera must be capable of recording sharply the expressions of as many people as are important to the scene. In the *Porgy and Bess* picture, there is not a single face that is out of focus or unclear."

Important to the play also is the lighting. . . .

"Generally I use floods and spots, except for very fast action. The kind of lighting I use varies according to the kind of play I am photographing. Naturally, an eerie play requires eerie light effects. A comedy requires to be lit with bright and sharp lighting. I like to use soft, natural-appearing light, which is the reason for my carrying baby spots with me. I use flash only when it is necessary to capture fast action—like a person running or dancing across the stage."

Karger generally uses the camera on a tripod. . . .

"Since most of the scenes which I shoot are planned entirely beforehand, I know exactly where and when the action will take place. At the last minute, all I must do is check details and look into the ground glass to be sure I am getting the exact scene I want. Therefore, I use the camera on a tripod to insure maximum sharpness. When I want to get action, I use the camera at eye-level. I have a specially built rangefinder attachment for it—for those scenes in which I want to capture fast action.

"As for holding the camera at breast-level—I have never yet become dizzy from looking down into the ground glass. As I said, I generally use the camera on a tripod, but there are times when I use it hand-held or at eye-level. I find it is satisfactory in all these positions and methods of holding. I vary the position according to the particular shooting angle desired for a particular picture."

When not using the tripod, Karger finds it possible to hold the camera very still by hand, and he advises each person to experiment till he finds the best grip for holding the camera still. He himself has taken sharp hand-held exposures which last as long as a full second. His approach to the pictorial side of his job is like this:

"I can always keep the composition I want in mind when I am shooting. If I shoot for layout purposes, I have the notes right at hand. And since the scene is planned ahead of time there is no problem about changing the composition at the last minute. There is no time anyway to spend fussing with changing from horizontal to vertical shapes when shooting a play and with a twin-lens reflex there is no need for it either. Make up your mind what you want *before* you start shooting and remember that the actors are giving a special performance for you—and you must be capable of directing action, lighting, and position with the least fuss and effort. Every minute counts when you are working with people who have shown up to do their best for what is really *your* story. You must be able to re-write the script, to pick out the high spots, and then to stage them. The camera which is capable of capturing large scenes and of framing them so that you can be certain of the fact that you have the scene as it is shot is a good one to use.

"In spite of the fact that my scenes show people at full length, you will notice that very few of them ever take in the whole stage. The reason for this is that showing the whole stage gives a false impression. The human eye is selective and confines itself when looking at a play to that area of the stage which is the centre of action. Just so, when taking a picture of a scene of a play, the camera must select a portion of the stage and concentrate on it. It is important to have a camera which will permit you to see exactly that area of the stage which you want to appear on your final negative."

The reversed position of the figures on the ground glass may sometimes present a problem to the stage photographer:

"The only time I have difficulty with the laterally reversed position of the figures on the ground glass is when I am trying to capture the action of someone running or dancing across the stage. This does not happen very often, however. Mostly I prefer using the camera at eye-level with the special rangefinder attachment when taking action photographs."

The stage photographer sometimes finds a photograph for which it is necessary to have a lens different from that of the twin-lens reflex.

"It would be wonderful, of course, to be able to interchange lenses so that one would not be restricted to the use of one lens. However, there simply is no all-inclusive camera. So I don't worry about the problem, nor am I

"Porgy and Bess" by *George Karger*

Dr. Mayfield, Fire Eater *by George Karger* (Courtesy *Life*)

Floor Show *by George Karger* (Courtesy *Life*)

' Finian's Rainbow '' *by George Karger* planning to exchange my twin-lens reflex for another camera. Whenever I have a really special problem—and remember that is the exception to the rule since the majority of the pictures I take are done with the twin-lens reflex—I just use another camera."

Of course, the amateur does not always have the co-operation granted the photographic representative of a leading magazine. However, this should not discourage his desire to make stage photographs.

"In many cases it is possible for the amateur photographer to get full co-operation from local theatrical groups to take their pictures in return for a promise to give the cast free photographs. In that case, you will be able to attend dress rehearsals and to approximate the technique which I use in my work.

"It is always a good idea in such cases, to look over the lighting equipment of the theatre beforehand, and then bring along whatever you need in the way of supplementary lights. This will save a great deal of effort in carrying equipment.

" If you cannot get the management to re-stage the play or allow you to attend rehearsals, you must take pictures from the audience. In this case, do not carry flashbulbs, or you may find yourself out of the theatre by request.

"Meter readings won't help you very much, since you are necessarily fairly far away from the stage. It is a good idea to experiment with several exposures at varying speeds and apertures till you learn to judge theatre lighting. If it is at all possible, see the play through once before photographing it. Stage lighting technicians usually increase or drop light according to the mood of the scene. If you see the play through once and take notes on the lighting at important moments in the play, your photographs will be more successful.

" The best place from which to shoot the play is the first row of the balcony. The footlight seats will, in my opinion, provide a very distorting angle, and your subjects will have no feet !

"One of the important things to keep in mind is that dim theatre lighting requires long exposures. You must learn to hold the camera very steady (tripods are too bothersome in the audience) for long periods of time. Remain motionless and use only the joints and muscles of the fingers to hold steady, for great tension will cause your hands and the camera to shake. And do not try the impossible : to photograph scenes where the action is too fast for the lighting. There is a great deal of material which *can* be shot, even from the audience."

ARNOLD EAGLE ON PICTURING DANCE

ARNOLD EAGLE learned photography the hard way—as an apprentice to a New York photographer in the early 1930's. He worked as a director of photography with the National Youth Administration during depression years, and helped to develop many young photographers who are making successful careers today. He is known for his documentary as well as his dance pictures, particularly for his coverage of New York. His dance photographs have appeared in *Dance* and other magazines, many newspapers, and several books. Besides his dance photography, Eagle works at the present time at Standard Oil (N.J.) where a group of photographers are documenting the story of oil, under the direction of Roy Stryker (who helped to bring contemporary American photography its first recognition when he headed the photographic department of the Farm Security Administration).

"A dance by the American choreographer Lathrop provided the picture on page 210 of this book and a demonstration of what one can do with the twin-lens reflex. I was working in Lathrop's studio one evening about two years ago on a set of pictures which were to tell the story of his dance called 'His Birthday'. The story was built around three characters—a husband, a wife, and a dream girl. The dream girl was a fantasy to which the husband's mind turned whenever his personal life seemed unbearable. The wife was aware of the dream girl and was insanely jealous of her. My job was to convey the entire story in one picture. To do this, I decided to record a moment which showed the dream girl in action and the husband and wife static. All three dancers had to be in the photograph. Each had to be physically separate from the other two, yet the lighting and the mood had to show the close psychological relationship.

"I watched closely as the group danced the story several times, making notes as they worked. Then I decided on the scenes which I wanted to photograph. I had the dancers go through each scene several times. As they danced I tried several shooting angles and planned the lighting. Since dance is action, the most important characteristic of the camera I choose is that it must be capable of following action easily. And, since it was absolutely necessary that I should see the scene at the instant I was taking the picture, the twin-lens reflex had additional attraction for me.

"I placed the resentful wife in the foreground, and the dream girl whirling in the back, near the husband. I lit the scene with three flashbulbs—one close to the side of the wife's face so that the light would spill directly across her and emphasize the emotion of bitter frustration by casting strong shadows.

"When the whole scene was set in my mind, the dancers went through their movements again, and at the peak moment I snapped the shutter. The exposure was 1/250 second at *f* 11. (I used this speed rather than the 1/500 second which my camera reaches since I wanted the dream girl to blur a bit, thus adding to the quality of her unreality.)

"I doubt if any other type of camera would have followed the motion so exactly and allowed me to see the final picture just as I was taking it."

Arnold Eagle approaches dance photography in the same way as he approaches documentary work. Dance is a series of movements which result in action. The photographer's job is to catch this action at an emotional climax. This does not mean that good dance photography is nothing more than a series of leaping figures. Eagle believes that photography which persists in stopping figures in mid air defeats the purpose of the modern dance—which is to carry through a mood, an idea, an emotion.

Thus, the most important test for a dance photograph, as far as he is concerned, is: How well has the photographer caught the mood of the dance? To meet this test the photographer must know the dance well. Generally Eagle sees the dance performed five or six times before he starts working with it. In this way he discovers the moments of peak emotion—the "topic sentences" of the dance, as he calls them. Once he has decided on the single scenes which he wants to photograph, he begins to plan individual photographs.

"Working out a dance photograph sometimes involves even changing the choreography to get good photographic perspective. This may sound like an outrageous demand to make on a choreographer, but if you make it clear to him that you want to photograph the spirit of his work faithfully, he will change groupings of dancers or movements and directions to suit you and your camera. He will do this as long as you are able to convince him that you are desirous only of keeping the mood of the dance and recording it with your camera.

"My planning for a dance picture sometimes goes to the point of marking the floor with chalk for certain steps so that I will know where a dancer will be at a given instant. In that way I am able to plan my picture beforehand so that all I will have to do at the last minute is watch for the expected action on the ground glass and click the shutter.

"A great advantage of my camera is that I am able to shoot with it from any angle. This is most important since I may have to shoot from the floor or climb a ladder to catch the full movement or spirit of a dance. I do not confine my work to shooting from the position of the audience, since one cannot always get the full story of the dance photographically from the front view. Often in modern dance back and front movement are both essential to the story. One must be able to photograph from any angle, any position. And from any angle, a good twin-lens reflex is manœuverable, easy to use."

One of the important factors to consider in showing a mood photographically is the use of lighting. Dance may be brash or subtle, over-dramatic or delicate. . . .

Martha Graham in " Death and Entrances " *by Arnold Eagle*

Lathrop in " His Birthday " *by Arnold Eagle*

Mercer Cunningham in " Appalachian Spring " *by Arnold Eagle*

Folk Dancing *by Arnold Eagle*

"I have no rules for placing lights, since the lighting requirements of each dance vary as much as its choreography varies from that of the previous dance. However, there are a few general ideas which I repeat. I use at least one side light in every picture to throw shadows, and I use from one to six lights, depending on the effect desired. My camera is adjusted for synchronized flash, and I never use floodlights since all my work is done on location and they are a nuisance there. The dancer's home ground, his own stage (either his studio or theatre) and sets give him the proper feeling for working happily and exactly. The lights hold me back from changing my plans for photographing a certain scene at the last instant. Once the scene is lit in a certain way, it must be photographed to that plan. Exactly the opposite is true of my few excursions outdoors."

Once the pattern of the movement is set, the shooting angle chosen, the lights set up, Eagle pre-focuses the camera, the dancers go into action, and he has the picture which he so carefully planned.

The question of composition in something as ever-changing as a dance, is, of course, an important one. The square format of the twin-lens reflex has presented problems to Eagle since sometimes he is so moved by the dancing that he forgets he is composing for a vertical shot and the negative shows movement reaching clear across the width, instead of just part way across. The vertical composition is ruined by his over-enthusiasm.

"I have finally overcome this difficulty by having four fine red lines painted on the ground glass. Two lines cut off that portion of the ground glass on either side not needed for composing a vertical picture. Two more lines, drawn horizontally top and bottom across the glass aid in composing horizontal pictures. This kind of mechanical aid is a must for the dance photographer since most dances fall naturally into a square composition, so the photographer is often tempted to compose a square picture. And everyone knows the square picture is unfortunately an anathema to magazine and newspaper editors."

With the question of composition comes the question of using a tripod. The tripod can and should be used much of *the time since dance photography is largely a matter of following planned action. . . .*

"The tripod is a necessary aid at times in dance photography to prevent the chance cutting-off of a figure at the edge of the picture. Many times the whole purpose of a shot will be to get a movement at the edge of the photograph. If you don't use a tripod, you may find yourself following the action of the dancer in the centre of the frame and losing the edge motion entirely. So, to be absolutely sure of that kind of picture, it is wise to use a tripod. However, climbing ladders and working from odd angles will lead you to depend more and more upon your own judgment, less and less upon the tripod."

The problem of catching the spirit of the dance is connected to the part the speed of exposure plays in a good dance photograph. In this field of picturing motion, great speed is not required of the camera.

"Even though I can take pictures up to 1/500 second with my camera, I seldom use this speed. For me the best speed is 1/250 second. Dance photographs taken at very high speed for their so-called 'frozen motion' are a denial of the spirit of dancing. Dancing is *flowing* motion, and that is why the sometimes slightly blurred figures taken at 1/250 second are preferable to those of frozen stillness at higher speeds."

Another element which must be mentioned in connection with speed is that many modern dances have their emotional peaks at an instant when all the figures on the stage are motionless. It depends entirely on what the photographer sees as the peak moment of the dance. At times an instant of stillness will provide the epitome of emotion of a dance. . . .

"Most dance pictures contain important foreground and background figures, which is another reason why the twin-lens reflex camera works so well in the dance. Both near and far objects appear sharp in the final picture owing to the camera's great depth of focus. At the same time the lens is able to deal with any reasonable demand by the dance photographer. The fact that the lenses are not interchangeable does not affect my dance work at all. Anything in the dance can be photographed through the lens of my camera and that is all I need.

"Every once in a while someone reminds me that I am not seeing the picture on the ground glass exactly as it will appear later, since the image on the ground glass is laterally reversed. If I weren't reminded, I doubt that I would be conscious of this reversal. I try always to train my *eye* to photograph. Good photographs are composed by the eye, not the camera. I see the picture in mind exactly as I want it to appear on the film so that by the time I look into the ground glass, I am merely checking details. It is my eye, not the camera, which sees the final picture. And I am so used to checking details in reversed lateral position that the problem never bothers me."

NELSON MORRIS ON SPORTS PHOTOGRAPHY

NELSON MORRIS's academic background is coloured by an intense interest and study of painting. When he was in high school in New York City, he also became interested in photography. He spent his out-of-school hours in the art galleries, and one day at "An American Place" he met the late Alfred Stieglitz. Stieglitz encouraged his interest in the camera art, and spent many hours explaining the intricacies of the photographic approach. Young Morris translated theory into practical application, and used his camera more and more, till he was finally covering scholastic sports for one of the New York daily newspapers. Today he works as a magazine photographer. He covers all types of assignments—from fashion to ice-boating—and back again. And his pictures appear in the leading American magazines like *Life, Parade, The American, Holiday, Collier's.*

"One of the most exciting afternoons of my life occurred when I was taking the picture on page 220 of this book. I was covering an ice-boat race at Lake St. Claire near Mount Clements, Michigan. I wanted to get a shot which would carry the idea of the danger, speed, and thrills of this sport. To do this I sat in the front of one of the boats which was speeding along at 80 miles an hour. I faced backwards and shot the oncoming racers. I did not use high speed to shoot this picture since an exposure of 1/500 second would have frozen the motion of the other boats. You see, we were all travelling at about the same speed, and unless I had been able to get a boat off the ice, at 1/500 second, I might just as well have shot the boat standing still as far as the reader would be concerned.

"So I shot at 1/100 second. This speed blurred the background a bit and added the feeling of great speed and motion which was necessary for this picture.

"A shot such as this illustrates rather well both what I want to get in my sports pictures and why I use a twin-lens reflex to get it."

Naturally what the professional photographer wants in a sports picture is not always what the amateur will desire. However, Morris's definition of the qualities of a good sports photograph represent a mark to shoot for. . . .

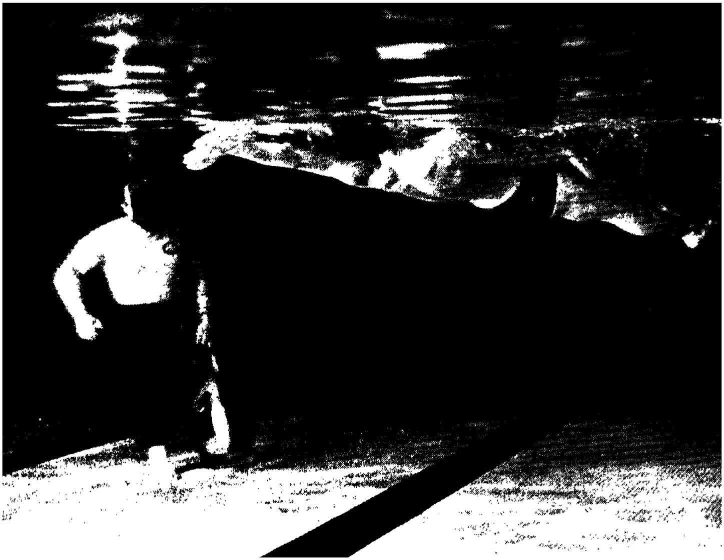
"A good sports picture is not one that is merely exciting, but one which shows understanding of the game photographed. It should demonstrate the particular characteristic of the sport in question. Just recently I covered my second assignment on bull-fighting. I feel that the second assignment was far more successful than the first, since I knew what I was after in each picture.

"Coupled with knowledge of the sport, the photographer must have perfect command over his camera. Sport is action. Action means that the photographer must move fast and that his camera must move with him. The instrument must be a part of the photographer. I have developed my own technique for using the twin-lens reflex with sports. I do not use the customary frame direct vision finder, but hold the camera close under my chin. Usually I leave the magnifier up. I compose my picture with one eye, look up quickly to check the action, and I have my picture. I don't find this position in the least uncomfortable, and I recommend it to anyone who wants to get good sports action pictures with a twin-lens reflex."

Nelson Morris has used a Rolleiflex since 1936. Although he has used other cameras since that time, he always comes back to using the twin-lens reflex. . . .

