FIRST STEPS IN PHOTOGRAPHY

J. C. H. WALLSGROVE


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FIRST STEPS IN PHOTOGRAPHY

PLATE 1.

THE NEGATIVE.

This Plate illustrates the Arrangement of Parts and Lights of the Subject in the Negative, when it (the Negative) is held at an angle of 45 degrees to a piece of white paper or card.

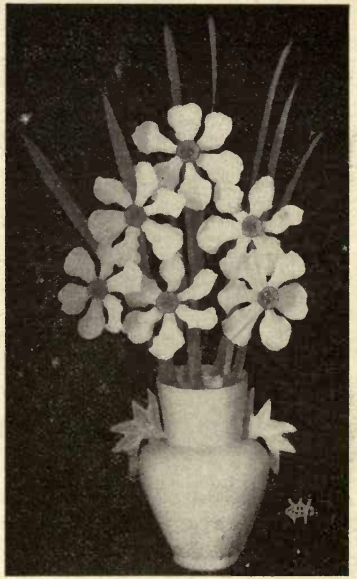

PLATE 2.

THE POSITIVE.

This Plate illustrates the Arrangement of Parts and Lights of the Subject in the Positive.

FIRST STEPS IN PHOTOGRAPHY

BY

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DEPARTMENT—ITS INCEPTION AND MANAGEMENT,"
"PHOTO-PRELIMS," ETC.

FIFTH EDITION

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PREFACE

TO FOURTH EDITION

THE preparation of the fourth edition of this little book has been undertaken with some amount of pleasure on account of the very favourable reception accorded to its immediate predecessor—respecting its practical and simple explanations—by the Press and by Beginners who have found its teachings of great use to them.

The new edition has been more profusely illustrated with drawings lettered in such a manner that they may be easily connected with the text. From this cause it has been necessary to practically re-write the whole work. This feature should be of great assistance to the reader, as it renders the descriptions so much clearer. The drawings have been made without any intention of illustrating any special make of apparatus, but to explain the structural arrangements and to show the principles underlying the various movements.

To be successful in the practice of photography it is essential that it is not undertaken in any haphazard sort of manner. It requires thought, system and cleanliness. Results do not so much depend upon the apparatus as upon the individual using it. Good apparatus in the hands of a good worker will always turn out good work, but it is equally capable of pro-

ducing inferior work in the hands of the careless, and again it is astonishing what really creditable work poor apparatus can do in the hands of a capable worker.

The aim of this little book is to state in a concise and simple way the simple truths in the practice of photography. As the worker progresses and it becomes necessary to make "Second Steps," it cannot be better done than by consulting a specialized work treating only upon the subject on which he is desirous of obtaining information. Practically every department of photography has its own special book. Whilst touching upon "Specialization" it is suggested to the reader that, having acquired a good general knowledge of photography, if there should be a desire to make further progress, the very best thing to do is to make a special study of one branch, or in other words "To Specialize."

TO THE FIFTH EDITION

THE dominating scheme of the fourth edition has been retained in this issue; the matter has, however, been subjected to a very careful revision and fresh added in order that it may be thoroughly up-to-date.

J. C. H. WALLSGROVE.

"BIRCHFIELD"
BLETCHLEY.

SYNOPSIS

First Steps in Photography

CHAPTER I.

THE CAMERA.

STAND—HAND—FOLDER.

PHOTOGRAPHY depends upon the effects of light on various chemicals sensitive to its action.

Some means are required for the proper control of the light, in order that it may be entirely excluded from the sensitive surface, until such a time that, all things being ready, it may be admitted, and then only through

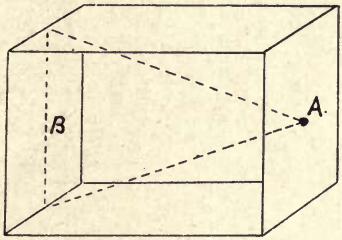

Fig. 1.

a proper channel. The embodiment of these requirements is the camera.

The prototype of all cameras is the Pin-hole Camera, Fig. 1. This shows it in its simplest possible form, consisting merely of a box having at its front end a small hole, A, made by a pin-prick, through which passes the image in the direction indicated by the dotted lines

to be received at the opposite end, B, where, if a sensitive plate—suitably screened—is made to take the place of the back portion, the image will be impressed.

This type of camera is not often met with, so the first advance, in which the pin-hole is replaced by a lens, will be considered. This is typified in the Hand camera, Fig. 10.

Cameras are divided into two classes, namely, the

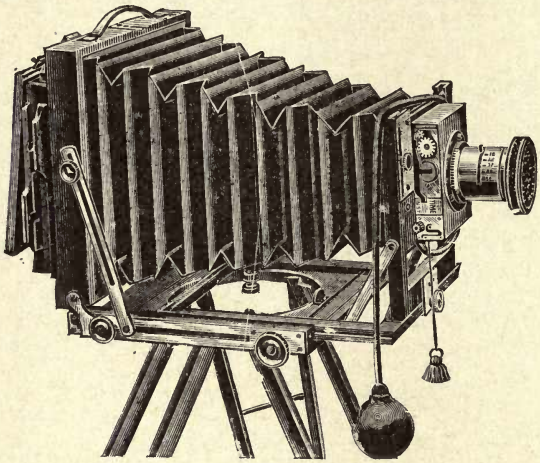

Fig. 2.

" Stand " and the " Hand." The latter is again divided into three sub-classes, the " Magazine " the " Reflex " and the " Folder."

The Stand Camera,

as its name implies, is for use upon a stand or tripod, and is really the most satisfactory form to use for most purposes in photographic practice. Fig. 2 gives a general view of the stand camera most

frequently met with. Fig. 3 is an outline sketch, by means of which it will be possible to more readily describe the various parts.

The camera consists of a lens A, a focussing screen of ground glass, situated at the back of B (and shown in Fig. 5, C), with the intervening space enclosed by bellows, C, which are made of leather or some such material, pleated to allow for closing up into a small space, when the camera is not required for use, also to

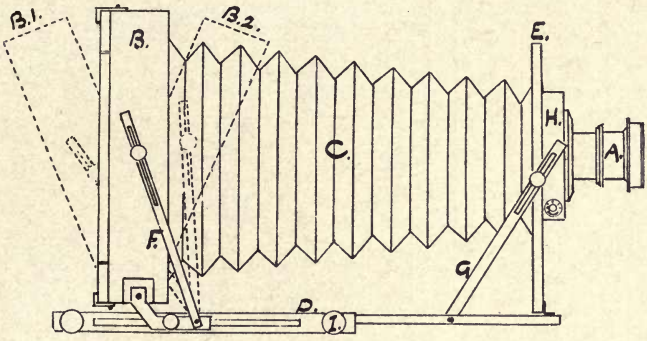

Fig. 3.

conveniently open and close during the racking out in the operation of focussing.

There is a large variety of cameras to be met with, more or less elaborately fitted. These fittings tend to bewilder the beginner, but there need be no fear if only the simplicity of the elementary form of camera, as the pin-hole camera previously described, is borne in mind.

The Body.

The wooden framework with the elements of the camera—lens, focussing screen and bellows—is called the "Body." It is made up of the baseboard, D, at one end of which rises the

frame of the back, B, carrying the focussing screen, and at the other the front, E, carrying the lens, A, and the shutter, H.

The Extensions. The baseboard, Fig. 4, A, has one or more movable portions, B, working upon it. These constitute what are known as "Double or Triple Extensions," and are worked by the rack and pinions, C C, to lengthen or shorten the bellows, which are securely attached to the

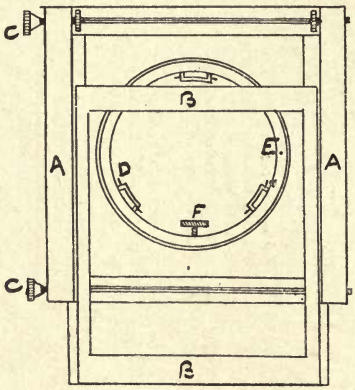

Fig. 4.

front and back of the camera in such a manner that all light is completely shut out. The turn-table fitting, E, to which the tripod legs are attached, is also connected within the baseboard.