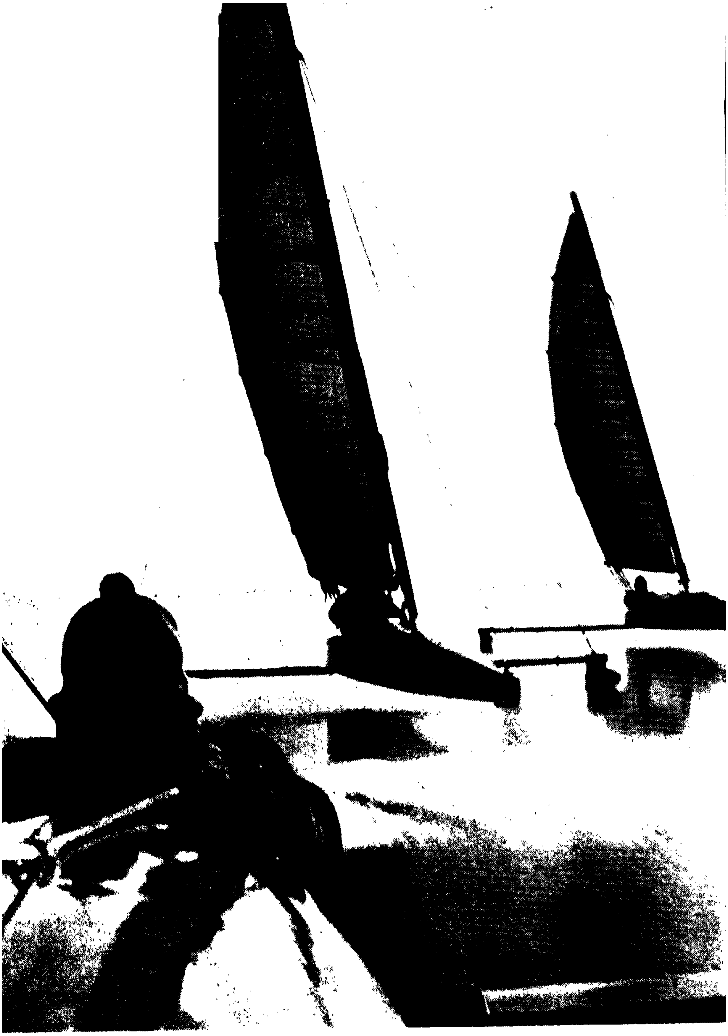
"I feel the twin-lens reflex has many advantages over

Canadian Skiers *by Nelson Morris*



Swimming Coach at Yale University by *Nelson Morris*

Six Day Races in Chicago *by Nelson Morris*



Ice Boat Race in Michigan *by Nelson Morris* other cameras. To name just a few of them: The fast film transport means that you are ready for another shot almost as soon as the first one is taken. The importance of this to the sports photographer is obvious. Second, I can see the picture at the moment it is taken, and thus get accurate composition. When a split second can mean the difference between winning and losing a tennis match or bike race, the very same split second may also mean losing exactly the picture you wanted to take. Further, I am able to focus during action with a twin-lens reflex, That is why I usually keep the magnifier up. My eye can see quickly whether or not the action is in focus. There are no delays, no prefocusing—which is always inaccurate unless action is planned.

"Another important thing to remember when using this camera is that it permits you to get down on the ground when shooting. This low angle is very important if you want to eliminate distracting background detail. As a rule there is quite a lot to see on the average sports photograph without including a lot of fussy incidental background.

"The last great advantage of the twin-lens reflex as a sports camera has little to do with the mechanics of the instrument—but a great deal with its weight. You see, very often we are allowed to get in close to sports events. Sometimes we even end as unwilling participants. I have had to climb into wrestling rings, into bullfight arenas, and many other tight places where my ability to keep myself and camera as unobtrusive and as mobile as possible was important. The Rolleiflex was ideal on both counts.

Nelson Morris usually shoots at high speeds. . . .

"Since speed is of the essence in this active field of photography I generally take my sports pictures at 1/500 second. This rule holds true in all cases, unless I am trying for a special effect as I was when I took the ice-boat shot."

The position from which you shoot should always be chosen in terms of the particular sport which you are photographing.

"For example, in covering football or soccer matches, I always follow the team from the sidelines for the first half of the game, shooting from a kneeling position on the turf.

This position gives the elements of power and speed which characterize the game. The second half I divide between the two goals, thus concentrating on the place where the maximum of action takes place.

"In a similar fashion, in photographing basketball I concentrate on the territory under and near the basket, and because basketball is a jumping game, I shoot from the floor.

"In field and track meets, I choose the angle according to the event. If it is a race, I try to get permission from the officials to straddle the lanes (so as not to interfere with the runners), and I shoot just as the winner breasts the tape. For high jumping, I shoot from a low angle so that the jumper will appear to be soaring above the heads of the spectators.

"Horse racing presents many angles for interesting photographs. One is a shot of the rear view of the horses at the instant the barrier is raised. A second is from the judges' stand (you will need permission for this) just as the horses round the first turn. The high angle makes the horses stand out against the background and gives the feeling of speed. Then, of course, there is the inevitable shot of the winner crossing the finish line which may be shot from the spectator's side of the track.

"To cover boxing or wrestling matches, you must be as near to the ring as possible, preferably in the press row. You need a speed of 1/50 second at least—which is about maximum for the kind of lighting you will find. The camera must be held very steady at this speed, so brace yourself against the ring, the row of seats in front of you, or any other stable object.

"The finish of a race, the winning goal—these are the things to look for in sports photography. And it is almost a rule that the best sports shots are angle shots—and the best of these are low angle, whether the sport be highly competitive or merely a shot of your best friend ice-skating. This position will give punch to your photographs and will eliminate the distracting background which ruins many otherwise good shots."

The problem of composing sports pictures depends largely on the nature of the sport which is being covered.

"Subject matter really dictates the composition of a sports photograph and not the art director of a magazine. It is a simple truth that horizontal action—a runner for example—cannot be turned into vertical composition by the whim of the photographer. Since action in many games changes within an instant, the photographer who works with a square negative has a definite advantage. He does not have to worry about turning the camera from one side to the other. All he must do is get the action within the frame of the ground glass. There is always sufficient space in which to trim. It is a waste of time for a sports photographer to worry about pictorial necessities since the action is taking place so fast that it is difficult enough to get it all on the negative, let alone create a perfect composition".

Some sports photographers use synchronized flash to add to the brightness of certain outdoor shots. . . .

"I never use artificial light outdoors in covering sports events. If you understand basic exposure your pictures will be bright enough without flash. Further, I believe that the person who sees your picture will know there is something unnatural about it if you use artificial light. The reading public accepts trick light effects in indoor sport shots. But people do not expect it outdoors. A good sports picture, above everything, must carry with it the ring of authenticity, and that is another reason I stick to existing light."

In spite of Nelson Morris's success with the twin-lens reflex in sports photography, the camera is not universally used in this field. . . .

"I think that one of the reasons why it is not used more often in the sports field is that many sporting events are such spectacles that photographers are assigned to certain spots and told that they must work from them. This means telephoto lenses in many cases. So the lack of interchangeable lenses to the twin-lens reflex definitely eliminates the camera from that kind of activity.

"However, the magazine photographer and the amateur (who wants good action pictures of his daughter playing tennis) approach the problem of sports photography in a more intimate manner. Many of my assignments are personality stories. Because of the time lag in magazine production, I never cover sports events as a news photographer would. I have a chance to work closely with the participants, just as the amateur does. Therefore, I don't need telephoto lenses in my own work. Neither does the amateur."

FRITZ HENLE ON FASHION PICTURES

FRITZ HENLE, whose work has appeared in *Harper's Bazaar*, *Vogue*, *Mademoiselle*, and practically every other fashion magazine worth mentioning, was born in Germany where he received his photographic education. He has travelled widely since his school days 15 years ago and has published four photographic books about Paris, Japan, Mexico and China. He came to the United States in the early 1930's and worked as a photo-journalist. The early years of *Life* saw much of his work. In recent years, however, he has turned his attention more and more to the fashion field. Both his fashion and travel books reflect an air of casualness blended with excellent technique. Henle is now an American citizen and lives in New York City. From there he travels for several months each year on assignments from fashion magazines and advertising agencies.

"I was working in the Bahamas for several agencies and magazines when I took the photograph appearing on page 229 of this book. The assignment was a heavy one, including beach shots, informal pictures on the streets of Nassau, and photographs of evening dresses. One afternoon my model and I were trying to picture a hat-shirt-shorts beach *ensemble*. I had made several exposures in the bright sunlight of Love's Beach about 20 miles from Nassau, showing Jeannette eating a picnic lunch, but the work felt unsatisfactory. I was hunting for that spontaneous ease and naturalness which is essential to a good fashion picture. It was late afternoon, there was a breeze to add the proper touch of freshness to the scene, but still the pictures seemed dull.

"Suddenly a sailboat appeared in the distance. I remembered that in the late afternoon the inhabitants of nearby islands made their way over the reefs into Nassau, and I decided to take advantage of the photogenic sails. I told Jeannette to stand watching the incoming boat—and just as quickly I framed the scene in the ground glass of the camera and clicked the shutter. There could be no retakes of the shot. The first one had to be right, and I felt certain that it was since I had seen it in the ground glass at the moment of exposure exactly as it would be on the negative.

"The result was just what I intended it to be—natural, interesting, spontaneous. It is a picture which will say to the man who pays me for picturing his fashion products: 'This will sell your clothes. The woman looking at this picture will see herself in the same happy setting. She'll buy the beach *ensemble.*'

"I suppose that the same scene might have been recorded by a 35 mm. camera, but it would be difficult to enlarge the 35 mm. negative to the 16 × 20 inch size demanded by some agencies and retain the detail asked for by the client who wants every fold, every button of his garment and the texture of its material shown in the photograph. On the other hand, it *is* possible to enlarge a 2¼ × 2¼ inch negative to 16 × 20 inches. The medium-sized negative permits sufficient latitude for magnification with only a slight softness in large prints."

In every way this one picture shows why Henle considers the twin-lens reflex the best camera for his work. For example, note the fact that the depth of focus (the lens has a focal length of 7.5 cm.) renders both the near object (the model) and the far object (the sailboat) clear. It is true that the speed of 1/50 second with which he shot the picture caused the waves to blur a bit, but he feels that the blur adds to the feeling of action. The f 3.5 lens serves his needs satisfactorily. In his opinion, there is no need for additional lenses in fashion work. So, the fact that the twin lenses are not interchangeable does not bother him.

"My definition of a good fashion picture is one that not only shows the clothes to advantage, but is pictorially pleasing and catches the reader's attention by telling a story. Without that sailboat, the beach picture would not be particularly pleasing. It would be a conventional shot of a pretty girl gazing out to sea; with the boat, the photograph becomes interesting, tells the story of a girl dressed in the latest fashion, eating a picnic lunch, and watching a sailboat pass in the Bahama breeze. It catches a moment of simple pleasure—and without the twin-lens reflex it could not have been taken; for only that camera permits you to see the picture at the instant it is being recorded.

"I try even in fashion work to catch the psychological moment, the instant when everything—pose, lighting, expression—points to the desired mood. This does not mean 'dramatic' photography. For example, although many of my colleagues distort the height of the models by shooting from a very low angle, I never do. I feel that the woman who sees the picture will be more likely to buy that piece of material if the model looks like a human being, not a surrealist dream. Spontaneity is the keynote—whether the fashion be a pair of beach shorts or a Greek goddess inspired formal dress. For that reason the square ground glass serves as a perfect instrument for my work.

"The darkroom hours decide for me whether the final print is to be horizontal or vertical. Besides, the square negative is particularly valuable when a whimsical art director who has ordered a vertical print two weeks ago, suddenly decides that he *really* wants a horizontal print. The size and sharpness of the negative allow sufficient latitude to trim as one sees fit and still retain the sharpness needed for the final print. The very fact that I am unable to make a final choice of composition when I am taking the picture saves me time and many good shots. Otherwise, as in the case of the girl on the beach, I might have missed the shot while arguing the pros and cons of horizontal or vertical composition."

A recognizable attribute of a Henle fashion shot is its sharpness and brilliant print quality. And if you follow a few simple rules, the twin-lens camera will help you achieve something similar in your own work. . . .

"Remember that the slightest, even unnoticed, camera shake will result in a blurred enlargement. Make it a practice to use a tripod whenever possible. I shoot out of hand only when lighting conditions are ideal (as in Mexico) and when my models are expert at holding a pose. When I shoot out of hand, I wear the camera on a strap around my neck and hold it as high as possible on my chest, right under the chin. In this way I avoid the difficulties and discomforts of the ordinary breast-level position, and retain a firmer grip on the camera. I never use the eye-level viewfinder affected by many professionals, since the finder is too inexact for my work, and I have little need to follow the candid action for which this attachment was designed."

Parallax?

"The answer to the problem of parallax is merely adjustment. It hardly ever bothers me since most of my fashion shots are full figure, and the distance from the camera is great enough to make the factor of parallax negligible. When I work in the studio and use my Proxars for close-ups, I just automatically compensate for the slight difference, so that I won't cut off the model's head. Soon you become so used to a problem that it ceases to be a problem. It is a question of time and practice. And I have had fifteen years of using a Rolleiflex."

In the same way, the fact that an image is laterally reversed on the ground glass becomes a matter of routine adjustment for the photographer who uses a twin-lens reflex. . . .

"At first it seemed strange that the figures moved on the ground glass opposite from the way they moved before my eyes. But after all these years the movement has lost its quality of strangeness. I believe that to use a camera correctly, one must work with it till it becomes as normal in its actions as one's own fingers. It is probably safe to say that rather than *adjusting* my approach to the camera, I actually *developed* my style from the twin-lens reflex."

In these days of speed, much is made of the fact that the lack of a focal-plane shutter and the lower speeds afforded by the Compur shutter are a disadvantage. But for fashion work, extreme speeds are seldom needed.

"Although some of my photographs show action—a girl dancing on the beach perhaps—I find my camera fast enough to do the job well. The trick is to gauge the instant of peak action (for all action has a peak, a time when motion is arrested or finds its direction), by merely watching for it on the ground glass. The peak action may be captured at an ideal speed—1/250 second. At this speed, the body will be static, but the dress will be moving. The result will be an unblurred negative, full of exciting movement. More speed than this is seldom needed by the fashion photographer."

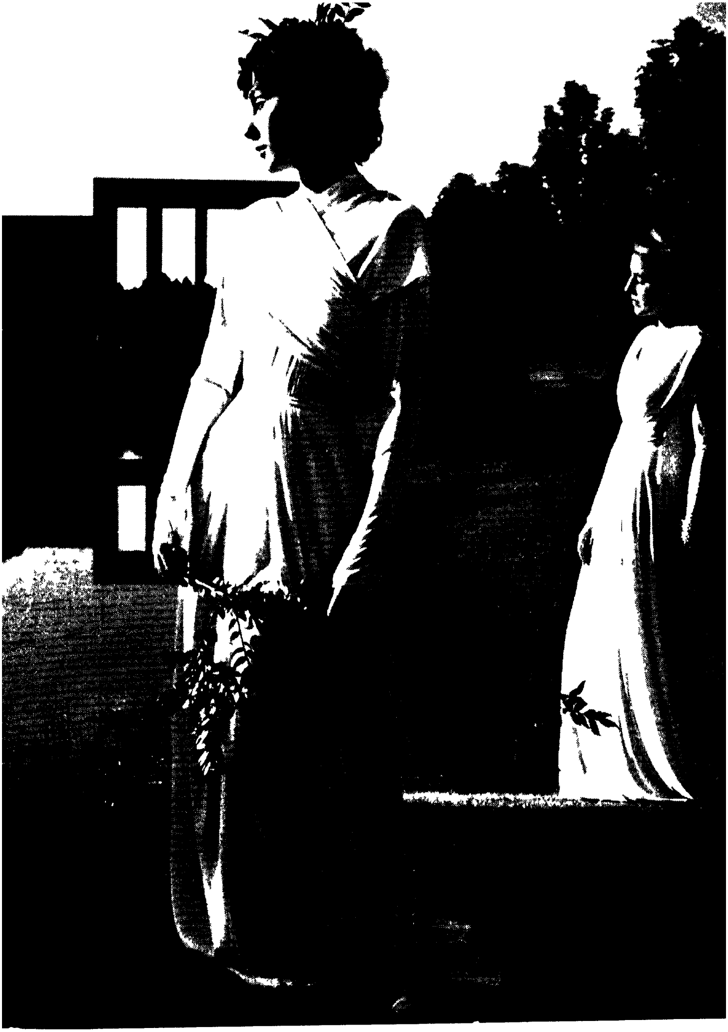
Another feature which fits into Henle's fashion formula may at first sound unimportant—yet to him light weight is of the utmost importance. The weight makes the twin-lens reflex ideal for the photographer who works out of doors, who travels, and must carry his equipment to beaches, up the side of Mexican pyramids or across rivers. When one is packing equipment for a journey, weight is an important factor. There are enough things to carry, enough drains on one's energy without adding a heavy camera. This is particularly true when one is on assignment and has a tough, long-houred schedule to complete.