The Back. The back, Fig. 5, is the framework in which the focussing screen is fixed. There are two portions. The first, A, is attached to the woodwork, rising from the baseboard, and is held in position by means of the small catches, D D and

E E (shown also in side-view, in Fig. 3, B). It is by altering the position of this frame that the focussing screen is arranged for upright or horizontal pictures; this is done by moving round the top catches, D D, lifting out the frame and turning it round. The second frame, B, carrying the ground-glass screen C, is connected with A by double hinges; these permit it to be swung back (as shown in Fig. 35) to allow the dark slide or

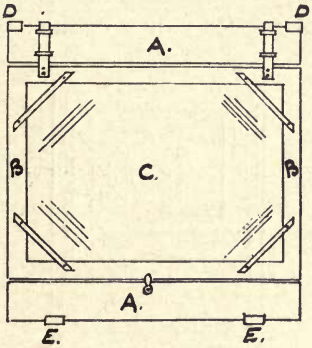

Fig. 5.

plate-holder to be fitted into position before the exposure is made.

The Swing-Back. It is at all times a matter for careful consideration that all lines in the picture shall be rendered perpendicular; to ensure this the back must always be upright. If the situation require that the camera be tilted either up or down, the back must be brought to the upright by loosening the binding screw of the slotted slide struts, Fig. 3, F. This produces what is called a

" Double Swing-Back," and is illustrated in Fig. 3, B1 and B2. In some cameras, the swing-back is arranged for by slotted brass plates and milled nuts and screws attached to the stationary and movable part of the back in place of the struts.

The Front. The Front, Fig. 6, is connected by hinges with the extending portion of the baseboard, and is composed of a wooden stage, A, into which slides a square flat piece of wood, B, to the back of which the bellows are fastened. The piece, B, is pierced with a circular hole, in front of

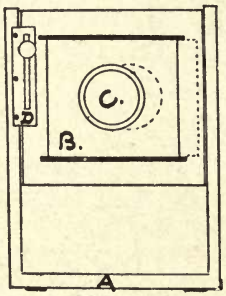

Fig. 6.

which the shutter is attached, and to the shutter-case the flange, C, of the lens-mount is screwed.

Rise and Fall Front. The stage, A, is so arranged that B is held firmly in position by the binding screw on the slotted brass plate, D. If the screw is loosened, B can be raised or lowered through the length of the slot forming what is called a " Rise and Fall " Front.

A lateral or cross movement is obtained if B has a movable piece working in grooves on its front. The

lens and shutter will then be attached to the extra piece.

The Plate-Holder or Dark Slide.

This is the piece of apparatus in which the plates are carried to protect them from the light, when brought from the dark-room to be used in the camera.

There are several forms of plate-holders. The "Book-form" holder is, however, the one in most common use. In this, as the two halves of

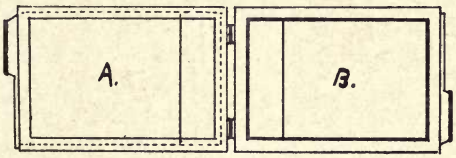

Fig. 7.

which it is made up are hinged together, they will open and lie flat like a book, hence the name. Fig. 7 gives a full view of the open holder and Fig. 8 a side sectional view. There is accommodation for two plates, which are separated by blackened card or tin to prevent the light passing through one to the other. The half, B,

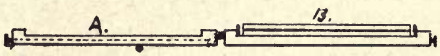

Fig. 8.

has a well—indicated by the heavy lines—into which the plates and partition fit. The half, A, then closes down closely upon them. Each half has a sliding portion—shown by the dotted lines round A—to draw out when the holder is in position in the camera.

The other plate-holders do not open as the above. In these the sliding portion draws quite out; the plate

is then put in through the open side and held in position by springs. The opening through which the slide is drawn is furnished with a spring "cut-off" to close up after the removal of the slide and to prevent the light from entering.

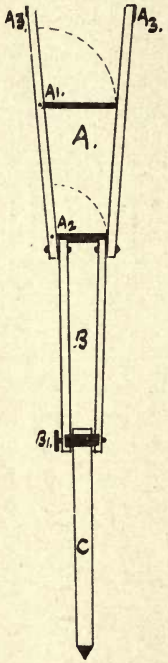

Fig. 9.

The Tripod or Stand.

The Tripod or Stand is the support for the camera. Each leg, Fig. 9, has two or more joints for conveniently folding up in a compact manner, when not in use. The bottom joint, C, slides out from the middle one, B, and is

clamped by the T-screw, B1 ; this is a convenient arrangement, as C may be pulled out to any distance for varying the height of the camera. The top joint, A, swings out from the sides of B, and is held in an upright position by the metal cross-piece, A2 ; this pulls out from the side, and fits into two grooves at the top of B. The cross-piece, A1, also coming from an inlet, is to keep the top joint open.

Each leg is attached to the baseboard of the camera at the points, A3, by pulling the parts of A closer together at the top and springing them upon the pins, D D, Fig. 4, in the case of the turn-table head—the one most frequently met with—or to the ordinary head of the tripod. When the tripod has an ordinary head, it is fastened to the baseboard by means of a thumb-screw.

It is very necessary that the tripod when set up for use is quite rigid, as any shakiness will cause trouble and disappointment.

The Hand Camera.

The hand camera, as suggested by its name, is one for easy manipulation when held in the hand, but it requires some amount of practice to keep it quite steady beyond a fraction of a second ; the pulsation of the body, breathing, and nervous excitement will cause the camera to jerk, and blurred pictures will result. The manner in which a person stands affects the rigidity of the body ; when the feet are close together as if toeing a line, the body in not nearly so firm as when the left foot is slightly advanced and separated from the right, the latter being turned at a slight angle to bring the heel of the left towards the middle of the right. This latter method of standing should be acquired when working with a hand

camera, and the camera must be held firmly against the body in such a position that it is possible to easily look into the view-finder. When the subject in hand requires an exposure of greater length than a fraction of a second, the camera must be placed on some sort of support.

The Magazine Hand Camera,

illustrated in Fig. 10, shows the general outside appearance, while Fig. 11 gives a sectional illustration of the interior.

Fig. 10.

The interior is divided into two compartments, separated by a wooden partition, provided with a circular hole before which the lens is fixed. In the smaller or lens chamber are accommodated the lens and its accessories—diaphragm, shutter and focussing fittings. The diaphragm is worked from the outside of the camera by the arm, A; the shutter by the trigger, B, and in this case the focussing arrangement of magnifiers by the arm, C. O is the lens and F the view-finder. Fig. 12

is a front elevation of the camera with the above letters repeated to facilitate connecting the one with the other. A is the diaphragm number plate ; B the shutter-release ;

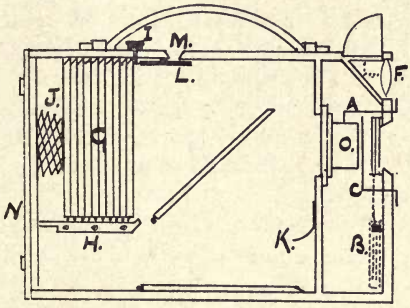

Fig. 11.

C the magnifier numbers plate ; the lens opening is covered with a cap or other protector for shielding the working parts from dust or injury while the camera is

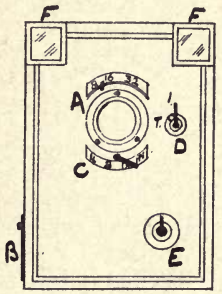

Fig. 12.

being carried ; F F the vertical and horizontal view-finders ; D is the milled screw for altering the shutter from instantaneous to time (by turning the arm I,

Fig. 28), and E, the shutter speed indicator. The larger chamber is for the accommodation of the plates and the mechanism for changing them. Each plate is carried in a metal sheath, of which there are generally twelve, Fig. 11, G. These sheaths rest upon the stage, H, and against the plate changer, I. When I is pushed, it frees the plate-sheath, and this being free is carried forward by pressure from the spring, J, and falls into the well of the camera. The spring, K, prevents the sheath getting back into the way of the unexposed plates. Each time a plate is changed, the lower part of I rotates the small metal disc, L, upon which figures are engraved to record the number of the plate exposed. This number is seen

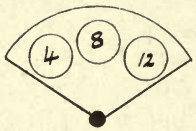

Fig. 13.

below the opening, M. The sheaths are put into and taken from the camera through the door, N.

Focussing Appliances.

Many of the cheaper hand cameras have what is called a "Fixed" focus, and can only be used upon objects situated at a distance of ten feet and further away. The better ones have supplementary lenses called "Magnifiers," Fig. 13. These work in conjunction with the lens of the camera and make it possible to have the object sharply in focus at 12, 8 and 4 feet. They are mounted in such a manner that they are readily brought into position by moving the arm, C, Fig. 12. Other cameras have a bellows arrangement, Fig. 14, by which

the distance between the lens and the plate is varied by means of the milled screw, A ; the distance numbers will appear beneath the opening, B.

View-Finders.

The arrangement of the subject is done in the view-finders, the fronts of which are seen in Fig. 12, F F. The image of the object passes through the lens to a mirror placed at an angle at the back by which it is reflected upwards and can be distinctly seen. The dotted lines in Fig. 11 F, indicate the direction.

It is always advisable to practically test these finders, to ascertain if the subject-matter they depict coincides

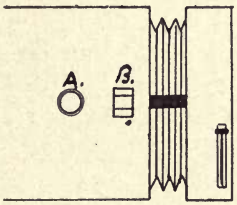

Fig. 14.

with that on the negative. It will be frequently found that the negative will show more than the finder gives. Such a test will be found quite a simple operation. The camera is placed upon a support with the lens pointing towards a wall, upon which two chalk lines have been drawn. The camera should be so arranged that these two lines will be at the sides or top and bottom of the finder ; an exposure is then made and the plate developed and fixed ; the difference, if any, will then be quickly noticed, and should be allowed for when working the camera upon any other object.

The finder just described is looked into from above,

but there are other finders for use when the camera is held at the level of the eye ; they consist of a mounted lens, and are looked at through a viewing-piece. It is not actually necessary to use a mechanical finder at all ; it can be accomplished by drawing two lines from the corners of the front of the camera to meet at a point at the middle of the back edge. The eye is placed at the point of the back and looks down the cone, the view will lie between the two points at the front.

Successful focussing depends largely upon the power of an individual to estimate the distance between the camera and object to be photographed. This can only be acquired by continual practice. One good plan is to make guesses at the distances of different objects, and then measure to ascertain how far the guesses prove correct ; a few experiments of this description will soon give the worker a practical grip on the matter.

The Reflex Camera.

Amongst high-class cameras the variety known as the " Reflex " is at the present time increasing in popularity, but is a somewhat expensive instrument.

Its leading feature is an enlarged reflected image of objects in front of the lens ; the image being received upon a mirror set at an angle to the lens is reflected upwards to a ground-glass focussing screen, which is at the base of a sleeve-like focussing hood. In this way focussing is done right up to the time of the exposure, so doing away with distance judging.

As the lens is constantly open—therefore light is admitted until the moment of the actual exposure—provision must be made to protect the sensitive plate or film ; this is done by using a focal-plane-shutter,

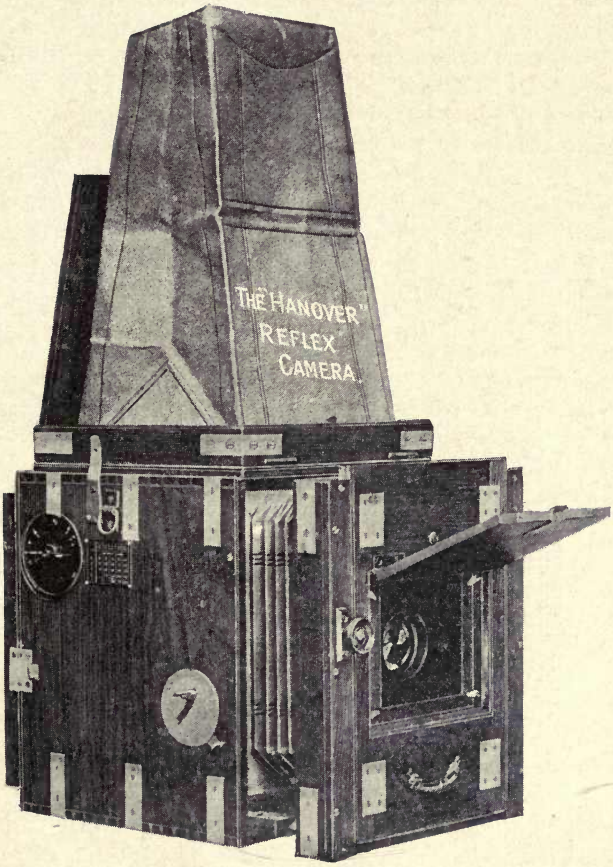

Fig. 15.

which is of the roller-blind type, excepting that it is fixed up in the camera immediately in front of the plate, and in the case of the Reflex is made up of two parts, one acting as a cut-off, while the shutter

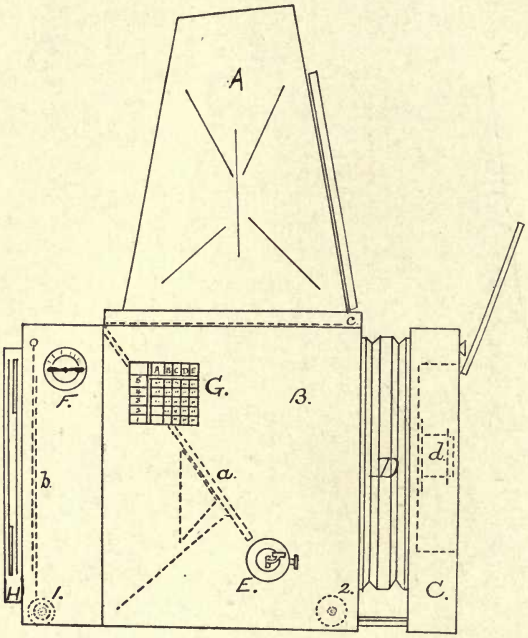

Fig. 16.

is set; while in "time" exposures one section only works.

The shutter-release may be so fixed that the mirror closes up the focussing trap and also holds the shutter open; when so arranged the camera may be used as an

ordinary focussing camera on a stand and exposing by the cap, as there is a second focussing screen at the back.

In other respects and in the method of manipulation the Reflex is very similar to the ordinary Magazine Hand Camera. The usual form closely resembles the latter class of camera, but makers are producing a folding type for convenience in carrying.

Fig. 15 represents the general external appearance of the Reflex; while Fig. 16 explains the position of its component parts. A is the focussing hood; B the body; C is the lens chamber; D the connecting bellows to shut out all light during the extension in focussing. On the right side of the body is the trigger-release, E, to shutter; the shutter-speeds regulator, F; and the speeds adjuster, G. The dark-slide, H, is shown in position at the back, while on the left of the camera is the shutter-openings regulator 1, and the rotating screw for extension 2; these are shown in dots, as they are on the opposite side of the camera to that shown by the side-elevation of the illustration. Again, the internal parts are shown in dots, *a* being the reflecting-mirror with its support and spring to hold it in position at the time of focussing. *b* indicates the position of the shutter, while *c* gives that of the ground-glass focussing screen at the top of the camera.

To use the Reflex camera. The hood, A, which is collapsible and lies secured by its covering door, is opened out and made rigid by the stays. The door of the lens chamber is opened and the cap removed from the lens. On looking down the hood the image of objects in front of the lens will be seen in the focussing screen, C.

The image may be more or less indistinct, but is sharpened up by turning the screw 2.

The varying speeds of the shutter are obtained by increasing or decreasing tension of its spring, and by altering the width of the openings of the blind. To effect this the speed adjuster, G, is consulted; on this will be found some letters and figures, and the indicators on the dials, F and I, are set in accordance with these combinations. In the place of the focussing screen at the back of the camera is put the plate-holder, and the shutter of this drawn.

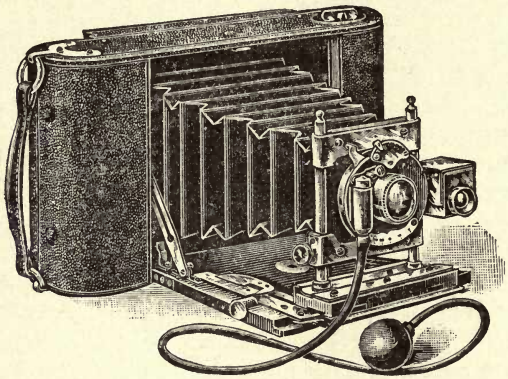

Fig. 17.

All is now ready for making the exposure; this is done by pressing the trigger on E, which causes the mirror to close up the trap-opening at the base of the hood and at the same time releasing the shutter, and the exposure is made.

The Folding Hand Camera.