ANDREAS FEININGER ON LOOKING AT BUILDINGS

ANDREAS FEININGER was born in Paris in 1906, and although he has lived the greater part of his life in Europe is an American citizen by birth for his father was a native New Yorker. His early schooling he obtained in Germany. Following that, he studied architecture under the famed Le Corbusier and worked professionally as an architect for the next five years. In 1930 he became interested in photography, switched professions and went to Sweden. He wrote several books on photography which were published in Germany and later translated into French, English, and Czech. In 1936 a picture book of Stockholm was published in Sweden. In 1939 the *New Paths in Photography* was published in the United States. Feininger is well known for his experimental use of the camera. His work for *Life* magazine is varied over a wide field. He

Beach Outfit *by Fritz Henle*

Mexican Inspired Dress *by Fritz Henle*



Classic Evening Gowns *by Fritz Henle*

Ballet Slippers by *Fritz Henle*

admits, however, to a special fascination for cities, and for the buildings which make up cities. He has done for *Life* a complete coverage of New York which was later bound into a picture volume.

"One day I was walking down West 48th Street in New York City near Rockefeller Center. The day was bright and windy and I stopped near a glass store front to light my pipe. I looked up and saw in the window the reflection of the building on the opposite side of the street. I had my Rolleiflex with me, took it out, and the result was the photograph on page 237 of this book.

"I consider this picture a good example of the kind of architectural photograph which it is possible to get with a twin-lens reflex. In the first place, I needed a camera in which I could compose the picture exactly as my eye saw it. Then, too, the camera was small enough to carry with me comfortably—and it was precisely that habit which resulted in the photograph. Many of the pictures which I take in my coverage of a city are the result of days, weeks, and sometimes months of planning and waiting. Others depend on my having a camera capable of use within an instant's notice. This is that kind of photograph."

Feininger believes that the challenge of man-made city buildings is difficult for the photographer to resist. In a short article in his book "New York", he said: "Unlike the natural world . . . the works of man confront the photographer with difficult problems. Nature in her infinite variety affords limitless opportunities for pictorial pictures, while man's handiwork, entirely of a constructional nature, forces the photographer to work within the limitations of his own created order. The variety in cities, while great, is not indefinite, and unlike the world of nature, one is confronted with basic backgrounds that are primarily angular structures . . . the curve being a rarity. Consequently, the pictorial problems are frequently so difficult that one finds but a single satisfying solution."

Three of the qualities of a good architectural photograph are: good light, perspective, and scale. . . .

"Good light is necessary for a fine architectural photograph because through it the photographer can add the effect of three-dimensionality to his work. This is necessary since architecture itself is three-dimensional. Most important is to watch for a strong sidelight. It may be that this light will appear on the particular building you want to photograph for but ten minutes during an entire day. In that case it is necessary for you to wait for that ten minute period if you want a good photograph.

"Hazy days are also an aid to the architectural photographer. Very often you will want to shoot monumental-sized structures. In that case you should shoot against the sun to capture the various planes of light and dark which will give the photograph a quality of three-dimensionality. It is important always to keep in mind the balance of masses within your photograph. Silhouettes, too, will be of help in getting the proper effect into your work.

"The question of perspective is of ever-present importance to any architectural photographer. Verticals must appear vertical in the final picture, unless it seems natural to the reader for the lines of the building to converge.

However, there is an old darkroom trick which will help at least partly to overcome this difficulty. When enlarging, tilt both negative and paper to correct the converging lines into straight lines. It is possible to correct for straight lines by tilting just the paper. But the difficulty with this technique is that the resultant photograph will be sharp only in the middle. To get all over sharpness, you must tilt both negative and paper. More and more enlargers are appearing on the market which permit the negative to be tilted, so the technique is not mechanically impossible—although it is by no means foolproof. It may eliminate converging verticals but it may also introduce false proportions.

" Scale is the only thing which will give your reader a proportional idea of how big or how small the structure you have photographed is. I never take a photograph of a building which does not have a person in it—unless I am taking the picture for a special purpose, as in the case of the reflection shot mentioned before. People are necessary in every architectural photograph, not only to add life to it, but also to give some idea of the size of the structure shown.

"Of course, this technique must be used with care as one should be certain that the people in the photograph are not too close to the camera. In that case, the shot will cease to have anything to do with architecture and will become a photograph of people. This is a particular danger of the twin-lens reflex since the focal length of the lens is so short that in street shots, people loom up far too large in the final picture. Keep people far away, at a distance, and they will add immeasurably to the final picture. Anyone who is placed wrong (too close to the camera) will ruin an otherwise excellent picture."

The square format of the twin-lens negative presents of course particular problems of its own.

"Most buildings are vertical structures, and I have discovered that ninety-nine out of a hundred of my negatives must be trimmed vertically. I am not, conscious however, of composing a picture vertically."

Furthermore, the fact that the image is laterally reversed on the ground glass does not bother him. . . .

" Balance in composition is balance, regardless of the direction in which the object faces. I am quite sure that I do not reverse the image in my mind to face in the proper direction. To me, composing a picture, even though the image is laterally reversed, has become as automatic as reading. In reading, the mental image which is called to your mind by a word does not call for a conscious transition from the word to the image. In that same way, I do not make a conscious reversal of the image which my mind sees on the ground glass."

Feininger says that the $2\frac{1}{4} \times 2\frac{1}{4}$ inch negative is of sufficient size for a certain amount of trimming and will still retain sharpness in the final enlargement. He shoots the majority of his pictures on fast film, 1/50 or 1/100 second at f 16. There is no need in architectural photography to shoot at a faster speed, for the subjects are stationary. The question of parallax, too, is an unimportant one since the objects to be photographed are so large that the problem of close-ups never arises.

Feininger never uses a tripod; he believes that the fact the twin-lens camera is not held at eye-level is an advantage. . . .

"If the camera is held at eye-level, the heads of the passers-by become naturally of prime importance in the picture. To shoot from body-level rather than eye-level gives the final picture a better effect. The other advantage of holding the camera low is that the people you are photographing do not notice you. Many times it is important to me that the work I do be completely candid.

"Sometimes I hold the camera at the side of my hip—and as I walk by, I click the shutter at the proper instant. In this way, I get people in the proper position as foreground objects for my architectural picture; yet they are completely unconscious of the fact that their picture has been taken.

"Another old trick which I use when a crowd is so dense that it will ruin the picture, is to hold the camera high over my head, upside-down, and shoot."

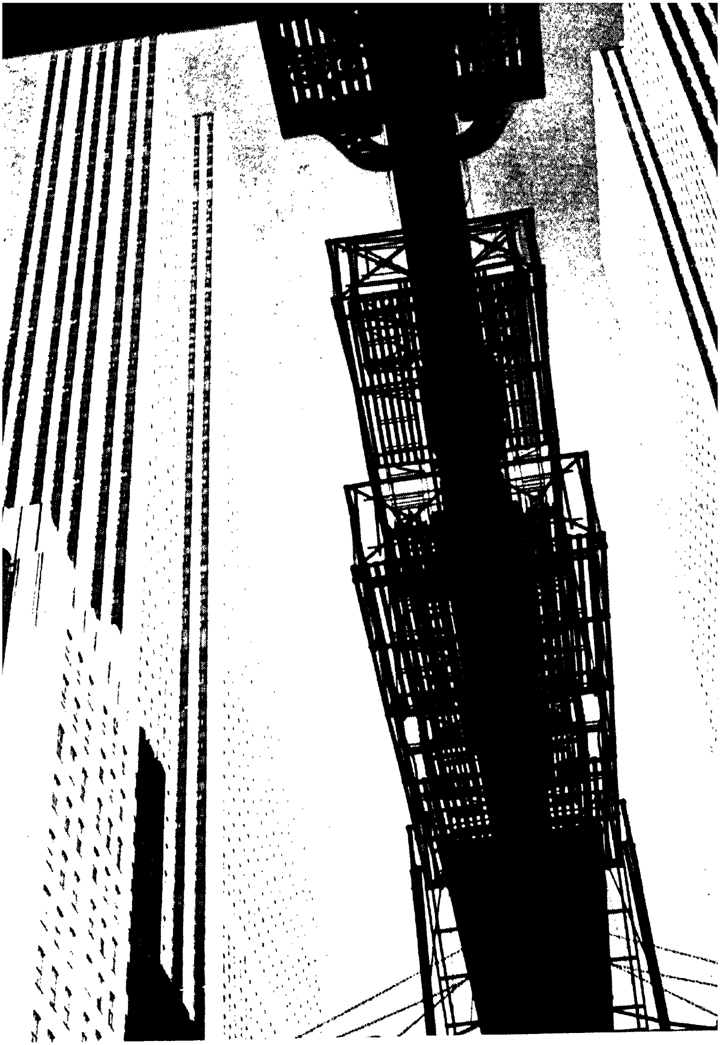
The problem of focusing a camera which does no show the depth of focus on the ground glass does not disturb him. . . .

"I know exactly where to focus. The problem of focusing the camera is completely automatic with me. I have the same attitude towards it which I described before as I was discussing the laterally reversed image on the ground glass. It is one of the things which a photographer must learn and never forget. One should also remember that with cameras on which the ground glass does show depth of focus, there are times when the image becomes indistinguishable. That, too, can be a disadvantage."

The problem of lenses brings up the biggest drawback of the twin-lens reflex camera for architectural photography. . . .

"The fact that the lenses on the twin-lens reflex are not interchangeable leaves the architectural photographer with but one recourse—to use other cameras for part of his work. For example, to me, an essential part of the coverage of any city is the approach to the city. I want to see the city, its buildings, and sky-line as they appear to the person standing on the outskirts. To do this it is necessary to use telephoto lenses. The lens difficulty is the biggest problem of the twin-lens reflex camera.

"It is possible by using the twin-lens reflex camera to take many excellent architectural photographs. It is not possible to take every picture which the most exacting photographer or editor might demand."



Rockefeller Center, New York *by Andreas Feininger*

East Side, New York *by Andreas Feininger*

St. Patrick's Cathedral, New York *by Andreas Feininger*

Chicago by *Andreas Feininger*

FRITZ GORO ON PICTURING SCIENCE

GORO began photography as a boyhood hobby—and he used the appropriate hobbyist's camera—a Kodak Brownie. His interest in pictorial problems (although he did not take pictures) continued throughout the years that followed, even in the period when he studied sculpture at the Bauhaus in Weimar. From there he went into publishing to work as art director and editor. He thought up ideas for picture stories, assigned photographers to them, worked on problems of design and layout. But still he did not take pictures. There was an old Leica around that publishing house in Munich, and Goro became a week-end photographer with this camera. Sometimes he even did picture stories of subjects which did not interest the photographers who worked under his direction. In 1933 he went to France, and there the one-time amateur turned to photography as a career. In 1936 Goro left France for the United States, and from 1937 on he worked almost entirely for _Life_ magazine. The year of 1937 saw his first scientific stories in _Life_, and marked the turning point in his career.

"The picture on page 245 of this book is a natural science picture which shows barnacles feeding. It was taken at the U.S. Bureau of Fisheries at Pensacola, Florida, where many types of marine life are kept for purposes of research and study. Barnacles, which attach themselves to the bottom of ships in such numbers that they seriously impair the speed of the ship, present one of the most difficult marine problems which remain unsolved.

"Now barnacles are seldom seen in the feeding position. Usually you see these creatures on rocks or pilings or ship bottoms. They look like masses of white shells—for the animal's body remains inside the shell. But as I was looking at the bottle on which the barnacles were attached, I decided to photograph the graceful, pulsating in-and-out movement which the animal's antennae make as he feeds.

" It was not an easy idea to follow up as the picture had to be backlit—and I was afraid that the light would bounce straight into the camera and spoil the picture. I did a dress rehearsal with floodlight and saw that my fears were justified. To discourage the light, I constructed a huge 'lens shade'—which consisted of black paper covering one entire side of the tank, with just a small window for the camera. Then I moved the flash so that it was just off-centre, but still a backlight. Finally, to make doubly sure, I moved the camera out of the line of the light —just enough to be absolutely safe.

"At that point, the barnacles, slightly disturbed over the unexpected light and heat and having their home moved (I had to move the bottle into a better camera position), pulled into their shells. I waited and waited for hours for them to come out. Finally they did, and I shot the picture 1/250 second at *f* 22."

Goro makes it clear that by strict definition he is not a science photographer. A science photographer is a man who presents data through pictures. Goro is explaining scientific matters to the layman through every picture. He looks upon himself as a teacher—a person who explains to people in graphic form, intricate problems of all sorts. His job is to take an important subject, and reduce it to pictorially simple photographs.

This job he did magnificently in the first history on a plutonium laboratory which brought to the readers of Life *magazine an understandable graphic concept of a subject which was supposed to be both unintelligible and unpictorial. Goro's job is not a job to him—but a vocation in the true teacher's tradition.*

To help him interpret science to the reading and picture-fascinated public, Goro employs a twin-lens reflex at least half the time.

"My Rolleiflex is simple to handle and fast to work with. By the time I have the picture in focus I am ready to take it. There are too many time-consuming steps between focusing and taking the picture on large cameras. With the Rollei the two operations are almost simultaneous.

"The negative is large enough if the picture is taken properly, for any practical purpose. For example, the barnacle picture is from a section of a $2\frac{1}{4} \times 2\frac{1}{4}$ inch negative. This section is smaller than a Leica negative; yet the final picture, a big enlargement, is sharp enough."

Goro feels that the basis of his photographic style is his handling of light. . . .

"I think always in terms of light when solving a photographic problem. Light models the subject of my photograph. It gives it form, importance.

"If possible, I try to approach my lighting problem in terms of natural light. For example, if I were to use flash to illuminate a picture of a scientist working at his lab table, I would place the flash in such a way that the light would appear to be coming from the window itself. To intensify or key natural light is always my aim since I believe that an honest photograph will duplicate as nearly as possible the conditions which the photographer sees with his eyes. In the case of pictures which are taken merely for pictorial purposes, of course, this rule does not necessarily hold."

This is one of the reasons why Goro does not use flash directly on the camera. . . .

"I will use any combination of lights to get lighting the way I want it. This means long time exposures with natural light, floods, flash. My system for using synchronized flash is a bit out of the ordinary. First, I set up the shot by placing the camera on a tripod, focusing and composing. Then I start around the room, extension flash in hand, hunting for exactly the right angle for the light. When I find it, I shoot the picture from that position by setting off the flash. Sometimes I am many feet away from the camera when the picture is taken. Of course, I don't use this technique all the time. I certainly would not use it for portraiture."

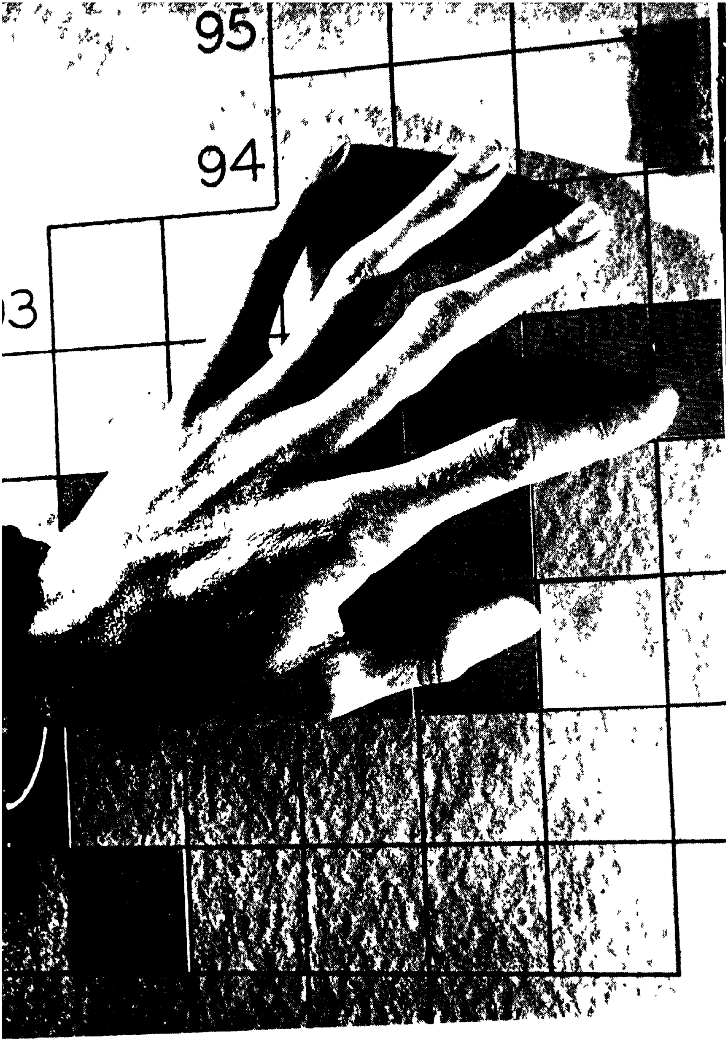
Goro developed this system because he discovered that he saved more time this way than by motioning an assistant backward and forward, up and down. He uses only two or three flashbulbs, even in his more intricate shots, and places them carefully. Always he figures out the lighting scheme by using a dress rehearsal with floods as he did with the barnacle picture. In that way, he is always sure of the effect which he will get. He is uncompromising in his desire to get the lighting of the picture right—even if he has to carry the light and not the camera to get it. This light-carrying technique explains why Goro, unlike many other photographers, uses the camera always on a tripod—even indoors, with flash at high speeds. It is also one of the reasons why his negatives *are so crystal-clear. There just isn't any chance of camera shake in his scheme of things. . . .*

"I do not compose my final picture in the ground glass although I try to fill the negative as much as possible, so that I won't have to trim away too much. I am usually led into a square composition by the square format of the ground glass. Thus, I make the final composition in the darkroom. Many times a vertical appearing picture will end as a diagonal, a medium shot will enlarge into a close-up. The film and the camera plus careful handling give a negative that can be varied in the darkroom.