Fig. 17 illustrates the external appearance of the folding camera. This class of camera is more especially

arranged for use with films rolled upon spools. Most makes, however, are so made that adapters for glass plates can be readily attached. These adapters are provided with ground-glass focussing screens, and the plates are carried in holders or dark-slides in exactly the same manner as for the stand camera, which in its general characteristics the folder resembles, being provided with bellows between the front and back, but it lacks many of the mechanical movements of the other. It is most frequently used entirely as a hand camera for

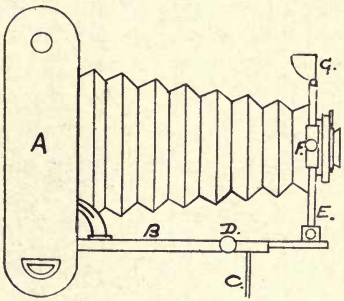

Fig. 18.

films. Its portability when closed and its light weight when loaded make it a most convenient companion for the photographic tourist. Fig. 18 is a sectional view of the folding camera. A is the chamber into which the bellows, the front and its fittings close. The baseboard, B, acts as the door and shuts all in. The leg, C, is provided to support the front in a level position, if the camera is standing open upon a table or any similar support when making a long exposure. The baseboard has an extending portion worked by the milled screw, D. This extension has metal guides, along which the stage

of the front, E, is drawn until it reaches a stop-catch. The front can be raised or lowered by loosening the milled screw, F. The view-finder, G, is carried at the top of the stage upright and, being provided with a universal screw, it may be arranged for either upright or horizontal pictures.

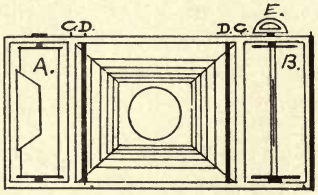

Fig. 19.

The interior of the chamber, A, has two compartments, one for the accommodation of the bellows, etc., the other is closed and is for the protection of the films. Fig. 19 gives a view of the open back ; A, is a loaded spool of unexposed films, and B is an empty spool to receive the exposed films. More will be found relating to this under " Loading the Camera."

Focussing.

This is done by racking out the bellows. A little bone or metal plate, engraved with distance numbers (one set for films and one for plates), will be found attached to the base-board, and to the movable portion a small pointer is fixed.

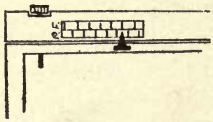

Fig. 20.

Fig. 20 will explain the arrangement. The adjustment is made to suit the distance of the object to be portrayed.

CHAPTER II.

THE LENS.

LENSES—DIAPHRAGM—SHUTTERS.

FIG. 21 gives the general appearance of the lens-mount. The centre portion is called the "Tube" and the end upon which the cap or shutter fits, the "Hood."

The lens proper, Fig. 22, is the glass through which the image of any object in front of it passes to be received upon the focussing screen. The lens is fitted up inside

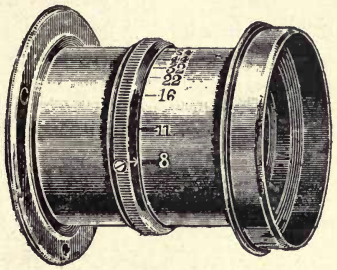

Fig. 21.

the mount; it may consist of one or more pieces cemented together, giving to it the appearance of a solid piece. The image, after passing through the lens, is inverted. This is owing to refraction; this means that when the image reaches the outer surface of the lens it is twisted, and after passing through the substance of the glass it is again twisted and has imparted to it an upward or downward direction.

There are two classes of lenses, namely, the " Single " and the " Double." The latter is the better one for architectural work, in order that all lines may be rendered true—see " Position of Diaphragm." They are again divided into two sub-classes : 1st, the " Round-field," and 2nd, the " Flat-field " lens. The flat-field lens is composed of glasses of different refractive powers, which

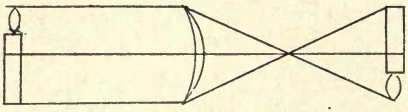

Fig. 22.

compensate each other and give to the lens the power of being worked at a full aperture ; that is, as wide open as possible with good definition all over the plate. Therefore it is a lens well adapted for use on a hand camera for instantaneous work. It is known under various names, as " Stigmatic," " Anastigmatic," etc. The possession of a good lens of this type places the hand-

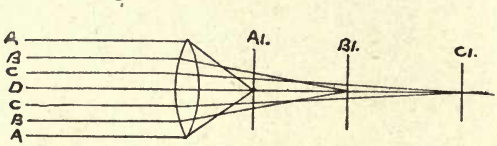

Fig. 23.

camera worker in the best possible position for securing the finest results from snap-shot exposures.

The round-field lens gives an image which is sharply defined in some parts, but more or less blurred in others. This effect is owing to the lens having different refractive powers at different points of its surface. Fig. 23 shows this : the rays, A A, passing through the lens are brought

to a focus on the principal axis at the point, A1 ; the rays, B B, come to a focus at B1, whilst the rays, C C, which approach the principal axis of the lens and become nearly parallel to it, are in focus at the point C1 much farther away.

The Diaphragm.

This uneven definition is overcome by using a diaphragm or stop, to cut off the marginal rays, A A, giving a much clearer image and greater depth of focus ; this, however, necessitates a much longer exposure. There

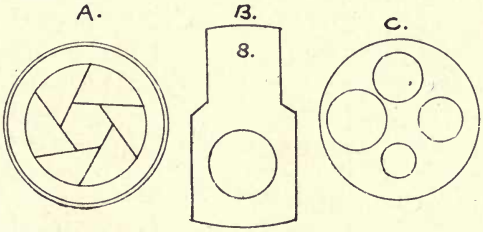

Fig. 24.

are three kinds of diaphragms, Fig. 24, the " Iris," A, the " Waterhouse," B, and the " Rotating, or Wheel," C.

The " IRIS " is the most frequently met with. It is made up of small metal plates passing one over the other, by which the opening or aperture is made larger or smaller. It is worked from the outside of the lens-mount by a milled-ring or a knob. Its position in Fig. 21 is shown by the milled band passing round the middle of the mount.

The " WATERHOUSE " Stops are small metal plates pierced with holes of varying size, showing a given

relation to the focal length of the lens, which will be further described under "Apertures." Each stop is a separate piece, and is placed in position through a slit in the lens-mount at about the same position as the Iris diaphragm occupies.

The "ROTATING" diaphragm is not often met with, except on cheap cameras. It is a circular metal disc pierced with circular holes of varying size, as shown in the illustration. It is screwed to the camera or in the lens-mount in such a manner that it will easily turn upon the screw, bringing the openings exactly in front of the lens as it is rotated.

Apertures.

The fullest working aperture or opening varies in different lenses according to their construction. High-class, flat-field lenses frequently used on the best hand cameras have a working aperture of what is termed f/5·5 or f/6, but the greatest number of lenses have their fullest working aperture at f/8.

The meaning of the term f/8 is, that it shows the opening of the diaphragm to be equivalent to one-eighth part of the focal length of the lens; thus, supposing the opening to be one inch across, it might be understood to show that for all practical purposes the focal length of the lens is eight inches.

The diaphragm sizes generally met with are f/8, f/11, f/16, f/22, f/32, f/64. These figures are generally stamped upon the milled ring working the Iris, and on each stop of the Waterhouse.

The smaller the stop the longer will be the exposure necessary for the plate. This differs inversely to the square of the size of the stop or opening; thus, supposing f/8 required an exposure of one second, the stop, f/16,

although only half the size, would require four seconds, but it will be found in practice that exposures at these large apertures are expressed in fractions of a second, and it is only when stopped down to f/32 or f/64 that the exposures will be counted in seconds ; more, however, will be found under " The Exposure " on this subject.

The position of the diaphragm in relation to the lens in the single type has an effect upon straight lines in the subject when near the camera. When it is in front, as is usually the case, it gives to the lines a bulging shape, something like a barrel ; if behind the lens, the lines would curve inwards. In the double lenses the diaphragm is between the front and back combinations, and therefore has a compensating action, so that the lines are rendered straight ; hence the term " Rectilinear," by which name double lenses are sometimes known.

Focal Length.

The focal length of a lens may be roughly ascertained by pointing the camera at an object about 100 yards away, then carefully focussing. When the image becomes perfectly sharp upon the centre of the screen, the distance between the lens and the focussing screen in the single lens or the diaphragm and the screen in the double, will represent approximately the focal length of the lens.

Angle of the Lens.

The focal length of a lens gives to that lens a given " Covering power " or " Field of view," that is, it will embrace a certain amount of the subject before it ; this is called the " Angle of the Lens."

Lenses are spoken of as " Narrow," " Medium," and

"Wide" angle. Fig. 25 graphically illustrates the working of these different angles of the lens on the same camera and upon the same object. The lines 1 and 2 might be taken to represent the boundaries of a road; 2 might be regarded as a blank wall, beyond which it is impossible to get to photograph the house on the opposite side; 3 is the point selected to place the camera to take the front of the house. The portions lying between A A might be considered as indicating the field of view of a narrow-angle lens; by replacing this with a medium-

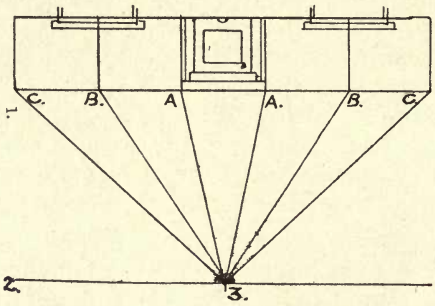

Fig. 25.

angle one, without moving the camera, it would be the matter included between B B, and by substituting a wide-angle lens, the whole between C C would be embraced.

Some double lenses are arranged to give three distinct lenses of different focal lengths. The lens in its entirety is of one focal length, the back lens after the removal of the front another, and the front without the back a third. It must always be borne in mind, however, that the diaphragm openings do not bear the same relation to each lens when separated, and the exposure must be

made accordingly. Any double lens may be divided and used as a single ; it will be found that in a great many instances the single combination is practically twice the focal length of the double. The focal lengths should be found and the relative values of the largest apertures ascertained after the manner described under " Focal Length." The focal length of a medium-angle lens—which is the one most serviceable for general purposes—should be equal to the diagonal measurement of the focussing screen.

The polished surfaces of lenses are very sensitive to any rough treatment, and the greatest care should always be exercised when handling them. To clean a lens, any superfluous dust should be removed by a camel-hair brush, and then a piece of soft chamois leather used to polish with. When not in use, lenses are best protected by enclosing in a proper lens case or a soft chamois-leather bag.

Shutters.

To shut out all active light from the interior of the camera—previous to making the exposure—the lens is provided either with a leather cap or a shutter. There are several forms of shutters. Those in common use are the " Roller-blind," the " Iris," and the " See-Saw."

The " ROLLER-BLIND " shutter, Fig. 26, is a shallow wooden box having circular holes front and back. Inside are two rollers—which are connected with the working parts of the outside—the bottom one is furnished with a spring ; a piece of black opaque material —having an opening at its centre—is attached to the rollers. The shutter is set by pulling the tassel, A ; this draws the blind up on the top roller, where it is held in

position by the arm, B, acting on the projections on the cogs, C. The word " Set " is shown on the blind, and a click sound will indicate when it is set ; it is liberated by pressing the bulb, D, which inflates the teat, E, causing the arm, B, to lift ; the bottom spring acts immediately and pulls the blind down. The exposure is made as the

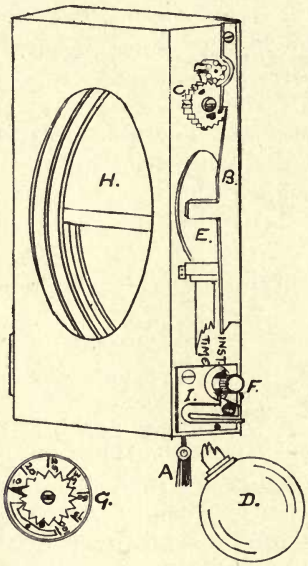

Fig. 26.

opening in the blind passes the lens. The shutter must always be set before the slide of the plate-holder is drawn. The speed of the shutter is altered by means of the thumb-screw, F. This screw tightens the spring of the roller, the spindle of which passes through the shutter-box to the opposite side, where it is connected with a

small dial, G, upon which the speeds are shown. An indicator passes round this dial and shows at what rate the blind, H, works. The speeds vary from 1/12th to 1/90th of a second. To reduce the speed from 1/90th to 1/12th after the spring has been wound up, the spring I is pressed to liberate F, the spring of the roller then runs down. For time exposures, the brass arm, B, is pushed over from " Inst." to " Time," then after the shutter is set, on pressing the bulb, the blind flies down until it is stopped by the large projection on C ; the lens is uncovered and will remain so until the pressure is taken off the bulb, when it will close.

For very long exposures the blind is merely drawn up until the lens is open and a click sound is heard ; it will remain in this position until it is closed by pressing the bulb.

Some makes of this shutter have a speed indicator let into the india-rubber tube near the bulb, and when so arranged exposures up to several seconds can be given ; the shutter will then close automatically. This action depends upon the escape of air through a small hole in the indicator.

The shutter may be screwed to the front of the camera and carry the lens flange, as shown in Fig. 3 at H ; or it may be arranged to push on the hood of the lens-mount.

The " IRIS " Shutter, Fig. 27. The Iris shutter is a between-lens shutter, being fitted up near the diaphragm. It is made up of metal plates which work one upon the other. There are two kinds of this shutter, one requires to be set before the exposure, the other is " Ever-set." The first is set by pulling round a small knob, usually found at the top of the dial, A ; this dial also sometimes carries the speed numbers of the shutter. In the illus-

tration, these speeds will be seen on the plate near the bottom. The variations are made by moving the top indicator along. The bottom indicator governs the diaphragm apertures. The shutter is worked either by the trigger, B, or by an india-rubber tube and bulb fitted to the bottom of the cylinder, C. When the bulb is pressed, it lifts the inner cylinder, D, and the shutter plates are freed. The same result is obtained by pressing the trigger, B.

The speeds vary from 1/100th of a second to two or

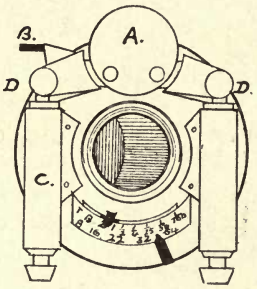

Fig. 27.

more seconds. When the indicator is over T, the shutter is opened by pressing the bulb, and remains so until further pressure is given. When over B on the plate, the shutter is opened by squeezing the bulb, and remains open as long as the pressure is maintained, but closes immediately it is relaxed.

The " SEE-SAW " Shutter, Fig. 28. The shutter here illustrated is the type usually met with on magazine hand cameras. The mechanism of the shutter in many instances is much more complicated than the illustration

shows. The sketch was made from a shutter on a small hand camera and selected on account of its simplicity ; it embraces all the essentials of a good shutter. It consists of three metal plates, A, B and C. The plate, A, is screwed to the camera, and has its edges turned to form grooves to receive B and C. The second plate, B, is pierced with a square hole ; the third plate, C, is between A and B, and is indicated by the cross lines in front of and under the opening of B, and extends as far as the dotted lines only. It is called a " Cut-off," as it

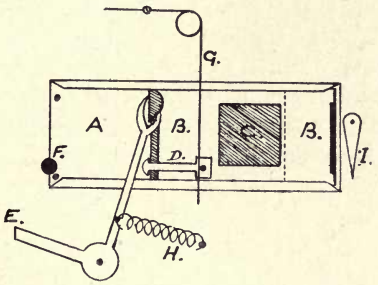

Fig. 28.

keeps the opening in B closed, while it passes in front of the lens. The little spring catch, D, holds B and C together. For instantaneous exposures the shutter is worked by pressing down the lever, E, the fork at the other end pulls B and C along, until they reach the projection F ; this lifts the spring, D, and frees B, which is forced along by the spring, G ; as its opening passes the lens the exposure is made. When the pressure is taken off the lever, E, the spring, H, draws C back to its proper position.

To set the shutter for time exposures, the arm, I, is

turned by means of a little button on the outside of the camera (shown in Fig. 12, D); this pushes B and C along A. When the lever, E, is pressed, B is liberated by F and slides along until it reaches I; here it is checked, the lens uncovered, and remains so until the pressure is taken off E. C then closes the lens. Very long exposures are made by opening the lens and pushing E into a notch at the side near the bottom of the slot in which it works. The lens is closed when the necessary exposure has been given.

The shutter as illustrated has only one speed for instantaneous exposures, and that speed depends upon the strength of the spring G. Most shutters of this class, however, have a different kind of spring, which is regulated by the button, E, Fig. 12, to vary the speeds at which the shutter will pass the lens. These speeds may vary from 1/10th to 1/100th of a second.

CHAPTER III.

THE SENSITIVE MATERIAL.