Goro finds that the non-interchangeable lenses of the twin-lens reflex present a problem which can't be overcome for some of the subjects which the scientific photographer must cover. However, he employs a technique which increases the number of jobs for which the twin-lens reflex may be engaged. . . .

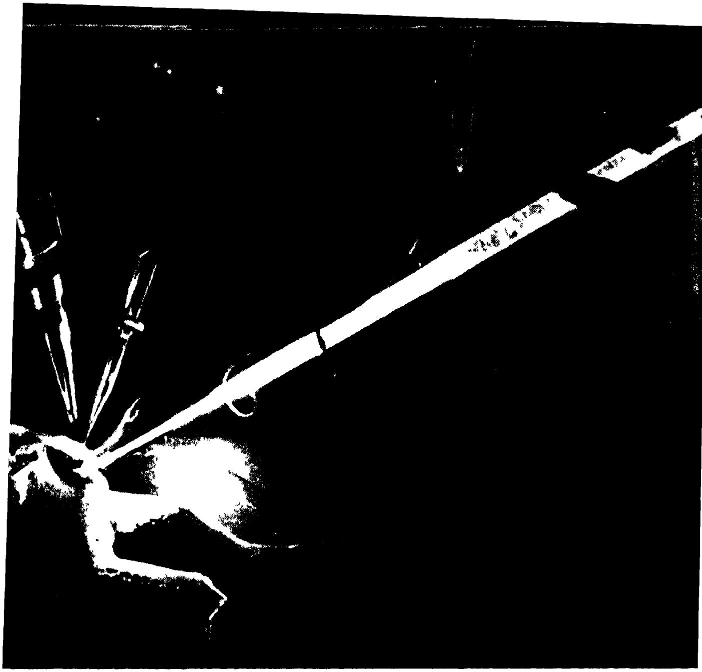
"To get very *close* to certain subjects, I use two Proxars, one on top of the other. This brings the camera to within less than eight inches of the subject and results in many interesting photographs—particularly of insects. It is a true fact that these lenses increase the problems of distortion and parallax. However, I feel these two difficulties can be overcome by experience. Don't let them deter you from getting close to the subject. Experience and patience will be the best guides."

Barnacles Feeding *by Fritz Goro* (Courtesy *Life*)



Hand of Prof. Glen Seaborg by *Fritz Goro* (Courtesy *Life*)

Prof. Thorfin R. Hogness *by Fritz Goro* (Courtesy *Life*)



Filming Blood Circulation *by Fritz Goro* (Courtesy *Life*)

DARKROOM ROUTINE

DARKROOM EQUIPMENT

NO MATTER how we intend to process our film, no matter with what care we compose the picture and calculate the exposure, it is in the darkroom that our efforts come to fruition, and it is the processing and subsequent handling of the films that determines whether they are going to produce the flawless enlargements that we desire, or whether they will prove to be "just another strip of negatives."

The darkroom requirements for processing our roll films are very simple. A well equipped laboratory, pleasant though it may be, is by no means necessary. Some of the finest work is done in the kitchen, boxroom, or even a cupboard under the stairs. The essentials are that it should be free from dust, and that it can be made *absolutely* dark. Many darkrooms appear satisfactory in this respect on first entry, but after a short while light can be seen creeping in under the door and through other unsuspected chinks. Before it is safe to handle present-day fast films, these leaks must be sealed up.

The actual requisites for processing are few and simple.

A developing tank of the spiral groove or "celluloid apron" type—such as Johnson's or the Correx respectively.

A measure glass (20 oz.).

A stirring rod.

Thermometer, preferably the mercury type; I have found that spirit filled thermometers are not always as accurate as they should be.

Finally, a bottle of your chosen developer, acid fixing solution, and some acid stop bath (see below).

A clock or watch.

PROCESSING PROCEDURE

LET ME just run through my own routine of developing a film (a process with which most readers are doubtless already familiar), just in case I can add any hint or suggestion that may be useful.

On entering the darkroom (lights on) I check the temperature of the developer. If it is below 68 degrees F., I secure some hot water (temperature immaterial) and pour this into a 12 × 10 inch developing dish. I pour about 20 oz. of developer into a clean wholeplate dish, and float this on the hot water. The temperature of the developer is checked continuously until it has risen to 70 degrees F., and I then fill the developing tank with warm water (about 75 degrees) for a few moments so that it shall not cool down the developer when they come into contact. I discard the water and fill the tank with the recommended amount of developer, placing the tank in a convenient spot on the bench where it can be found at once by feel in the dark, without risk of knocking it over.

The reel and apron—or the spiral reel, according to which tank I am using—are ready on a dry part of the bench. At this point I switch off the light, break open the seal on the film, and load the film strip on to the reel (I will go into this in detail in a moment). When the reel is loaded I switch on my darkroom clock and insert the reel into the tank full of developer, plunging it in and out several times, and rotating it at the same time to ensure that there are no air bells adhering to the film surface. After about 10 seconds of this, I put on the lid (which was carefully placed by the side of the tank), and switch on the lights.

The agitating knob is now inserted through the hole in the top of the tank, so that the film reel can be moved as required. Because development time varies so enormously with the degree of agitation given, I make a practice of standardising this; and *every two minutes throughout the period of development* I twiddle the knob briskly both ways *for a period of* 5 *seconds.* Every second time I do this, I switch off the light, remove the lid of the tank, and withdraw the film reel so that I can again plunge it in, thus stirring up the developer vertically as well as horizontally. This may savour of unnecessary care, but at least I am never bothered with films that appear denser on one edge than on the other.

It will have been noticed that my developer is heated to 70 degrees, when I propose working at 68 degrees. I find that these odd two degrees usually vanish while I am loading the reel, and through putting the (relatively) cold reel and film into the warmer developer. In the summer or when I do not have to heat the developer, I try to keep the solution at 68 degrees all the time, as then there is no loss of heat.

When the time of development is completed, I pour back the developer into the stock bottle, and fill the tank with the acid stop bath, again agitating briskly for the first 10 seconds or so. This stop bath is allowed to act for 5 or 6 minutes, and is then discarded, for it does not keep when mixed.

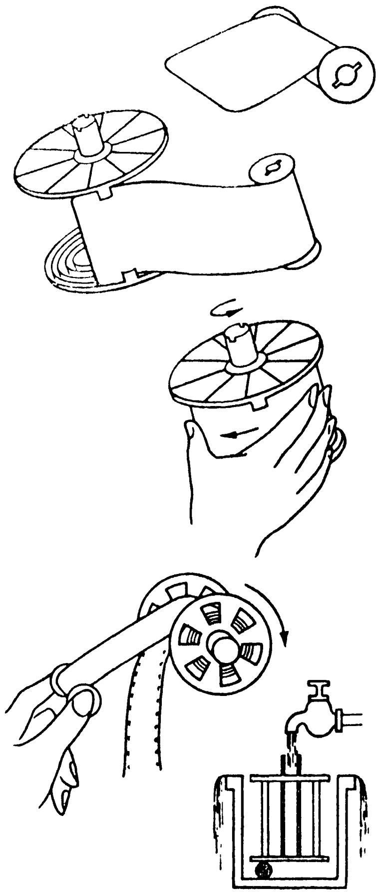
The acid fixing solution—prepared while the film was in the stop bath—is then poured into the tank and again the film is agitated. After about 10 minutes I remove the lid and examine the film on the reel ; by this time the milky appearance is usually just about vanishing from the back, and I then leave the film in the fixer for 10 minutes after the last of this creaminess has disappeared. The fixer is then poured off, and the film put to wash.

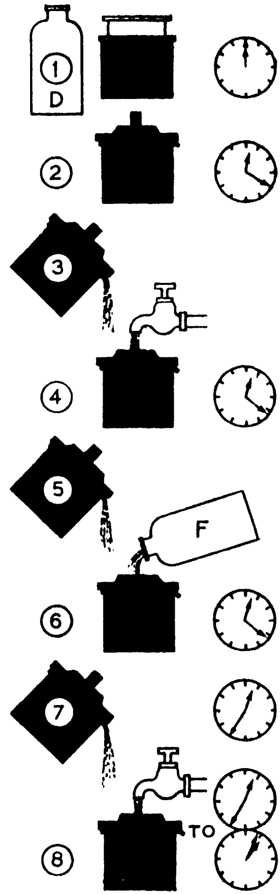
As far as possible, all solutions except the washing water are kept at the same temperature.

Now let us retrace our steps, for the sake of a few details.

HANDLING TANKS

IN THE case of a spiral reel where the film is fed in from the outside (Johnson's, Nebro, etc.), I find it desirable to straighten the first 2 inches of the film, but to bend the extreme tip—say ⅛th inch slightly inwards—I also round off





Left : Loading a spiral reel—trim the film end (*top*). Inserting the film in the reel (*upper center*). Coaxing the last few inches in (*centre*). Loading an apron reel, let the apron hang (*lower centre*). A cork under the bobbin (*bottom*) ensures efficient washing.—See p. 269.

Right : Tank development.—(1) Immerse film into tank. (2) Develop —with agitation. (3) Discard developer. (4) Rinse. (5) Discard rinse. (6) Fix for about 15 minutes. (7) Discard fixer. (8) Wash.

the extreme points at the leading end; only a trace is cut away, but just enough to allow the film to run smoothly into its groove.

Sometimes a film on a particularly thin base is very difficult to coax in for the last few inches. Obviously one must not grasp film between finger and thumb, so as to touch the sensitive surface; but by grasping the whole coil of film round its back gently and firmly with the hand, it can usually be coaxed into the reel without much difficulty, and without causing it any harm. The hand is turned clockwise (or the reel anti-clockwise) until the end of the film is drawn into the grooves.

With the apron type of tank (Correx) I make sure that the end of the apron is secured under its clip, before turning off the light. I then introduce the end of the film under the same clip on top of the apron, and, rotating the reel with the right hand, allow the film and apron to wind on together *by their own weight.* It is most important not to *pull* either of them while winding, as this sometimes causes one or other to kink, with the result that the surface of the film touches (or gets extremely close to) the apron, which means uneven development. By allowing the apron to hang down, and taking care of the film with the left hand holding it only by the edges, this trouble is avoided.

DEVELOPERS

BASICALLY ALL developers suitable for our work seem to fit into three groups. Broadly speaking there are :

A. Maximum energy fine grain developers.
B. Fine grain developers.
C. Ultra fine grain developers.

Any of these can be used with the film types discussed.

There are also even more energetic developers. We shall not consider them, for they give relatively coarse grain, and are not really suitable for our work.

Type *A* will produce negatives of satisfactorily fine grain if extreme enlargement is not required. Because of its energetic nature it will develop quickly and make full use of the speed of the film. It is the type of developer for films which are known or expected to be underexposed.

Developers of type *B* I would recommend for all normal amateur work. They are not quite so energetic as type *A*, and yield images of somewhat finer grain. Such developers do not make the utmost of the available film speed, and it is usually necessary to give more generous exposures. The extent of the increase is quoted in the table.

Type *C* ultra fine grain developers are still less vigorous, and for this reason require more exposure than *A* or *B*. This depends on the exact developer used, but is generally in the region of an extra 100 to 200 per cent.

DEVELOPER TYPES

Type	*Grain*	*Extra exposure required*	*Diameters enlargement possible*	*Development speed*
Normal high energy	Not used for miniature work			
A. Maximum energy fine grain	Reasonably fine	nil	6–10	Fairly rapid
B. Fine grain	Fine	50 per cent	8–13	Fairly rapid
C. Ultra fine grain	Very fine	100–200 per cent	12–20	Slow

I suggest that all normal requirements are adequately catered for in this list.

I have mentioned the fact that if a film is normally exposed, a developer such as D.76 will produce satisfactory negatives and that extra exposure is required for many of the other formulae giving still finer grain. From my own personal tests, I advocate the increases shown in the following table for those developers already described.

It will be noted that the increased time required varies slightly with the speed of the film itself; the particularly rapid films are affected more, in proportion, than those which are basically slower.

TYPE A.—MAXIMUM SPEED

	D. 23 grams	oz.	grrs.
Metol	7.5	—	115
Sod. sulphite (anhyd.) *or*	100	3½	—
Sod. sulphite crystals	200	7	—
Hydroquinone	—	—	—
Glycin	—	—	—
Borax	—	—	—
Pot. bromide	—	—	—
Water to make	1000 c.cs.	35	—

Among the proprietary developers in this class are also to be found :

TYPE B.—FINE GRAIN

	DK. 20 grams	oz.	grs.
Metol	5	—	77
Sod. sulphite (anhyd.) *or*	100	3½	—
Sod. sulphite crystals	200	7	—
Meritol	—	—	—
Glycin	—	—	—
Paraphenylene diamine	—	—	—
Kodalk	2	—	31
Borax	—	—	—
Potassium thiocyanate	1	—	15
Pot. bromide 10 per cent solution	5 c.cs.	85 min.	
Tribasic sod. phosphate	—	—	—
Sodium carbonate, anhyd. *or*	—	—	—
Sod. carbonate crystals	—	—	—
Water to make	1000 c.cs.	35	—

Proprietary developers of this type include :

DEVELOPERS FOR FINE GRAIN

D. 76 (ID. 11)			Ansco 17			Edwal 10		
grams	oz.	grs.	grams	oz.	grs.	grams	oz.	grs.
2	—	31	1.5	—	23	5	—	77
100	3½	—	80	2	360	100	3½	—
200	7	—	160	5	300	200	7	—
5	—	77	3	—	50	—	—	—
—	—	—	—	—	—	5	—	77
2	—	31	3	—	50	10	—	155
—	—	—	0.5	—	8	—	—	—
1000 c.cs.	35	—	1000 c.cs.	35	—	1000 c.cs.	35	—

Burroughs Wellcome Fine Grain, Johnsons Fine Grain, Dupont N.D.2.

DEVELOPERS

MCM 100			Edwal 12			Focal S.F.G.		
grams	oz.	grs.	grams	oz.	grs.	grams	oz.	grs.
—	—	—	6	—	93	3	—	50
85	3	—	90	3	80	90	3	80
170	6	—	180	6	160	180	6	160
16	—	250	—	—	—	—	—	—
—	—	—	5	—	77	5	—	77
—	—	—	10	—	155	—	—	—
—	—	—	—	—	—	—	—	—
2.3	—	35	—	—	—	1	—	15
—	—	—	—	—	—	1	—	15
2 c.cs.	35 min.		—	—	—	5 c.cs.	85 min.	
6.9	—	105	—	—	—	—	—	—
—	—	—	—	—	—	1	—	15
—	—	—	—	—	—	2.8	—	42
1000 c.cs.	35	—	1000 c.cs.	35	—	1000 c.cs.	35	—

Kodak D.25, Fink Roselieve 33, Johnsons Meritol Metol.

TYPE C.—ULTRA FINE

	Sease I		
	grams.	*oz.*	*grs.*
Metol			
Sod. sulphite (anhyd.) *or*	90	3	80
Sod. sulphite crystals	180	6	160
Paraphenylene diamine	10	—	155
Orthophenylene diamine			
Glycin			
Paraminophenol			
Pot. metabisulphite			
Water to make	1000 c.cs.	35	—

Other developers of this class include : Johnsons Super

EXPOSURE INCREASES COMPARED WITH D-76 DEVELOPER

Developer	*Slow Ortho Fine Pan*	*Fast Ortho Medium Pan*	*Fast Pan*
D. 76 or ID. 11, Ansco 17 Edwal 10, B.W. Fine Grain Johnson's Fine Grain	No increases needed for any film		
DK. 20	1½x	1½x	2x
MCM 100, Edwal 12 Meritol-Metol	1½x	2x	2x
Sease III, Edwal 20 Windisch W. 665	1½–2x	2x	2½x
Meritol (Johnson's Super F.G.)	2x	2x	3x
Sease I	2x	2½x	3½x

Sease III			Windisch 665			Edwal 20		
grams	oz.	grs.	grams	oz.	grs.	grams	oz.	grs.
—	—	—	11.6	—	180	—	—	—
90	3	80	90	3	80	90	3	80
180	6	160	180	6	160	180	6	160
10	—	155	—	—	—	10	—	155
—	—	—	11.6	—	180	—	—	—
6	—	93	—	—	—	5	—	77
—	—	—	—	—	—	5	—	77
—	—	—	10	—	155	—	—	—
1000 c.cs.	35	—	1000 c.cs.	35	—	1000 c.cs.	35	—

Fine Grain (containing Meritol), P.A.C. Super Degrainol, Sease N.D.3.

LENGTH OF DEVELOPMENT

DEVELOPER MANUFACTURERS publish recommended times based on their own experiments for development of the majority of popular films. As, however, one's own standard of what constitutes the perfect negative is necessarily self-imposed, it is sometimes a little difficult to reconcile the manufacturer's ideas with one's own personal likes and dislikes.

I have long wished that all such matters as film speeds, exposure meter readings, and developing times could be settled once and for all by an independent laboratory. In the absence of such an authority I can only suggest that the published times for development should be taken as a basis for any personal experiments. If, as not infrequently happens, the maker's times appear to be too generous, and produce a negative of too great contrast then a reduction of the time by, say, 10 or 20 per cent can be made.

The times published by the makers rarely prove to be too short. I have never known—nor expected to find—any film maker who was pessimistic about the speed of his products, and I think that this is the reason for the somewhat generous times of development which are so often recommended. The maker knows that most films will be exposed according to his estimate of speed, and this exposure in fact probably cut to the minimum. The result is that much of the developable image will lie on the toe portion of the film curve. The somewhat generous development times recommended take care of this slight degree of underexposure by building up printable contrast even in that part of the image which is slightly underexposed.

In the table on p. 261, therefore, I have tried to indicate suitable development times for some of the more popular films in the developers already described. These times are based on the assumption that the films have been *adequately* exposed by using a reliable exposure meter in the manner described.

It is just as well to bear in mind at this stage that the necessary development time can vary as much as two to one, depending solely on the extent to which the film is agitated while in the developer.

Some makers quote their recommended developer times as, e.g., "from 10 to 20 minutes at 65 degrees F." Now while this seems hardly to be an adequate guide to the photographer who is trying to put his hobby on sound scientific lines, it is safe in such circumstances to assume that the shorter time quoted applies if the film is agitated continuously and vigorously throughout the development period, and that the longer time applies to "stagnant" development (without agitation). The latter system, however, is *not* recommended, as it generally leads to uneven development. My own method which seems to work very well is to take the mean of these times (e.g., 15 minutes) and to agitate the film vigorously every two minutes for a period of five seconds. This includes switching off the darkroom light and removing the lid of the

SUGGESTED DEVELOPMENT TIMES IN MINUTES

Times are based on agitation as described in the text and temperature 68°F. (20°C.) except where otherwise stated.

	Kodak				Selo			Agfa	Ensign			Gevaert	
Developers	*Super XX*	*Panatomic X*	*Verichrome*	*Plus X*	*H.P.3.*	*F.P.*	*Selochrome*	*Isopan I.S.S.*	*F.G. Pan*	*Ultrachrome*	*Ultrapan*	*Panchromosa*	*Superchrome*
D. 76	15	13	13	13	15	11	13	15	13	13	15	13	13
ID. 11	15	13	13	13	15	11	13	15	13	13	15	13	13
Edwal 10	16	13	13	13	16	11	13	16	13	13	16	13	13
Burroughs Wellcome Fine grain	7	5	5	5	7	4½	5	7½	5	5	7	5	5
Johnson's Fine grain	10	7	7½	7½	9	7	8	10	8	8	9	8	8
DK. 20	18	15	15	15	18	12	15	16	14	14	14	14	14
MCM. 100 (70°F.)	18	15	15	15	18	12	14	18	16	16	16	16	16
Edwal 12	20	16	16	16	20	13	16	20	16	16	19	16	16
Champlin 15 (70°F.)	20	16	18	16	20	13	16	20	16	16	19	16	16
B. W. Fine grain and Sulphite	20	14	14	14	18	13	14	18	14	14	16	14	14
Meritol-Metol	10	8	8	8	10	7	8	10	8	8	9	8	8
Sease III	30	24	24	24	30	20	24	30	24	24	29	24	24
Sease I	50	30	36	36	50	30	36	50	36	36	45	36	36
Windisch W. 665	18	13	14	14	18	12	14	18	13	13	16	13	13
Edwal 20	22	20	20	20	22	16	20	22	20	20	22	20	20
Johnson's Meritol	20	16	16	16	20	15	16	20	18	18	20	18	18

This table can, of course, not be complete, but I have tried to list those films and developers which the owner of a twin-lens reflex camera is most likely to use.

tank so that the bobbin holding the film can be agitated *vertically* as well as laterally, thus ensuring that there is no difference in the density or temperature of the developer at the top or bottom of the tank (see also under development procedure).

NEGATIVE CONTRAST

THE LENGTH of the development also determines the contrast, i.e., the relative amount of light transmitted by the densest and thinnest parts of the negative. Since this contrast also depends on the contrast range of the subject, it has to be quoted in comparison with the latter.

This is usually done in terms of *gamma* (γ). The gamma of a negative is nothing more than the ratio of *negative contrast* to *subject contrast.*

Here is an example. Let us take a subject where the brightest high-light reflects 100 times as much light as the darkest shadow. The negative obtained by an exposure of this subject will then have a gamma of unity if the thinnest part of the negative (corresponding to the shadows) passes 100 times as much light as the densest parts (corresponding to the highlights). If the shadows on the negative transmit only 80 times as much light, the gamma is 0.8, if the ratio is 120:1 the gamma is 1.2, and so on.

The gamma of a negative will also depend on the negative material itself, as some soft working films are unable to produce a high contrast even after long development.

Commercial development of larger negatives is usually designed to produce a gamma of 1.2 or thereabouts. This suits the man who uses, for instance, a postcard size camera, and relies on contact prints from his negatives. It ensures crisp and clean results.

At the other end of the scale is the 35 mm. film user who is concerned above all with getting grain-free enlargements to a considerable size. Because overdevelopment increases grain, and because overdeveloped negatives are inconveniently hard for enlarging, he is best suited by keeping the gamma of his negatives down to about 0.7 to 0.8.

Because of the difference in the size of material, and the consequent extent to which it has to be enlarged, our own requirements lie more or less mid-way between these extremes. I suggest that in most cases a gamma of 0.9 will best suit the needs of any user of 2¼ inch square materials.

Few amateurs have the means of accurately measuring gamma, but most of the film makers publish dependable information on this point, at least for their own particularly recommended developers.

It should be noted that all the suggested times are still open to adjustment, as may be considered necessary according to personal preferences or the particular printing or enlarging methods employed. For example, if negatives are to be printed through an enlarger employing diffused light, they will require to be quite appreciably more contrasty (more fully developed) than when a condenser enlarger is used. For average requirements the advocated times will be entirely satisfactory.

RE-USE OF DEVELOPERS

THE MAJORITY of those developers which we have so far considered may be bottled after use, and re-used several times. While it is impossible to generalise, it is usually safe to develop at least four films in 1,000 c.cs. (35 oz.) of solution in this way.

Once a film has been developed, a certain amount of life has gone from the developer, and each successive film calls, in consequence, for an increase in the developing time.

APPROXIMATE INCREASES IN DEVELOPMENT TIME WHEN 1,000 c.cs. ARE USED FOR MORE THAN ONE FILM

Time in minutes					
Original Film	*Film 2*	*Film 3*	*Film 4*	*Film 5*	*Film 6*
6	6½	7¼	7¾	8¼	9
6½	7½	8	8½	9¼	10
7	7¾	8½	9½	10	10½
7½	8¼	9	9¾	10½	11¼
8	8¾	9½	10½	11¼	12¼
9	10	10¾	11¾	12¾	13½
10	11	12	13	14	15
11	12	13¼	14¼	15½	16½
12	13¼	14½	15¾	17	18
13	14¼	15½	17	18¼	19½
14	15½	17	18¼	19¾	21
15	16½	18	19½	21	22½
16	17½	19	20¾	22½	24
18	19¾	21½	23½	25	27
20	22	24	26	28	30
22	24¼	26½	28¾	31	33
24	26½	29	31¼	33¾	36
26	28½	31	34	36½	39
28	30¾	33½	36½	39	42
30	33	36	39	42	45
32	35	38½	41½	45	48
34	37½	40½	44	47½	51
36	39½	43	47	50½	54
38	41½	45½	49½	53	57
40	44	48	52	56	60
45	49½	54	58	63	67
50	55	60	65	70	75
55	60	66	72	77	83

Note.—Exhaustion factors of different developers vary. These figures are therefore approximate and subject to test.

As different developers vary in their life, and different films will exhaust a developer to different degrees, there can be no absolutely hard and fast rule for this increase, but the majority of developers we have discussed are sufficiently uniform in their behaviour so we can give a rough guide in tabular form, as on page 264.

DEVELOPING TEMPERATURE

THE REMAINING factor affecting the time of development is the temperature of the solution. With two exceptions the times quoted on page 266 are based on a normal temperature of 68 degrees F. (20 degrees C.). As it is not always possible to adhere strictly to this, desirable though it may be, I have provided in the following table a means of approximate conversion showing the effect of a higher or lower temperature on the normally recommended times.

Armed with these three tables there should not be much excuse for unsatisfactory negatives, whatever combination of film and developer is chosen.

CONSISTENCY IN DEVELOPMENT

THERE IS an unfortunate tendency among camera users to change around between various makes of film, because perhaps an acquaintance, whose work is admired, uses so-and-so's product ; while later a picture made on some other material seems particularly striking, so off goes the photographer to try this brand.

At the risk of shattering fond illusions, I would go so far as to say that it just doesn't matter whose film you use, provided that it is suitable for the work to be done. The

DEVELOPMENT TIMES AT VARYING TEMPERATURES

Normal time in minutes at 68°F. (20°C.)	*Approximate time at other temperatures* 62°F. (16.5°C.)	65°F. (18.5°C.)	71°F. (22°C.)	73°F. (24°C.)
6	8½	7¼	5¼	4½
7	10	8½	6	5
8	11	9½	6¾	5½
9	12½	11	7½	6¼
10	14	12	8½	7
11	15½	13	9½	7¾
12	17	14½	10	8½
13	18	15½	11	9
14	19½	17	12	10
15	21	18	12½	10½
16	22½	19	14½	11¼
18	25	22	15	12½
20	28	24	17	14
22	31	26	19	15½
24	34	29	20½	17
26	36½	31	22	18½
28	39	33½	24	19½
30	42	36	25½	21
32	45	38	27	22½
34	48	41	29	24
36	50½	43½	31	25½
38	53	46	32½	26½
40	56	48	34	28
45	63	54	38	31½
50	70	60	42½	35
55	77	66	47	38½

Note.—Not all developers have the same time/temperature reaction. These figures are therefore necessarily approximate.

same state of affairs exists with developers. Whenever a new one is described in the press there is a sudden rush to buy it, in the belief that it is necessarily better than the one already in use. To try out new goods sanely, and in the spirit of experiment is good; but to make a change simply for the sake of the change, is—photographically—bad business. It takes quite a long time to become entirely familiar with any particular film or developer. To switch from it to something else, just because it *may* be better, is throwing away a lot of good experience.

Apart from reiterating my warning against trying out everything as it comes along, I think the best way that I can help in the choice of a developer is again to outline my own practice, and give my reasons for it.

With 2¼ inch square films I employ three of the developers described on page 255. When the maximum emulsion speed is required, i.e., when I know that my exposures are on the short side, I go for D.76 every time. I know of no other type of developer with any pretentions to fine grain which will give me so good and printable a negative in such circumstances.

When my exposures are adequate, I much prefer to employ one of the paraphenylenediamine-metol-glycin formulae (Edwal 12, etc.). With Kodak film I have also latterly been using their own recommended DK.20, with very satisfactory results.

For negatives which I know will have to be enlarged to the utmost and where I can give as much exposure as I like, I usually come back to the old original Sease III, which gives me the finest grain of all.

Broadly, then, my own choice is the one that I recommend for everyone. For general purposes a developer of type *B*. For the utmost speed, one of type *A* ; and where fineness of grain is vital and exposure time of no consequence, one of type *C*.

Which particular one you choose does not matter. Any of the listed developers are suitable for those films already described. All I ask is that you choose one type (and make) of film, and one developer, preferably of type *B* ; and use them for everything until you are certain of your results—before you try out any other film or formula.

STOP BATH AND FIXING

NOW LET us get back to the practical procedure. While the film is developing, I mix up my acid stop bath from two separate stock solutions.

STOP BATH

A	Water	1000 c.cs.	35 oz.
	Chrome Alum	20 grams	¾ oz.
B	Water	1000 c.cs.	35 oz.
	Sodium Bisulphite	20 grams	¾ oz.

These are mixed in equal parts immediately before use. I do not care to prepare this from dry chemicals just before use, as it is sometimes difficult to ensure that there are no undissolved particles floating in the solution.

I always make a practice of filtering the acid stop bath and the acid fixing solutions, to make sure that no undissolved specks are allowed into the tank. If they do reach the film, they usually manifest themselves by making little pitted marks in the emulsion, which show up on enlarging. A small tuft of cotton wool in the base of a glass funnel is generally sufficient to hold back such fragments, and is much speedier than the use of laboratory filter papers.

The fixing bath can be made up while the other operations of development are in progress, but it is far better to do it beforehand. It is then ready, and there is no risk of small particles of hypo floating about in the air and settling on the film, causing clear spots.

Normally the commercial acid fixing powders are completely satisfactory; the choice of any particular type of fixing bath will not make any difference to the negative.

Those who wish to make up their own fixing bath, can use the following formula :

FIXING BATH

Hypo	250 grams	9 oz.
Potassium metabisulphite	28 grams	1 oz.
Water to make	1000 c.cs.	35 oz.

WASHING

IN THEORY all the tanks of the types described can be used for film washing by allowing a stream of water to fall down the hollow centre of the reel, where—again in theory—it comes out at the bottom of the reel, diffuses up through the coils of film, and finally runs away over the edge of the tank.

My own tests do not satisfy me that films are always adequately washed by this method, but fortunately there is a very simple way of making sure that this process is properly carried out. An ordinary bottle cork dropped into the tank raises the reel so that the hollow centre core is higher than the edge of the tank itself. If water from the tap is now allowed to run into the hole through the reel, it *must* come out at the bottom and finally run to waste over the side of the tank, carrying with it the hypo washed out of the film, a state of affairs that does not necessarily exist if the top of the reel and the top of the tank are on the same level. I have often wondered why tank manufacturers do not supply a push-on or screw-in extension tube to be attached to the top of the centre tube of the reel, so as to raise the inlet water level to something higher than the wall of the tank itself.

Alternatively, a piece of rubber tubing can be attached to the tap, and pushed into the central tube of the tank. This will work equally well.

DRYING

WHEN WASHING is completed, usually in about thirty minutes, the film is removed from the tank, and hung up to dry.

I generally examine the emulsion side carefully by reflected light, and if there appears to be any scum or deposit on it, which is not uncommon when using type

B or *C* developers, it is swabbed *very gently* all over with a large wet tuft of cotton wool, while running water is allowed to play on it. The scum generally comes away as a grey mark on the cotton wool. As this is a three-handed job, I generally get someone to hold one end of the film.

When this is done, a film clip is attached to one end of the strip, and the other is usually secured with two pins to the top of the open doorway of my darkroom itself, where it is left until dry.

Nowadays I do not wipe down the film with chamois leather or viscose sponge. I find that I get trouble in the form of "tramlines" through so doing, because of particles of grit which are sometimes caught up and may scratch the film. Films which drain and dry spontaneously are usually just about flawless.

Wetting agents in the final wash water are supposed to minimise drying marks; they encourage the water to drain out of the film quickly, but my films dry very satisfactorily even without their aid.

If I am ever faced with very hard washing water which leaves a chalky scum on the film, I fall back on a final rinse in a 2 per cent solution of hydrochloric acid which dissolves the scum and leaves a beautifully clean film. This however, will *not* necessarily remove the silver scum mentioned earlier which occurs with some fine grain developers.

STORING NEGATIVES

AS SOON as the film strip is dry it should be taken down, and cut up into single exposures *at once*. On no account should it be rolled up—even for a few moments. To do so is to ask for trouble in the form of longitudinal scratches both on the emulsion and on the back of the film. To counteract the curling the latter is usually coated with thin transparent gelatine which is almost equally sensitive to surface abrasion.

When the negatives have been cut into single exposures they should be stored away. I know of no better or more convenient system than the ordinary negative albums obtainable from most photographic stores. My own preference is for those in which the envelopes are made of translucent paper. I do not like the transparent cellophane envelopes which seem to have a much harsher surface and are more liable to cause scratches when the films are inserted or removed.

The extent to which negatives are indexed so that any individual one can be quickly found, will largely depend on the personal tastes of their author. Anyone whose pictures are more than a casual series of personal snapshots will find it time well spent to evolve a simple system for his own particular needs.

Some years ago I spent a lot of time collecting a series of photographs of the beautiful old crosses and market halls with which this country is so richly endowed. The negatives were stored in separate envelopes, bearing a serial number, and brief details of the contents. A card index was prepared under "Counties" (with one or more cards to each county), the entries being simply the name of the place and the negative serial number. A separate card index, arranged alphabetically, under the actual place name recorded the town or village, a brief history of the cross or hall, and the serial numbers of all negatives of the particular edifice. Although this sounds a formidable business, making the necessary entries took but a few moments, and made negative seeking a pleasure that is hard to imagine by the photographer who just slips his films away in various envelopes or wallets, in this drawer or that; as they are made.

Whether anything quite so ambitious is warranted for ordinary work, is a matter for the individual amateur; but I certainly advise the adoption of some systematic filing method which allows easy tracing of any desired negative.

FAULTS IN NEGATIVES

SO FAR we have contentedly assumed that all our negatives will be up to standard. With adequate care to the necessary details of exposure and development as indicated, they should present a gratifyingly high average. But accidents and mistakes *do* happen, and we may find that one or more negatives in a strip suffer from the effects of either under- or over-exposure, or under- or over-development, or even a combination of any two of these. Fortunately, the majority of such errors can be remedied.

For severe under-exposure there is no cure. If the detail is not visible on the negative, nothing in the world can put it there; so negatives of this type may as well be discarded at the outset. Now for the remainder. The first thing is identify the exact fault or faults, and then decide on the cure. The table on p. 274–275 gives a summary of what can be done.

Below are three formulae.

Formula A is the intensifier that I recommend.

Formula B is a reducer which attacks the shadow areas as much as the highlights, and thus increases contrast.

Formula C is a reducer which attacks the highlights more vigorously than the shadow areas, and thus decreases contrast.

INTENSIFIER A

I. Potassium Bichromate	50 grams	1¾ oz.
Water to make	1000 c.cs.	35 oz.
II. Hydrochloric Acid (pure)	100 c.cs.	3½ oz.
Water to make	1000 c.cs.	35 oz.

For use the negative must be *thoroughly* washed, and then bleached in a solution made by mixing.