PLATES—FILMS—PAPERS.

It was mentioned in the opening chapter that the whole scheme of photography depends upon the effect of light on chemicals sensitive to its action.

This action varies according to the colour of the light. White light is composed of several colours blended together, violet, indigo, blue, green, yellow, orange and red, as shown by the rainbow, where the white light of the sun is broken up by the rain-drops into its component parts in precisely the same way as white light is decomposed by a prism. A prism is a piece of glass several inches long, having three equal sides, arranged triangularly. The strongest action on sensitive materials is shown by white and blue light, and gradually falls away through the others until red is reached, which has very little action and is therefore the most suitable for use in the room in which the photographic work is done, such as the handling of plates, films, etc. This room is commonly known as the "Dark-room," and will be fully described shortly.

Prominent among the substances sensitive to light are the Haloid Salts of Silver, as Silver Bromide and Chloride. These two salts give rise to two groups of varying sensitiveness, which might be called, first, the "Dark-room Group," embracing plates, films and bromide papers, as they can be opened and handled with safety in a specially lighted room only; and second, the "Daylight Group," which may be opened in weak daylight, and represented

by the printing-out papers as Gelatino-Chloride, Collodio-Chloride, Albumen papers and the Self-toning papers. Platinum paper, in which the sensitiveness depends upon the light's action on salts of Iron and Platinum. Carbon paper, in which the effect is upon Bichromated Gelatine.

The Dark-room Group.

The bromide of silver is thoroughly mixed with a thick solution of gelatine to form what is technically known as the "Emulsion"; this is evenly spread upon glass to make plates and upon celluloid for films.

PLATES are made in several degrees of sensitiveness, the most common being the "Slow, or Ordinary," "Medium," and "Special Rapid."

Relatively speaking, the medium speed plate is twice as fast as the ordinary, and the special rapid twice as fast as the medium, or four times quicker than the ordinary; to put it figuratively, if the special rapid plate required one second exposure on a given subject, the medium speed would require two seconds and the ordinary four seconds. The exposure required by a special rapid is rarely more than the fraction of a second.

The leading sizes of British plates are: $3\frac{1}{2}'' \times 2\frac{1}{2}''$ $4\frac{1}{4}'' \times 3\frac{1}{4}''$ ($\frac{1}{4}$-plate), $5\frac{1}{2}'' \times 3\frac{1}{2}''$ (post card), $6\frac{1}{2}'' \times 4\frac{3}{4}''$ ($\frac{1}{2}$-plate), $8\frac{1}{2}'' \times 6\frac{1}{2}''$ (whole-plate), $10'' \times 8''$, $12'' \times 10''$, $15'' \times 12''$.

FILMS are generally of one speed only, and that corresponds with that of the special rapid plates. They are usually sold in lengths sufficient for six or twelve exposures, rolled upon spools. A strip of black light-tight paper—just a little wider and a good piece longer than the film—is first fixed to the spool, a portion of this paper is first wound on, the celluloid film is then

attached to it and both wound on together. The paper is sufficiently long to wind several times round after the film has ended. The whole is made secure by an adhesive label. This arrangement enables the spool to be placed in position in the camera and set for starting—as will be more fully explained under " Loading the Camera "—in weak daylight.

The exposure sizes of films are $3\frac{1}{4}'' \times 2\frac{1}{4}''$, $3\frac{1}{2}'' \times 3\frac{1}{2}''$, $4\frac{1}{4}'' \times 3\frac{1}{4}''$, $5'' \times 4''$, $7'' \times 5''$. Films are also sold in various cut sizes.

BROMIDE PAPERS. The emulsion is spread upon paper. These papers are used for obtaining prints from negatives by exposure to artificial light. The image, as in the case of the exposed plate or film, is latent—that is, it cannot be seen after exposure until after the paper has been passed through a developing solution.

There are two speeds of Bromide paper, " Rapid " and " Slow." The paper commonly known as " Gaslight Paper " is really a slow bromide paper, relying on a long exposure and quick development ; hence, it is possible to handle it in very weak artificial light instead of in the dark-room. The surface of the paper is prepared either to give a glossy surface or a dead or matt surface.

Bromide paper is sold in cut sizes similar to those of plates. Post cards are also coated with the emulsion.

The Daylight Group.

The GELATINO-CHLORIDE Printing-out Paper (shortly called P.O.P.). The emulsion in this case is prepared by mixing silver citrochloride with solution of gelatine. The sensitiveness of P.O.P. is not nearly so great as that of bromide papers, and requires exposing to daylight for some time to properly

print out. This variety of P.O.P. is in most frequent use and is sold in various cut sizes. ALBUMENIZED printing-out paper and COLLODIO-CHLORIDE P.O.P. are not in so general use—in the first of these the silver chloride is diffused through albumen (white of egg), and in the second the emulsion is prepared with collodion. CARBON paper is prepared by allowing a gelatine-coated paper to float upon a solution of potassium bichromate. The gelatine absorbs the salt and becomes sensitive to light when dry. PLATINUM paper. The paper is first sized with starch (arrowroot), and is sensitized with solutions of iron and platinum. Further remarks upon sensitive papers will be found under the heading " Printing."

CHAPTER IV.

PHOTOGRAPHIC CHEMICALS.

DESCRIPTIVE NOTES.

THE chemicals required by the amateur for use in ordinary photographic practice are not numerous. The following descriptive notes will be found useful for reference. The solutions into which they enter will be described in the various sections under which they fall.

ACID, ACETIC, GLACIAL.

A colourless liquid with a strong vinegary odour. At low temperatures it becomes solid, hence its name, "Glacial," or ice-like. It has a burning action on the skin. Used in the preparation of ferricyanide and uranium intensifying solution.

ACID, HYDROCHLORIC.

The pure variety of this acid should always be used. It is colourless, has a strong burning action on the skin and clothes. It is used in a diluted form in the platinum-printing process as a clearing solution.

ACID, PYROGALLIC.

A very important chemical in photographic work. The word "Pyro" is frequently used in short. It is met with in two forms, either as a very light feathery crystal or in heavier crystalline form, in which it occupies much less space. In both varieties it is white, but after being kept for some time it darkens, especially if much exposed to the air. It constitutes the reducing element in pyro-soda and pyro-ammonia developing solutions.

ALUM.

In large glass-like crystals. Used generally for hardening gelatine of films, plates and papers.

AMMONIA, LIQUID.

A solution of ammonia gas in water and forms a colourless liquid with a very pungent odour. Great care should be taken when opening a bottle, especially if a stoppered one, also not to smell it. It is used sometimes as the accelerator of pyro in developing solution, also in mercury-ammonia intensification.

AMMONIUM SULPHOCYANIDE.

Colourless crystals, which are more or less damp and cling together. They become liquid if exposed to the air for any length of time, being deliquescent. For storing, it is probably best to keep it in a concentrated solution, representing so many grains per ounce. Used in conjunction with chloride of gold for toning P.O.P.

BORAX.

Large white crystals, and used in some toning solutions for P.O.P.

GOLD CHLORIDE.

Bright yellow crystals and usually packed in sealed glass tubes or bulbs, containing 15 grains each. This does not represent 15 grains of pure gold chloride, but a fraction over 7 grains in combination with another chloride to bring about crystallization. The tube is best broken by first wrapping in a piece of clean white paper and then, with a mallet or something similar, giving the packet a sharp tap. The contents are then

emptied into 15 drachms or 7½ ounces of distilled water. These solutions will then represent 1 grain per drachm or per half-ounce respectively, which constitutes a very convenient form for storing. Used in the gold toning baths for P.O.P.

HYDROQUINONE (sometimes called QUINOL).

Another of the important reducers used in developing solutions. It is a fine white crystalline powder. Its solutions are affected by low temperatures, and it will be thrown out if the solution is at all concentrated, therefore during the winter the solutions should be stored in a warm place.

LEAD ACETATE.

White crystals or crystalline powder. It and the Nitrate—which is of similar characteristics—are soluble forms of lead, and are used in combined toning and fixing baths.

MERCURY PERCHLORIDE.

In dense, heavy white crystals. It is intensely poisonous and should be handled with the greatest care. Fortunately, there is some difficulty in purchasing, as its sales are regulated by law, and unless the purchaser is thoroughly well-known to the seller it cannot be obtained. Used in the mercury-ammonia intensification process.

METOL.