Stock I.	1 part
Stock II.	1 part
Water	5 parts

Bleaching proceeds quickly and is carried on until there is no visible black in the negative, which should now appear a yellowy cream colour. When bleaching is complete, the film must be washed in running water *until the whole of the yellow stain is discharged.* It is then redeveloped in any good non-staining developer, e.g., M.Q. as used for bromide printing.

The fine grain developers described on p. 255 should *not* be used; a suitable formula will be found on p. 294. Redevelopment should be carried out in bright light. If the degree of intensification is insufficient, the process can be repeated after *very* thorough washing, but one application should be sufficient for all except very bad cases.

REDUCER B

I.	Hypo crystals (*Not* acid fixing)	125 grams	$4\frac{1}{2}$ oz.
	Water to make	100 c.cs.	35 oz.
II.	Potassium ferricyanide	100 grams	$3\frac{1}{2}$ oz.
	Water to make	1000 c.cs.	35 oz.

For use the negative is immersed in a solution composed of :

Stock I.	10 parts
Stock II.	1 part

The mixed solutions decompose quite rapidly, so the reducer should be prepared when required. The stock solutions keep well.

The film must be kept on the move during the whole time it is in the reducer. It should be inspected at frequent intervals, and removed *just before* it is thin enough, when it should be promptly and thoroughly washed for 15 minutes in running water.

REDUCER C

Ammonium persulphate	30 grams	1 oz.
Water to make	1000 c.cs.	35 oz.

The negative must be very thoroughly washed before reduction.

Just before use add 1 part of a 5 per cent solution of pure sulphuric acid to every 50 parts of the solution. Immerse the negative and keep it constantly moving all the time. The appearance of a certain cloudiness on the surface of the film shows that the solution is acting properly, this should become visible in $\frac{1}{2}$ to $\frac{3}{4}$ of a minute. When the degree of reduction is sufficient, the action of the reducer is checked by immersing the film for 10 minutes in a 5 per cent solution of sodium sulphite, after which it is washed and dried in the usual way.

Fault	*Appearance of Negative*
Under-exposed (normal development)	Absence of detail in light parts (shadows)
Over-exposed (normal development)	Even light parts very dense, high lights blocked up
Under-developed exposure)	Thin, flat negative, detail everywhere
Over-developed (normal exposure)	Very hard negative, almost unprintable, except on soft paper
Under-exposure and under-development	Very thin negative, very little detail very little contrast
Under-exposure and over-development	Hard negative but no shadow detail. Negative looks good, but prints disappointing
Over-exposure and under-development	Flat negative with all detail visible, but very light
Over-exposure and over-development	Very dense negative, needs long printing exposure

First Treatment	*Second Treatment*	*Notes*
Intensify in *A*	None	*Severe* under-exposure cannot be cured
Reduce a little in *B*	None	Take care not to dissolve shadow detail
Intensify in *A*	None	This usually results in complete cure
Reduce in *C*	None	This treatment usually saves the negative
Intensify in *A*	Wash thoroughly and repeat	Results not too good, as faults of under-exposure and under-development are combined
Reduce in *C*	Wash thoroughly and intensify in *A*	Results passable if under-exposure was not too severe
Reduce a little in *B*	Wash thoroughly and intensify in *A*	Reduction must be very slight, as shadow detail goes quickly
Reduce in *B*	None	Results usually passable

Failure to secure satisfactory results from these after-processes can almost invariably be traced to lack of chemical cleanliness, or to insufficient washing prior to the intensification or reduction.

Because the human skin gives off a minute trace of grease, it is most important that the surface of films destined for further treatment should *never* be touched; otherwise stains or irregular chemical action are almost certain. In any case, this is a very good rule to which to adhere where *all* negatives are concerned.

EXAMINING NEGATIVES FOR PRINTING

THERE IS, I think, a tendency to regard the production of the perfect negative as the one essential to good results, and to look on the printing or enlarging as something which more or less automatically reproduces what is on the negative. In the main, this is true, but there is much more in it than that. Before we really get down to the practical side of print production, a certain amount of time can profitably be spent considering the theory of what is involved.

To get a fuller understanding of the various factors, let us go right back to the subject we have photographed, and consider its range of contrasts. To serve as examples, let us take three representative subjects :

(*a*) A mountain landscape in sunshine with snow gleaming on the peaks and with trees and dark buildings in the foreground ;

(*b*) A well lit studio portrait of a model in clothes of average type; and

(*c*) An ordinary street scene on a grey, sunless, winter day.

Almost every keen photographer has negatives of these three types or their equivalent.

The ranges of contrast in these three subjects differ considerably. In the first if we take careful exposure meter readings of the different parts of the subjects, we may easily find that the distant snow in sunshine produces a reading of say, 1000 or more, while the foreground building on its shadow side, or the dark trees, may possibly read as little as 2. This gives a ratio between the lightest and darkest tones of 500 to 1.

In the case of the portrait, an isolated reading of the highest light in the face tones may be about 50 times as brilliant as the dark shadows in the clothes.

In the street scene we may find that, apart from the sky which, in this instance, will not be included in the picture, we have a contrast range of possibly only 10 or 15 to 1 between the lightest and darkest tones.

Modern films, good though they are, have only a limited capacity for recording these tones; generally it is safe to suggest a range of about 150 to 1 as the maximum for the majority of them. That is to say, if a piece of the film were exposed to a weak light of such a strength that an exposure of 1 second produced on development the faintest discernible darkening of the emulsion, an exposure of 150 seconds to the same light would make the film absolutely black. *No further additional exposure would have any visible effect on it*, as anything after the 150 seconds would be beyond the ability of the film to record.

If, therefore, we photograph our mountain landscape, exposing carefully by meter, we shall secure a negative in which are recorded all the half-tones and some of the lighter shadow detail, with a similar trifling amount of the not-too-intense bright parts. We shall have to sacrifice the extremes at both ends of the scale, because our material cannot cope with them.

In our second example we have a range of only 50 to 1 in the subject, and as our film is capable of recording contrasts of 150 to 1, all the available tones will record satisfactorily if the exposure is accurately timed.

The street scene will at best produce a flat looking negative simply because the contrast is low in the original itself. This negative will be a series of grey tones. If correctly exposed, there will be no opaque black highlights, and even the shadows will show an appreciable silver deposit.

I have assumed all along that we are trying accurately to reproduce the original and that our film has consequently been developed to gamma 1.0. Because of the curve of the film (see page 76) the middle tones will be more or less accurately separated, but in the long scale subject there will inevitably be some loss of tones at the extremities.

We have now three negatives:

The first uses all the available range of the film and even then really fails to do justice to the subject.

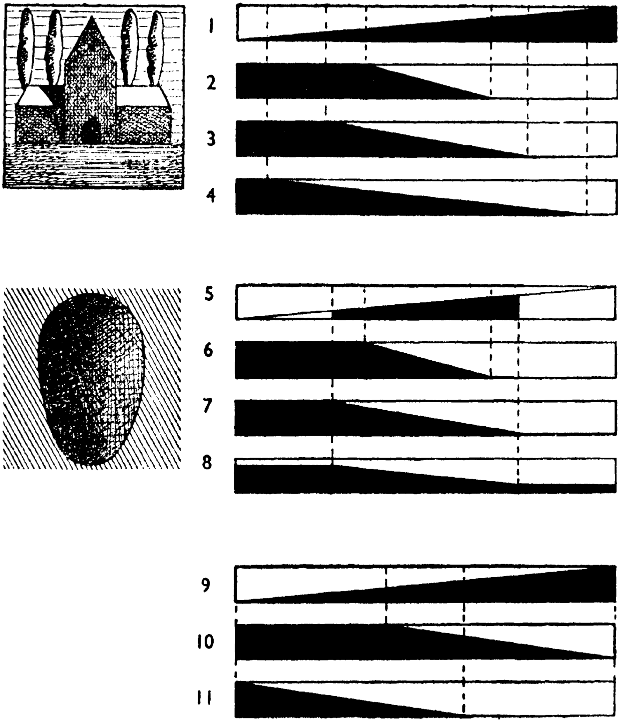
In the second much of the useful range of the film is employed, and nothing is allowed to go to waste on the shoulder or toe.

In the third all the tones in the original are faithfully reproduced on a small part only of the film curve, consequently the result looks very flat.

PRINTING PAPER GRADES

NORMAL BROMIDE paper has, unfortunately, a much shorter contrast range than has the film itself, and one has to remember that a print is always viewed by reflected light. Now even the blackest black produced on paper reflects *some* light (about 3 per cent) while the whitest white cannot reflect more than 100 per cent of the incident light. Usually it reflects only about 85–90 per cent. The contrast of a positive print will thus be at the best about 1 to 30. For a picture viewed by reflected light we are satisfied with this, simply because there is no brighter nor darker tone possible for comparison. The maximum contrast mentioned above appears therefore to be perfectly natural.

We can thus make a print from a contrasty negative, considerably compressing the tonal scale to bring it within the limits imposed by a picture viewed by reflected light,



Top : A long scale subject and negative with tones from black to white (1), printed on a hard (2), normal (3) and soft (4) paper, reproducing respectively a short part, the bulk and the whole of the negative tones which the respective papers " spread " from black to white.—See p. 280.

Centre: A short scale subject, the negative (5) of which will be reproduced with increased contrast (6), reproduced correctly (7) or flattened in contrast (8), by a hard, normal and soft paper respectively.—See p. 282.

Bottom : A long scale negative (9) can be printed on a normal or contrasty paper to secure highlight detail and tone separation at the expense of the shadows and dark tones (10). To reproduce the shadows satisfactorily to the exclusion of highlight detail, a suitably shorter exposure must be given (II), but the highlights will be blank.—See p. 282.

and still find the print reasonably true to life. It will show all the tones from black to white.

Provided the contrast range of our negative is not too severe, we can obtain a very good transcription of it on any normal bromide paper. To cater for those other negatives which have a range of tones longer or shorter than usual, the manufacturers produce their papers in a variety of contrast grades, usually designated "soft", "normal", "hard", etc. *All* these grades reproduce all tones from white (paper base) to black, but they differ in the *relative* amount of extra exposure necessary to produce the black tone in relation to the first discernible tone above white. The black tones of a soft paper require relatively *more* additional exposure, and those of a hard paper relatively *less* than in the case of a normal grade.

I do not mean that a soft paper requires a longer *printing* exposure than would be needed for a normal grade—often the reverse is the case. What I do mean is that a very contrasty negative should be printed on a soft paper because the latter will have received sufficient exposure to be able to cope with the bright tones, before the shadow areas have been over-exposed to an extent which causes them to print as detailless black.

The degree of hardness or softness of printing paper is expressed by its *contrast range*—e.g., 60 to 1. This means that if an exposure of one second will produce a tone just discernible from absolutely white paper, then sixty times this exposure will produce a full black tone. Further exposure will not make any difference; the black tone obtained by an exposure of sixty seconds will not be discernible from one obtained by exposing for twice as long. With a paper of a contrast range of 100 to 1, one hundred times the minimum exposure would be required, and so on.

We can easily determine the contrast range of any paper by making a series of progressive exposures on a strip. It is exposed (without a negative) to a weak light, and covered up step by step with an opaque card or other protector, so that a series of exposures of say, 1, 2, 4, 8, 16, 32, 64, 128 and 256 seconds are given. In this series each step received 100 per cent more exposure than the preceding one. The strip should be fully developed, and examined in a good light. If the strength of the light for the exposures was just right, we should have all the steps on the strip from pure white, getting progressively darker, until a point is reached where additional exposure does not increase the density of the black. If the first step is already appreciably grey, the printing light was too strong; if the last step is not yet really black, the light was too weak. So we shall have to adjust the light, and make another strip.

SUITING THE PAPER TO THE NEGATIVE

WITH SUCH a range of materials at our disposal we are now in the position of being able to reproduce all or part of the available tones of the negative in a number of different ways according to its range and nature, and to our own personal requirements.

Our only chance of reproducing on paper anything like a reasonable number of the available tones in the negative of the mountain scene is to use material of a soft grade. By doing so we are bound to compress the tone scale, so that *the difference between the individual tones appears less than* it is in real life. We have to resign ourselves to this for the sake of getting a print with detail everywhere from this negative.

Suppose, for experiment, we were to use a piece of normal paper with a contrast range of 60 to 1. As this will reproduce the negative tones more or less accurately, it can (with this negative) only reproduce about a third of them. If we expose it correctly for the middle tones, we shall have nothing but black for the shadow areas, and only dead white paper where there should be detail in the highlights of snow, etc. Those tones that we *have* printed, however, will be something like right in separation.

So if with this negative we decide that a picture can be made of the snow and sunshine alone, and that we are quite content for the trees and buildings to be nothing but a black silhouette, then normal paper can be usefully employed, and will preserve true tone differentiation *in that part of the picture in which we are interested.* In such a case we shall expose the paper sufficiently to secure the desired highlight detail, and not worry if the darker parts of the picture go absolutely black. Similarly, if the interest is solely in the dark tones we can deal equally well with those, *at the expense of all the lighter parts of the picture.*

Whether to use soft or normal paper in such a case must be left to the discretion of the photographer, and it will depend on the result desired. With soft paper he will record a wide range of tones, though the print on the whole will look flat owing to their small separation. With normal paper he will have to content himself with only part of the available tones in the negative, but will record these fairly accurately.

With the assumed negative of the portrait the contrast range approximates more nearly to that of the normal grade of paper, and this grade can be employed to reproduce the tones of the negative with reasonable accuracy. If, however, the use of normal paper produces a print which, while accurate, seems to be too contrasty to be pleasing, then a soft paper can be employed to compress the tones so that the lightest highlight is lower in tone, and the darkest shadow less black than would otherwise be the case.

In our final example of the street scene, the negative contains all the tone differences available in the subject. While these can correctly be conveyed on normal paper, the result will not be pleasing. We are accustomed to seeing something like the whole of the paper range from white to black usefully exploited, and in such a case we must use a contrasty grade of paper thereby *expanding* the difference between the individual negative tones, so as to make the most of the available paper tones.

I have quoted purely arbitrary figures for representative paper contrast ranges, and have suggested a simple means whereby we can find out the exact range of the various grades of any make of paper. I am afraid, however, that much of this information will only be of somewhat academic interest unless we have also the means of determining the density range of the negative itself.

The recently introduced Ilford Densitometer provides the worker with a means of accurately obtaining this information. This instrument, which is made in two models for "mains" or battery operation, allows minute sections of the negative to be measured by comparison with a standard light, the intensity of which is controlled by a rotating optical density wedge. From measurements of the lightest and darkest tones, the scale of any negative can easily be ascertained. The exact range of the negative can then be measured, and the printing paper with the right contrast range selected for the print.

With such accurate information as these instruments provide print making can be something of an exact science; but if these aids are not available, a certain amount of experiment with short, medium, and long scale negatives (which is, after all, only another way of saying flat, medium and hard), and the corresponding grades of bromide paper (hard, normal and soft) will enable us to determine the grade of paper most likely to produce the type of print we require.

PRACTICAL PRINTING

HAVING THUS provided ourselves with some theoretical knowledge of the principles involved, let us get down to the practical aspect of printing (or enlarging). We are dealing with (broadly) three types of negatives, hard, normal and flat; and we have at our disposal three grades of printing paper to suit them—soft, normal and hard.

We shall find that usually a hard negative requires a soft paper, normal negatives give their best print on a normal paper, and the soft or flat negative requires a contrasty grade of paper to brighten it up. After some experiment we can recognise more or less at sight the type of paper required by any given negative; all we have to do to secure consistently good print quality, is to expose accurately, and develop fully.

While mechanical aids such as the densitometer we have just mentioned are an aid to determining the necessary exposure, their possession is by no means essential, and everything that need be known can be learned from a *test strip* exposure. The simplest way to do this—if you have no idea at all of the exposure required—is to cut a sheet of bromide paper into a strip about 10 × 2 inches, and to expose it to the projected image in steps

(*Continued on p.* 289)

ENLARGING TECHNIQUE is illustrated in the following pages.

First we have a print on hard paper (page 285 *top left*) from a normally exposed negative of London's Broadcasting House.

Then the same negative printed on normal paper (page 285 *centre left*).

And again on soft paper (page 285 *bottom left*).

Now let us see a print from an under-exposed negative (page 285 *top right*).

Then correctly exposed (page 285 *centre right*).