Another of the important reducing agents in developers. Is a white powder, but darkens by oxidation when

exposed to the air or when stocked for any length of time. It has a peculiarity in requiring to be dissolved before any other ingredient is added in making up solutions, otherwise it is precipitated and refuses to re-dissolve. Another characteristic is that it will attack the skin of some people, causing a soreness; those who are susceptible to its attacks should keep a vessel of clean water near at hand when using the developer and rinse the fingers in it occasionally.

POTASSIUM BICHROMATE.

Yellow, smooth crystals. It is somewhat corrosive and poisonous. Used chiefly as the sensitizing agent in the carbon-printing process.

POTASSIUM BROMIDE.

White crystals of small size. It is the most frequently used restrainer, and is a frequent ingredient in developing solutions.

POTASSIUM FERRICYANIDE.

(There is a distinction between this and the Ferrocyanide, which is of no photographic utility.) It is in orange-red crystals, which, when old, become coated with powder and lose their brightness; this portion should always be washed off before making into solution. It has various uses. With sodium hyposulphite it forms a reducer—this class of reducer is entirely distinct from the reducers used in connection with the developers. With uranium nitrate, it makes an intensifier. It also forms a bleaching solution in some processes of bromide paper toning. It is a poison.

POTASSIUM OXALATE.

In white crystals, used in platinum paper development.

POTASSIUM PHOSPHATE.

Also in white crystals, used with potassium oxalate.

SODIUM CARBONATE.

Is in white crystals of a more or less irregular size. Care must be taken not to confound the Carbonate with the Bicarbonate, which is the article frequently sold when carbonate is asked for in the ordinary way. The bicarbonate being an acid carbonate has not the same neutralizing power as the normal carbonate, therefore make it perfectly clear when purchasing that it is for photographic purposes. Washing soda is an impure carbonate, the pure should always be used. Sodium carbonate is used as the accelerator in pyro-soda, and also frequently in hydroquinone and metol developing solutions.

SODIUM HYPOSULPHITE.

Commonly called " Hypo." This is one of the most useful chemicals in photographic work, being a solvent of the silver haloids. It is used for the purpose of fixing plates, films and papers. It is in bright colourless crystals of varying size. The variety known as " Pea-crystals " is the one generally sold. It should be stored in a dry place, as it has a tendency to become damp. Its solution is frequently called simply " The Fixer."

SODIUM METABISULPHITE.

White crystals of smaller size than those of sulphite. It is used for the same purposes. Being of an acid nature

it will neutralize a portion of the alkaline carbonate in a developing solution.

SODIUM SULPHIDE.

Damp white crystals, which become liquid if exposed to the air and give off an unpleasant odour. Used in sulphide toning of bromide and gaslight papers and lantern slides.

SODIUM SULPHITE.

In white crystals. Used in developing solutions as a preservative, also to assist in preventing stains on the negative.

URANIUM NITRATE.

Bright yellow crystals, and is deliquescent. It is used in the uranium and ferricyanide intensifying process, and also toning bromide papers and lantern slides.

CHAPTER V.

DARK-ROOM.

ARRANGEMENT—LIGHT—WATER.

THIS is the room in which the handling of the plate, film or bromide paper is done. It is not actually dark, but is suitably lighted with red or orange light according to the sensitiveness of the material being handled. The fitting out of such a room depends upon the means and accommodation at the disposal of the worker, the more convenient the equipment the greater will be the comfort in working, but the beginner need not experience any misgiving as to its being a costly affair in the early stages. Any accommodation for a dark-room really suffices—from a cupboard under a flight of stairs to an elaborately equipped apartment—provided that all photographically active light can be shut out.

The most practical thing for a beginner to do in the early stages of the work is to find some convenient place, as a dark cupboard, as above-mentioned, and put in just those things that are actually required for the treatment of the plate after exposure in the camera. The requisites for a satisfactory beginning may be listed as follows :—

Dark-room Lamp.
Developing Dishes (about three).
Graduated Measure.
Developing Solutions.
Fixing Solution.
Can of Clean Water.
Receptacle for Waste Solutions, etc.

To these may be added a work-bench, with accommodation for the various accessories. Such benches can be bought ready-made, or the home-made piece of apparatus shown in Fig. 29 will be found very useful. It may be made from any good ordinary packing-case

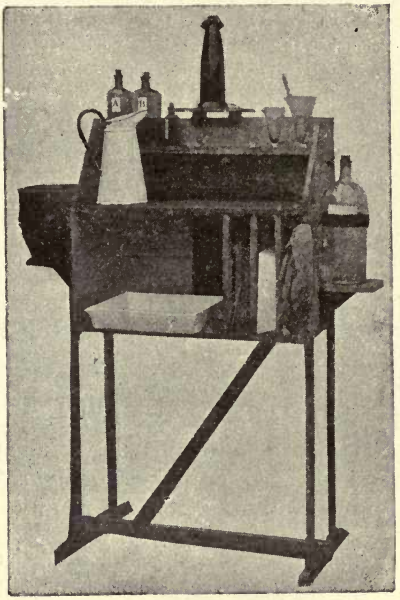

Fig. 29.

about 2 feet long, 1 foot deep and 1 foot wide, supported by four legs made from slate lath $1\frac{1}{2}$ inches by $\frac{3}{4}$ inch, screwed to the box and joined up at the bottom by cross-pieces to give firmness to the whole. The length of the legs should be sufficient to bring the top to a convenient

height for working upon. At each end is fitted a bracket ledge, one for the bottle of fixing solution, the other for the receptacle for waste solutions; the top covered with oilcloth that any spilt liquid may be easily wiped up. A portion of the box lid is screwed to the back of the box, and along this a small shelf fitted for the accommodation of bottles and measures. Above this shelf is arranged a smaller one to hold the lamp. This

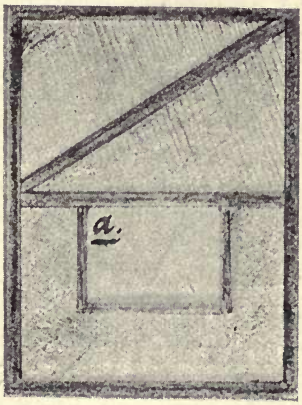

Fig. 30.

back fitting is made firm by means of side pieces of wood screwed to it and to the ends of the box. The interior is divided up into compartments for storing plates, papers, dishes, etc. This work-bench will be found self-contained, portable and capable of much service.

After some work in the above surroundings, the worker will have gained sufficient experience to know what goes to make up a really good and convenient

workroom, if it is possible to have the sole use of a room. If the window of the room has a northerly aspect, so much the better, because the sun will not shine upon it, therefore the light will be constant and safe. If the window is exposed to much direct sunlight, it will possibly be safest to shut it out altogether. The first thing to do—having acquired the room—is to make arrangements for covering up the window to shut out all the active light. This is best done by providing a light movable shutter, as Fig. 30. The shutter is made up of a light wooden framework with cross-pieces to give firmness. This is covered with calico or canvas and brown paper. Means must be provided for holding the shutter in position, or it can be made to swing in and out on hinges. It is advisable to have a strip of felt tacked around the edges of the shutter to form a cushion between it and the window-frame to ensure absolute contact.

Source of Suitable Light.

Daylight. If the room is on the shady side of the house—or its window is not subjected to too much direct sunlight—daylight properly filtered through coloured glass or fabric may be used as the illuminant for the workroom and will be safe for handling plates, as in loading the camera or developing. In Fig. 30, attached to the cross-piece is a small wooden frame, A, suitable for the accommodation of tinted glass—ruby or canary. Into this frame—which should be rebated—is first fixed a piece of ground or opal glass to diffuse the light ; this is held in position by some narrow strips of wood. These strips should

be faced with felt or cloth to form cushions for the coloured glass to rest against. All that is now required is to get one or two pieces each of ruby and orange glass. The size of these glasses should allow them to fit freely into the rebate of the frame for easily changing when desired. Some means must be provided by which they will be kept in position.

This frame for the coloured glasses need not be placed as shown in the illustration. If desired, it may be made to rise from the bottom piece of the window-frame. There is a further reference to this opening under "Enlarging by Daylight," and if there is any intention to make enlargements in the manner there described, it will be advisable to arrange the fitting accordingly.

Another method for constructing the window-screen is, instead of the frame A, for the coloured glasses, a portion of the shutter-frame is covered with brown paper over canvas to make it light-proof and the other portion covered with non-actinic fabrics, as one or two thicknesses of red twill or lining.

Artificial Light.