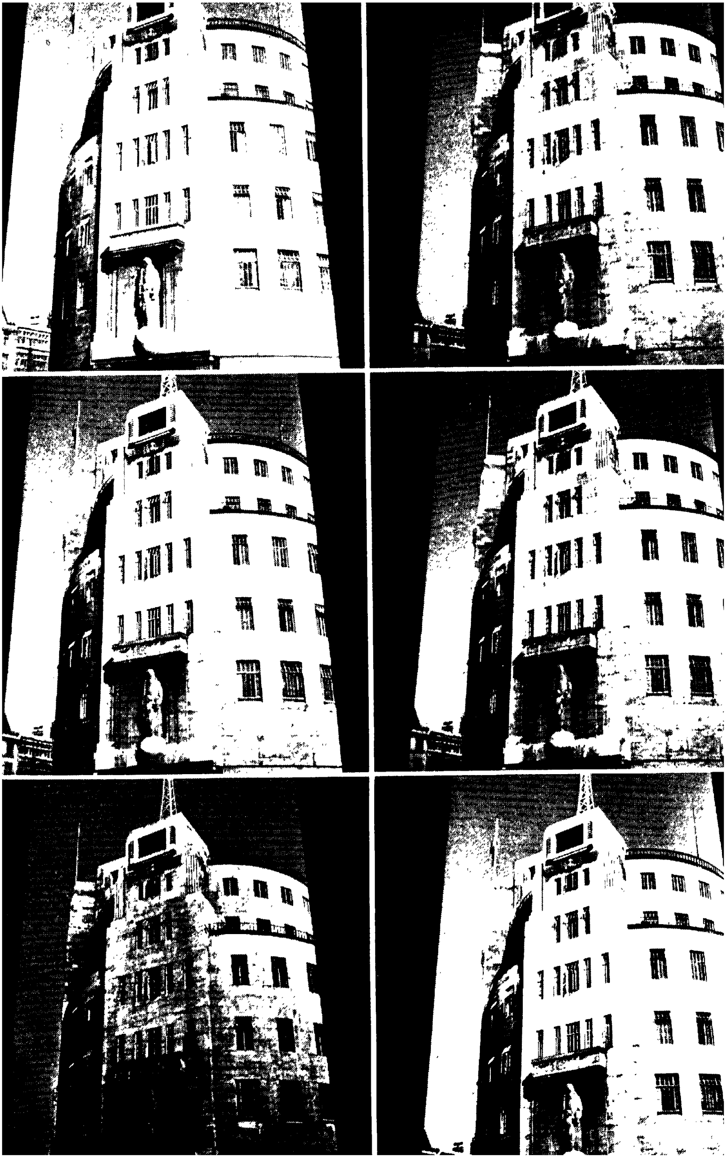
And lastly over-exposed (page 285 *bottom right*).

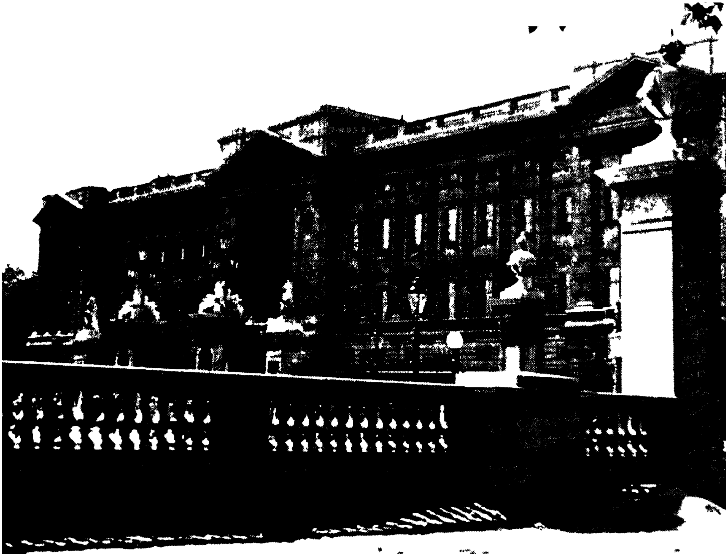
THE NEGATIVE IS ONLY THE BEGINNING, the picture is finished when the print is made.

A square negative of Buckingham Palace (page 286 *bottom left*) provides the choice between an oblong (*top*) and an upright (*bottom right*) composition.

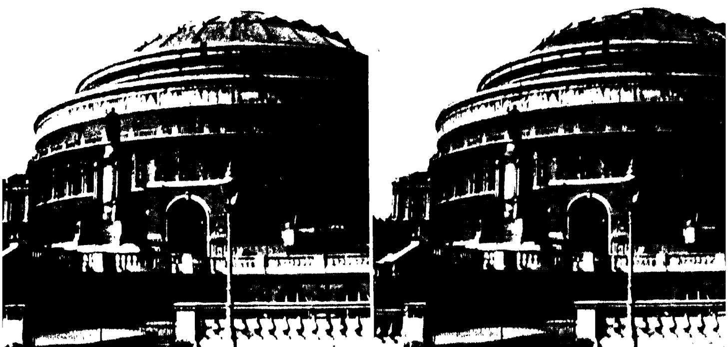
The entrance to Scotland Yard again can be presented in a variety of ways by trimming from the original square format (page 287 *bottom right*). The leaning verticals could easily be corrected in enlarging, see page 289.

(*Continued on p.* 289)









progressively for (say) 5, 10, 20, 40, 80, 160, 320 seconds, choosing a representative part of the negative where there are highlights, half-tones and shadows. After development for the recommended time this strip will at once reveal which exposure is *approximately* correct; and if there is some doubt as to which of two adjacent steps is the better, a further test can be made, or the actual print can be exposed for a time somewhere between the two. For average negatives this method will ensure adequate accuracy.

An alternative method that I use a great deal when working with negatives in which there are large highlight areas, is to make the test *solely* on the highlights. That is to say—my test strip is put down where the densest part of the negative will be projected on it, and a series of exposures is made in steps as before. On development I note which exposure produced the first *visible* shade of grey (as distinct from the unexposed, and therefore white paper), and expose my print for that length of time. This ensures that the detail and texture in the highlights will be rendered, and allows the rest of the darker tones to take care of themselves. This method can only be employed, however, *when we are certain that the paper in use will accommodate all the tones that are in the negative.* If there is any uncertainty on this score, the former method is to be recommended.

WE CAN CORRECT SOME FAULTS during enlarging. Converging verticals, due to a tilted camera (page 288 *top left*) can be rectified by enlarging on to suitably tilted paper as proved by the " corrected " print (page 288 *top right*) from the same negative of the National Gallery in Trafalgar Square.

A picture with a " baldheaded " sky (page 288 *centre left*) can often be improved by " spot printing " or " printing up " the sky as in this case of the Royal Albert Hall in the foreground (page 288 *centre right*).

A subject in which the shadow areas become clogged by the time sufficient exposure has been given to the lighter tones (page 288 *bottom left*) can often be improved by holding back or " shading " the dark areas for part of the exposure time ; as in the second view of St. Paul's Cathedral Churchyard (page 288 *bottom right*).

CONTACT PRINTING

NOWADAYS THE majority of prints are made by enlargement from the original negative, and a negative $2\frac{1}{4} \times 2\frac{1}{4}$ inches is, I think, just about the smallest size that is worth while printing by contact.

There are, however, occasions when enlargements are not deemed necessary, and when contact prints seem to be large enough to meet requirements. Because small prints are going to be closely examined, I think that the use of glossy paper is always desirable for such contact prints, whatever surface may be chosen for the larger pictures, as the fine detail is best retained on a paper with the smoothest possible surface.

The production of a good contact print is an elementary business. Such prints are usually made on so-called "Contact" paper, as distinct from the bromide paper used for enlarging. The difference is chiefly one of speed; contact or gaslight paper, as it was once called, can be handled by very subdued artificial light, provided that no direct light falls on the paper. Bromide paper always needs an orange safelight.

The equipment required consists of:

- A constant source of light which can be switched on and off as required to make the exposures.
- A printing frame of the right size (with glass).
- Three dishes.
- Contact paper in three grades, soft, normal and vigorous.
- Developer. This should be the formula recommended by the makers of the paper used, as not all brands of contact paper work satisfactorily with developers other than the recommended ones.
- Acid Fixer.

The negatives to be printed should be sorted out into three types

(*a*) Those which appear to be very contrasty (for which we shall use soft paper).

(*b*) The normal negatives.

(*c*) Negatives which look flat (for use with vigorous paper).

We then choose what appears to be a normal negative and a sheet of paper to match. These should be put in the printing frame by *very weak* artificial light. A 15 watt lamp, at the other end of the room will do, but a proper bright yellow safelight is preferable.

The frame is placed at a distance of (say) 3 feet from the normal room lighting source and a series of test exposures of, say, 5, 10, 20, 40, and 80 seconds should now be given by progressively covering up the face of the printing frame with an opaque card. On developing the print it will be easy to determine what exposure is required to secure a good print from that particular negative, and from others of approximately the same density and contrast.

The distance of the frame from the source of light should be carefully noted, as it has very considerable effect on the exposure time; so when a test print is made, the final print must be exposed at the same distance from the light as the first test.

When the exposed paper is put into the developer it should be kept under the surface of the solution to avoid stains. Development takes about 30 to 60 seconds, and after it the print is rinsed in plain water, or, preferably, in a stop bath made by dissolving about $\frac{1}{2}$ oz. (15 grams) of potassium metabisulphite or sodium bisulphite in 10 oz. (300 c.cs.) of water.

The paper is then transferred to the acid fixing bath in which it must again be kept totally immersed, and moved about for the first few minutes. Fixing takes about 5 minutes, and the print is finally washed for 20 to 30 minutes in running water, or in some ten changes of fresh water, keeping it for 5 minutes in each.

Fingers should be kept out of *all* solutions and two pairs of ebonite or stainless steel tweezers (one for developer, and the other for use in the fixing bath) are desirable accessories.

A mask, with a clean cut aperture $2\frac{1}{8}$ inches square, placed between the negative and the paper during printing, will ensure a clean white border to the print. To increase the apparent size of the print if it is to be used for album purposes, one or two other masking systems are worth considering.

By using a larger printing frame, say ¼ plate size, and paper to match, a print which appears to occupy the whole of a 3 inch square of paper can easily be made. The glass in the frame is masked with opaque adhesive tape or black paper cut to form two hollow squares, one 2⅛ inches inside, and 2¼ inches outside, the outer one 2½ inches inside and 3 inches outside. The negative is carefully placed on this glass, so that the edges of the pictures are completely obscured by the inner mask; the printing paper is then located so that the negative is central and the paper overlaps the edge of the outer mask. The finished print when trimmed neatly, has the appearance of being framed with a black line round a white border.

PRINTING BY ENLARGING

FOR THE vast majority of our subjects, however, we rely on *enlarging*. This, our normal method of print production, allows us to select any chosen part of a negative, and to reproduce it in almost any desired size.

A large variety of enlargers exist, but although they may differ considerably in appearance, their functional properties are all basically similar. Briefly, an enlarger comprises:

(*a*) A source of light contained in a light-tight ventilated box.

(*b*) A condenser or other device which evenly illuminates the negative.

(*c*) The negative carrier, below which, and carried in some form of focusing movement, is:

(*d*) The lens which projects the image of the negative on to the bromide paper.

There are two representative types of enlarger. One employs a condenser to spread the light evenly over the whole negative. The second relies largely on sheets of matt or opal glass, placed between the light source and the negative, for the same purpose. Often an enlarger uses a condenser illuminated by diffused light. Both these models follow the modern trend and are arranged vertically so that the image is projected down on to the horizontal baseboard on which the paper lies.

There is also the older type of horizontal enlarger with which the picture is projected on to a vertical easel.

With all these instruments the picture size is determined by the distance from the projector to the baseboard or easel. Sharp focus is ensured by visual inspection, and the necessary manual adjustment of the lens toward or away from the negative.

Some of the more expensive vertical enlargers focus automatically. The lens carrying board moves in and out under the control of a cam mechanism which operates as the lamphouse is raised or lowered on its support. With this type of enlarger we have only to consider the *size* of the desired image which shrinks or grows as the enlarger head is moved, remaining in focus all the time. Whichever type of instrument is used, the basic principles of projection printing remain the same.

The illumination of an enlarging darkroom must be more subdued than would be safe for contact printing, as the speed of the more rapid bromide papers is anything up to 60 times that of contact paper. A suitable safelight lamp with a yellow screen, such as Wratten O.A. or Ilford S. is recommended. Both of these screens pass an abundance of safe light by which one can see all that is necessary to the process, without risk of fogging the paper.

If there is any doubt as to whether the light is safe, a simple test can be made as follows. Take a small piece of bromide paper about 3 inches square out of a packet *while the room is in darkness.* Place this face up on the work bench where it will be in the direct rays of the safelight, and put a coin on the centre of the paper. Switch on the safelight and leave it on for 3 minutes. Then switch off, and develop the scrap of paper for at least 3 minutes, rinse it, and fix it for 5 minutes *before turning on any light at all.* If on examination the paper is white all over, all is well; but if the shape of the coin can be discerned, no matter how faintly, the darkroom light is unsafe. If fogging of the exposed part of the paper is appreciable, you will have to reduce the power of the lamp in the safelight, or move the lamp further away from the work bench. In either case make further tests until you are satisfied that your room lighting is entirely above reproach. Only then can you safely commence enlarging.

The fundamentals of enlarging do not differ appreciably from those of contact printing. Choice of a suitable paper surface is largely a matter of personal preference. For the smaller sizes glossy papers have much to recommend them, but for those workers who object to a very shiny surface, there are velvet, half-matt, silky, and many other surfaces suitable for almost all work. Unlike some of the dead matt and rougher papers, the appearance of glossy and velvet prints does not change a great deal as the print dries, which makes the production of satisfactory prints on these surfaces considerably easier than on a paper which differs in appearance according to whether it is wet or dry.

Having ascertained the correct grade of paper to suit the negative, and the exposure required to produce a good print, we have next to ensure that development itself is adequate.

Most paper manufacturers recommend their own developing formula, and I see no reason for departing from it if it is available. It is invariably one which will get the best out of that particular paper. Two normal formulae follow here.

M.Q. DEVELOPER FOR BROMIDE PAPERS

Metol	2 grams	31 grs.
Sodium sulphite, anhyd. *or*	25 grams	390 grs.
crystals	50 grams	1 oz. 340 grs.
Hyrdoquinone	3 grams	47 grs.
Sodium carbonate, anhyd. *or*	25 grams	390 grs.
crystals	70 grams	2½ oz.
Potassium bromide	1 gram	15 grs.
Water to make	1000 c.cs.	35 oz.

This is used at the above strength.

AMIDOL DEVELOPER FOR BROMIDE PAPERS

Sodium sulphite, anhyd. *or*	28.5 grams	1 oz.
crystals	57 grams	2 oz.
Potassium bromide	1.2 grams	19 grs.
Water to make	1000 c.cs.	35 oz.
Just before use add :—		
Amidol	5.7 grams	88 grs.

This solution does not keep well and should be prepared immediately before use.

Where development times and temperatures are recommended, most makers advocate 1½ to 2½ minutes development at about 65 degrees F. While this produces a good print, I suggest that a very much better print will usually be obtained if the development period is prolonged to 3 minutes at this temperature. If the print goes too dark during this extra development, it does not necessarily mean that the developing time is too long; it is an almost certain indication that the print is *over-exposed*, and the exposure should be reduced until this extra development time can be borne. This applies only to *bromide* papers.

When a print which has been correctly exposed in this way is developed, the image will gradually grow in intensity for the first 1½ or 2 minutes and will then apparently stop. If—for the sake of experiment—you then cut the print in half, putting one half in the fixing bath at this point, and continue developing the remaining half up to the recommended 3 minutes, I think you will find that the portion which had the fuller development, while no *darker* than the other half, is considerably *richer* in its tones, and that the black tones are much blacker, giving the print a degree of brilliance and quality lacking in a print which has had what I would call minimum development.

It is worth noting that most of the recommended developers are of the metol-hydroquinone type, and that this developer does *not* like low temperatures. The hydroquinone part of the solution (which is the part producing the strong contrasts and good blacks) is almost inert when the temperature falls much below 60 degrees F., and this is, I think, frequently responsible for poor quality prints lacking in contrast, particularly when made in a cold darkroom in winter.

In my own darkroom I have underneath the bench an electric heater which is switched on before a session of enlarging in cold weather. When the heater has been on for 30 minutes or so, the top of the bench registers a temperature of about 70 to 73 degrees F. I do all my print developing at this temperature.

Too high a temperature, or too long a development time will result in degraded highlights in the prints due to a kind of chemical fogging, but the times and temperatures suggested above do not seem to harm modern papers which are reasonably fresh ; and the gain in print quality is considerable.

As with contact prints, development should always be carried out with the print totally immersed in the solution. Bromide paper does not oxidise or stain as easily or as rapidly as contact paper, but if development is prolonged much beyond the usually recommended two or three minutes, attention to this point is desirable. Developer should always be fresh and active. Every time a print is developed, some of the activity goes out of the solution, and although it is difficult to quote hard and fast figures owing to variations in developer formulae, it is a fairly safe rule to reckon that *one ounce* of developer will satisfactorily develop *not more than* 20 *square inches of paper.*

This means that if you pour 10 ounces (300 c.cs.) of prepared developer in the dish, you should not do much more than four 8½ × 6½ inch prints, before discarding it. This may sound extravagant, but fresh developer has a very considerable influence on print colour and quality. An overworked developer often produces dull prints, and may cause unpleasant greenish-black tones instead of the strong neutral black that should always be the outcome of fresh materials and solutions.

The active life of a fixing bath is also limited, although not to so great an extent as that of the developer. I would not care to fix much more than twenty or twenty-five 8½ × 6½ inch prints or their equivalent in a pint of normal acid fixing solution.

Washing really big enlargements in domestic surroundings is always something of a problem, but in the absence of a print washing syphon or a commercial washing tank of suitable size the best method is to allow the print to soak in a dish of water for five minutes. Discard the water, and hold the print up to drain for one minute, replace in the dish, refill with fresh water and repeat the process six times. This should remove all the hypo. The one minute of draining is a very important part of the process, and should not be omitted.

Drying enlargements is quite simple. The frequently advocated method of hanging the prints from a line by means of clip hooks ensures speedy drying, but usually results in cockled or curly prints. My own method is to place the wet print down on a folded towel. I wipe it over with a viscose sponge to remove surplus water; first the back, and then the face of the print. I next turn the print face down on a dry part of the towel, and leave it until dry (a few hours). This method leaves the print almost flat, particularly if double weight paper is used.

Even rough towelling is quite satisfactory. If any fluff adheres to the surface of the paper it can easily be removed when the print is dry. Any trifling curl that then remains in the dry print can be removed by stroking the back of the print with a ruler—working from the centre outwards.

CONTROLLED ENLARGING

AS WE have seen, it is impossible to print a really long scale negative so as to preserve detail in both shadow and highlight areas at the same time, because no paper has a long enough scale to cope with the negative range. If we try to overcome this by using a very soft grade of paper, the result is insufficient separation between tones, and a general loss of brilliance.

Many negatives have a long scale, which contains possibly a good amount of shadow detail, and then nothing much else until the highlight area is reached. To print such a negative on soft paper to preserve detail in the shadows *and* the highlights results in both of them appearing flat and lifeless, while a print on a normal paper will brighten up the shadow tones to a satisfactory extent, but will leave highlights like the sky as a detailless expanse of white. If we expose the print more generously, we can obtain a bright crisp rendering of the sky and clouds, but the darker tones will then all crowd together and print as a more or less detailless black.

If, however, we expose the whole of the negative for the time required to secure satisfactory shadow detail and contrast and then cover up that part of the projected image with a suitable opaque mask, we can continue the exposure of the sky area for the necessary time to secure highlight detail. It is most important that the mask used to cover the shadow area is accurately cut to the necessary shape, and that it is kept slightly on the move during the additional exposure so as to avoid any hard line of demarcation.

What we have actually done is to bring the highlight and the shadow area *closer together* in tone values, so as to get them both on the same paper. Because that paper is of normal grade, we have preserved the *difference* between the individual highlight tones, and also retained a sufficient variation between the tones that make up the shadow detail. When this is done, the difference between the brightest and the darkest tones is just about the same as it would be if soft paper were used. However, instead of the shadow tones being compressed at the bottom end of the curve, and the highlight tones being all up on the top end where the difference between them will again be inadequately rendered, we have now made the shadows occupy quite an appreciable part of the straight line of the normal paper curve. We also have (by the additional exposure) pushed the highlight tones down so that they are recorded further down on the same straight line. The separation between the individual tones will now be adequate, owing to the more contrasty paper used.

The process that we have just described is generally referred to as *dodging*, or *printing up*. Its near relative is *spot printing*. Quite a number of negatives print well enough on the appropriate grade of paper, except for perhaps a small highlight area for which the normal exposure required is not sufficient. By holding an opaque card, pierced by a suitably shaped hole, between the enlarger lens and the printing paper for part of the exposure time, the necessary additional local exposure can be given to those parts which require spot printing in order to secure detail.

The mask must be kept moving, as the shape of the aperture generally only approximates to the outline of the area to be printed up, and if the mask were allowed to remain still, its shape would be apparent on the print.

I generally keep all the sheets of cardboard which are used in packing bromide paper, and have a selection of these pierced with a variety of circular, crescent, triangular, or irregular holes of varying size from about 1 to 3 inches. I find that these cover most of my needs, and by partially obscuring the hole with the fingers, almost any required shape can be easily secured.

Parallel with spot printing we have the other requirement where part of an otherwise satisfactory negative prints too dark. This is frequently found in shadow areas where, if the full normal exposure required by the rest of the print is given the shadows are clogged up. The remedy lies in *shading* or holding back that particular part that would otherwise be overprinted. This is done by holding an opaque mask of suitable shape over the area to be so protected. So that the mask may give a purely local cover, it is best to mount it on a thin but stiff wire which permits its use where it is needed without risk of the hands obscuring any of the rest of the picture. The mask must be kept moving slightly all the time it is in use, to avoid a harsh outline; this movement also effectively prevents the shadow of the wire appearing on the print. It is worth bearing in mind that the shadow of a small mask held at some distance from the printing paper has a very much more diffused edge than has that of a larger mask used more nearly at paper level. Sets of shaped masks are supplied by dealers under the name of enlarging control outfits.

Until considerable experience has been gained, the extent to which any particular part of the picture is to be controlled during printing should be ascertained by a trial strip print of that particular area.

MOUNTING

THE ACCUMULATION of hundreds of prints or enlargements in a variety of sizes and in varying stages of completion is all too frequently the practice of the keen camera user. Were he to admit it, he derives more pleasure from the purely practical work of making exposures, processing his films, and seeing how they print, than he does from producing the really finished result. In adopting this attitude, he is missing the best that photography has to offer: he knows nothing of the thrill that comes from the possession of a well turned out and mounted collection of pictures, always available for display to his friends, or for entry into camera club exhibitions and competitions; nor can he enjoy the perennial pleasure of browsing over pages of well presented albums in which his high spots, photographic and otherwise, are adequately illustrated.

I have described the desirability of securing *balance* in one's pictures. Obviously this will be done, so far as may be possible, at the time the button is pressed, but there is almost always more in a negative than is desirable in the final print. If the latter is to present the subject to the best advantage, a contact print or small enlargement from the whole of each negative should carefully be studied, to find out just what possibilities it holds, before starting to make the final enlargement for the collection.

An aid to finding the best part of a picture is a pair of L-shaped pieces of white cardboard of such size that they can be moved about over the surface of the trial print, isolating various parts of it. I use two such L sets. One measures about 7 × 5 inches, the other, used on large prints, about 20 × 15 inches. The smaller L is about 1 inch wide; the larger, about 3 inches. In use they are moved about over the face of the print until the choicest part of the composition is located. An enlargement of that part alone is then made to a suitable final size.

For displaying these final enlargements, I suggest standardising on a plain white or cream mount which conforms to the recognised exhibition sizes, i.e., 25 × 20, 20 × 16 or 15 × 12 inches, so that prints so mounted are available for exhibition, as and when occasion arises. For my own work, I have standardised on the two larger sizes of mount 25 × 20 and 20 × 16 inches, and the size to which I enlarge is usually 20 × 16. 25 × 20 inch prints fill the mount and "bleed off" (as the printer would say) on three sides, leaving only a narrow white strip along the base for title and signature. Enlargements on 20 × 16 inch paper also go on to the 25 × 20 inch mounts, while the smaller mount size serves admirably for prints 15 × 12 inches or smaller.

The method of mounting is largely governed by the facilities available.

Perhaps the best way is what is known as *dry mounting*. In this the print is attached to a thin tissue impregnated with shellac or similar resin, and put on to the mount. The whole is placed in a press at a temperature high enough to melt the shellac, and thus bind print, tissue, and mount together. This method eliminates the risk of warping, cockling, or other unevenness in the final print. Access to a dry-mounting press obviously simplifies matters. Although such a press is available to members of many photographic societies, the lone worker who does everything at home will have to make do with a domestic flat iron. This is by no means as convenient as the proper press, but it can be made to work quite well. Care must be taken to keep the temperature of the iron to that recommended by the maker of the tissue employed.

It is worth remembering that if the tissue adheres to the *mount* but *not to the print*, the iron is too hot; while if the tissue sticks to the *print* but *not to the mount*, the temperature is just below the desired point. Before putting down on to the mount, the print and tissue must be trimmed to the required shape. Many of the commercial print trimmers, even the expensive ones, do not necessarily cut accurate right angles. As the print is turned round to present each of its four edges to the blade in turn, any slight error that the trimmer may make in its first cut is progressively increased with subsequent strokes, so that the ultimate print is definitely out of square on every side. For large prints in particular where such small errors are very apparent, I prefer trimming by means of a straight edge and setsquare, using a really sharp penknife, or a razor blade.

Until the invention of dry-mounting tissue, print mounting provided more than its share of headaches. This was particularly so when the worker attempted to stick the print down with a water-soluble adhesive applied all over the back of the print. So unhappy am I about this method, that I would advise the worker who has no dry-mounting facilities to adopt as a preferred alternative the practice of mounting the print only along its upper edge. It will then hang on the mount by its own weight, and the risk of cockling or warping will be minimized.

A chemically pure photo mounting paste should be used in this case, or else pure commercial rubber solution which is largely employed for similar tasks by professional art and advertising studios.

When the picture is mounted, it should be titled—in pencil (not ink, please). This should be done as neatly and as inconspicuously as possible. Many otherwise excellently mounted enlargements are ruined by too blatant a title, or one which is so carelessly drawn that it attracts attention from the picture to itself. Unless you can print *well*, my advice is to use ordinary handwriting; nothing looks worse than "printing" done by someone who cannot print!

If a printed title *is* employed let it be as plain and readable as possible. Fancy or "artistic" lettering invariably draws attention from the picture.

For safe storage of these enlargements an artist's print folio is as good as anything; but if you wish to preserve the condition of the prints, it should be the type with dust excluding flaps.

I rather like the idea of pasting an ordinary contact print of the whole of the original negative on the back of the mount. It makes the exhibit much more interesting to other camera workers.

THE ALBUM

I SELDOM make any contact prints except for trial. I feel that larger prints do more justice to what the negative usually holds.

For the album my normal practice is to enlarge to $\frac{1}{2}$ plate ($6\frac{1}{2} \times 4\frac{3}{4}$ inches), or in the case of square subjects to $4\frac{3}{4} \times 4\frac{3}{4}$ inches with occasional $8\frac{1}{2} \times 6\frac{1}{2}$ inch or $6\frac{1}{2} \times 6\frac{1}{2}$ inch prints from really exceptional negatives. These prints again I usually make on double weight paper. As the majority of my album pictures are made on various holiday tours in one form or another, I usually try to let each such tour completely fill an album, or if this is impossible, to arrange for two tours in the same county or country to go in the same book.

The prints are naturally arranged in chronological order, and are mounted so as to leave room for the appropriate title or description to be added.

With touring albums I find that it adds considerably to their interest (even to me, in after years) to devote the first page to a drawn sketch map of the route followed with the night stops indicated. As a rule, the pictures carry only a brief place name title, but something of a running commentary describing the trip is written in to fill the blank areas between the prints on the various pages. This work takes time, and I sometimes find myself wondering—while I am actually doing it—whether it is worth while, but on looking over an album a few months after it has been done, I have no doubts at all!

For mounting the prints, again dry mounting is preferable; but a good paste serves equally well if its use is confined to the extreme edges of the prints. Paste all over the back of a print usually causes the leaves of the album to cockle; but if a thin line (about quarter of an inch wide) of paste is applied close to the edges only, this trouble is avoided; and, at least with prints on double weight paper, the prints and the album pages remain satisfactorily flat.

Every book has to conclude somewhere—even if the author is conscious of the fact that his subject is far from exhausted ; and that his own contribution to it is necessarily limited. But if I, and those who have so willingly contributed chapters to this volume, can feel that we have added something to your enjoyment of this grand hobby —I think we shall all be well satisfied.

TECHNICAL DATA

Page	Title	Author	Camera	Lens
149	Spring Sunshine	H. S. Newcombe	Rolleiflex	Tessar
150	Alpine River	H. S. Newcombe	Rolleiflex	Tessar
151	Stokesay Castle	H. S. Newcombe	Rolleiflex	Tessar
152	Low Tide	H. S. Newcombe	Rolleiflex	Tessar
153	Riverside London	H. S. Newcombe	Rolleiflex	Tessar
154	Figurehead	H. S. Newcombe	Rolleiflex	Tessar
155	Old Doorway	H. S. Newcombe	Rolleiflex	Tessar
156	Lilac Bloom	H. S. Newcombe	Rolleiflex	Tessar
169	Wendell Wilkie	Philippe Halsman	Own design	Tessar
170	Johnny	Philippe Halsman	Own design	Tessar
171	The writer, Janet Flanner	Philippe Halsman	Own design	Tessar
172	Reflection	Philippe Halsman	Own design	Tessar
177	Never Use 'Em	Roy Pinney	Rolleiflex	Tessar
178	First Dip	Roy Pinney	Rolleiflex	Tessar
179	Don't Drop Me	Roy Pinney	Rolleiflex	Tessar
180	Assembly Line	Roy Pinney	Rolleiflex	Tessar
185	Boston Bulldog	Ylla	Rolleiflex	Tessar
186	Foal	Ylla	Rolleiflex	Tessar
187	Gibbon	Ylla	Rolleiflex	Tessar
188	Cat and Kitten	Ylla	Rolleiflex	Tessar
193	Front Line	W. Eugene Smith	Ikoflex	Tessar
194	Tear Gas	W. Eugene Smith	Ikoflex	Tessar
195	Japanese Flare	W. Eugene Smith	Ikoflex	Tessar
196	Wounded in Leyte Cathedral	W. Eugene Smith	Ikoflex	Tessar
201	"Porgy and Bess"	George Karger	Rolleiflex	Tessar
202	Fire Eater	George Karger	Rolleiflex	Tessar
203	Floor Show	George Karger	Rolleiflex	Tessar
204	"Finian's Rainbow"	George Karger	Rolleiflex	Tessar
209	Martha Graham	Arnold Eagle	Rolleiflex	Tessar
210	Lathrop in "His Birthday"	Arnold Eagle	Rolleiflex	Tessar
211	Mercer Cunningham	Arnold Eagle	Rolleiflex	Tessar
212	Folk Dancing	Arnold Eagle	Rolleiflex	Tessar
217	Canadian Skiers	Nelson Morris	Rolleiflex	Tessar
218	Swimming Coach	Nelson Morris	Rolleiflex	Tessar
219	Six Day Cycle Races	Nelson Morris	Rolleiflex	Tessar
220	Ice Boat Race	Nelson Morris	Rolleiflex	Tessar
229	Beach Outfit	Fritz Henle	Rolleiflex	Tessar
230	Mexican Inspired Dress	Fritz Henle	Rolleiflex	Tessar
231	Classic Evening Gowns	Fritz Henle	Rolleiflex	Tessar
232	Ballet Slippers	Fritz Henle	Rolleiflex	Tessar
237	Rockefeller Center	Andreas Feininger	Rolleiflex	Tessar
238	East Side, New York	Andreas Feininger	Rolleiflex	Tessar
239	St. Patrick's Cathedral	Andreas Feininger	Rolleiflex	Tessar
240	Chicago	Andreas Feininger	Rolleiflex	Tessar
245	Barnacles Feeding	Fritz Goro	Rolleiflex	Tessar
246	Hand of Prof. Glen Seaborg	Fritz Goro	Rolleiflex	Tessar
247	Prof. Thorfin R. Hogness	Fritz Goro	Rolleiflex	Tessar
248	Filming Blood Circulation	Fritz Goro	Rolleiflex	Tessar

Focus (mm)	*Stop*	*Shutter Speed*	*Film*	*Filter*	*Lighting*
75	*f* 12.5	1/10	F.P.2	Med. Yellow	Sunlight
75	*f* 8	1/100	Panatomic X	Yellow Green	Sunlight
75	*f* 8	1/50	Isopan F	Light Yellow	Sunlight
75	*f* 11	1/100	Isopan F	None	Sunset
75	*f* 8	1/25	Panatomic X	None	Sunlight
75	*f* 8	1/100	Panatomic X	Light Yellow	Sunlight
75	*f* 4.5	1/25	Isopan F	None	Sunlight
75	*f* 8	1/50	Panatomic X	Med. Yellow	Sunlight
210	*f* 11	1/10	Super Portr't.	None	2 floods 2 spots
210	*f* 11	1/10	Super Portr't.	None	2 floods 2 spots
210	*f* 11	1/10	Super Portr't.	None	2 floods 1 spot
210	*f* 16	1/5	Wellington	None	2 floods 1 spot
75	*f* 8	1/25	Supreme	None	Floods and spot
75	*f* 11	1/200	Supreme	None	Sunlight
75	*f* 6.3	1/500	Supreme	Med. Yellow	Sunlight
75	*f* 16	1/100	Supreme	None	Multiple flash
75	*f* 22	1/100		None	2 synchr. flashes
75	*f* 6.3	1/500		Light Yellow	Sunlight
75	*f* 8	1/250		Med. Yellow	Sunlight
75	*f* 11	1/100		None	Sunlight
80				None	Daylight
80				None	Sunlight
80		Open		None	Flame
80		Open		None	Several long flashes
75	*f* 11	1/2	Super XX	None	Flood and spots
75	*f* 3.5	1/10	Super XX	None	Flame only
75	*f* 5.6	1/100	Super XX	None	Stage lighting
75	*f* 8	1/5	Super XX	None	Floods and spots
75	*f* 9	1/250	Super XX	None	3 synchr. flashes
75	*f* 11	1/250	Super XX	None	3 synchr. flashes
75	*f* 6.3	1/500	Super XX	None	3 synchr. flashes
75	*f* 11	1/250	Super XX	None	2 synchr. flashes
75	*f* 6.3	1/500	Super XX	Med. Yellow	Sunlight
75	*f* 5.6	1/500	Super XX	None	3 synchr. flashes
75	*f* 5.6	1/500	Super XX	None	3 synchr. flashes
75	*f* 11	1/100	Plus X	Med. Yellow	Sunlight
75	*f* 11	1/50	Supreme	Light Yellow	Sunlight
75	*f* 16	1/50	Supreme	Light Yellow	Sunlight
75	*f* 11	1/5	Supreme	None	Late afternoon sun
75	*f* 16	1/5	Supreme	None	Sunlight
75	*f* 16	1/50	Super XX	None	Sunlight
75	*f* 16	1/100	Super XX	None	Sunlight
75	*f* 16	1/100	Super XX	None	Sunlight
75	*f* 16	1/50	Super XX	None	Sunlight
75	*f* 22	1/250	Super XX	None	Synchr. flash
75	*f* 16	1/5	Super XX	None	2 baby spots
75	*f* 8	1/25	Super XX	None	Flood, 2 spots
75	*f* 8	1/5	Super XX	None	Kniseley's illuminator

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