Where the strength of the daylight is at all uncertain, it will be probably best to shut it completely out and work entirely by the light from a photographic lamp. The illuminant may be either candle, oil or gas. Electricity affords probably the finest source of illumination; it is, however, not available to the vast majority of workers, but where it is, there can be nothing better than three incandescent electric lamps to give orange, red and white light respectively, arranged over the developing sink and connected with a switchboard conveniently placed.

The "CANDLE LAMP" is probably the most popular.

Fig. 31 illustrates what is commonly known as the "Hock bottle" lamp. A good hard wax candle should be used; it should not be too long, as there is a tendency for it to soften as the lamp gets hot; it may then bend towards the glass and cause a fracture.

OIL LAMP. A good paraffin lamp, Fig. 32, is very useful. It should be provided with an outside winder for adjusting the wick—after the lamp has been lighted—without having to lift the glass. Best quality paraffin

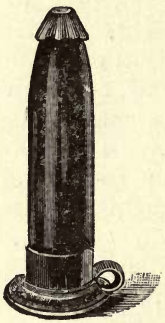

Fig. 31.

should always be used; the wick should be carefully trimmed and any charred portions removed, this will prevent any unpleasant smell. Ruby and orange glasses are generally supplied with the lamp, and it is always advisable to have an eye-shade to screen the eyes when working; this affords great relief.

GAS LAMP. This class of lamp is very much like the oil lamp in appearance, the oil burner being replaced by a gas jet, which is connected by means of flexible tubing with the gasfitting in the room.

The lamp—after being lighted—should remain open for a minute or two to warm, then any moisture from condensation should be wiped off and the lamp closed.

A test for the safeness of the light from a dark-room lamp might be mentioned, as such lamps are sometimes the unlooked-for cause of trouble, as fogged plates, etc. Put a plate—across which is placed a band of black or

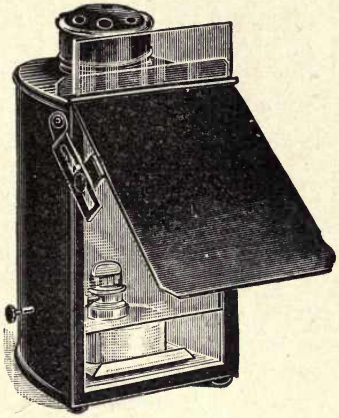

Fig. 32.

brown paper, one inch wide—film downwards into a printing frame and expose to the closed-up lamp for a couple of minutes at a distance of about 12 inches, afterwards develop. Any indication of the place where the paper has been on the plate will show the lamp to be unsafe.

WATER.

Where it is possible to bring the water from the main supply of the house to a tap immediately over the

developing sink, it will be found very convenient. This, however, is not often possible, and the next best thing is to have a covered tank placed in such a position that it may be readily filled and connected by flexible tubing with the developing-sink tap. A supply of water in a can is less convenient, but will be found useful where other means are not available, and there is not a very great deal of work to be done.

Quality of the Water.

Water of ordinary quality will do for general photographic purposes, as washing plates, rinsing out dishes, measures, etc. Sand in water from gravelly beds sometimes causes trouble in washing, as it gets embedded in the gelatine and projects after the film has contracted in drying. To avoid this a small piece of flannel should be tied over the tap and the water allowed to strain through it. When, however, developing and toning solutions have to be made up, as good quality water as possible should always be used, or impurities may cause unlooked-for troubles. Distilled water must always be used for making up gold chloride solution. Soft or rain water—which has been boiled and cooled—will be found satisfactory for the other solutions ; failing a supply of this, ordinary drinking water will suffice. If there be any hardness—which is always indicated by its action with soap, producing a flocculent scum on the surface—it may be partially removed by boiling, to drive off carbonic acid gas ; after the water has stood sufficiently long to become cold, lime will be precipitated, from this the clear water should be carefully poured off. It would be perfectly useless to attempt to soften water for photographic purposes by chemical means.

A run or two of shelving will be found useful in the dark-room for purposes of storage, etc. It must always

be carefully borne in mind that all sensitive materials must be stored low down, or they will become affected by gas or other fumes.

Ventilation. Where much time has to be spent in the dark-room, especially if artificial light—except electric —is being used, some means of ventilation must be arranged. Circumstances will probably suggest the best means of obtaining it. At all times, after work is completed, the window and door should be thrown open to allow a free circulation of fresh air. Any stray light admitted through the crevices of the door must be shut out by means of a curtain draped on the outside.

CHAPTER VI.

FIRST PRINCIPLES IN THE ARTISTIC TREATMENT OF THE PHOTOGRAPH.

PRINCIPALITY—TONE RENDERING—ORTHOCHROMATIC PLATES—COLOUR PHOTOGRAPHY.

THIS chapter should be carefully read, but its full value will possibly be more fully appreciated when some progress in photographic practice has been made. The desire may then arise to produce more thoughtful work than is generally the case in the early stages.

Before proceeding to describe the various operations in Practical Photography, a few hints on the treatment of the subject may be helpful. Rules are for guidance and not necessarily to be slavishly followed. Much depends upon the individual tastes of the worker. Let it always be borne in mind that *Simplicity is the keynote to success.*

The rules are, first :—

PRINCIPALITY.

There should be one special or chief object to claim attention. This is called the "Motif." It does not necessarily follow that it should consist simply of one person or thing only, but if more than one they should be brought together or grouped to form one item of interest, which will command first attention. Take the view in Fig. 33 : the house and church form two distinct items of interest, and the eyes naturally skip from one to the other ; this should not be, therefore the position of the camera or, in other words, the view-point, should

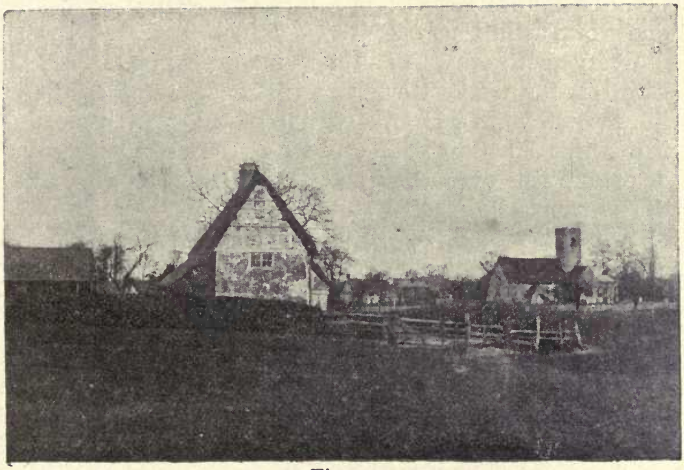

Fig. 33.

Fig. 34.

be altered until the two are brought together to form one group as in Fig. 34.

Every picture has its strong and weak points. The centre is the weakest, whilst the strongest is where the lines would cross each other if the picture were divided into three equal portions, long-ways and cross-ways. Therefore it is on one of these points that the principal object should be placed. In Fig. 34, taken as a whole, the group is too central—if the portions outside the lines are covered up the difference will be at once noticed. A second object may—with benefit—be introduced into the picture for the sake of balance, it must not, however, be too large to compete with the chief ; its place would be at or near the opposite cross-line. The smaller portion of Fig. 34 would be improved in this respect by a rustic cart or something near the gate. The focussing screen of a stand camera may be ruled into the nine divisions as above suggested ; this will materially assist the grouping of the objects. The final treatment may, however, be carried out when trimming the print before mounting it. In portraiture one or three objects may be more easily handled than two. If a group of three is to be made it is best to have one standing, one sitting in a chair on one side of the standing figure, and the third on a stool on the other side. This forms a more or less pyramidal arrangement, with the faces or chief points at different heights, but at the same time not too severely uniform.

Lights and Darks.

There should be one principal light in a picture. There may be others of equal brilliancy, but not of the same size, neither too many, otherwise the picture will appear "spotty" when looked at from a short distance away. The above remarks apply equally to the darks, which

should support the lights, connecting both by means of the half-tints. In landscape the strongest lights are generally in the sky and the darks in the subject. In portraiture they will naturally fall in the group ; if two of the sitters are dressed in light or dark they should be brought together for unity.

Planes.

The planes of a picture should be observed. The strongest accents come in the fore-part, where the definition—that is, the outline of the objects—should be sharpest, and gradually get weaker or less sharp the farther away it gets, until it is practically lost in the distance, there being a gradual gradation. This, in other words, constitutes the perspective of the picture. In landscape, the effect is materially assisted by what is termed " Atmosphere," that is when there is some haziness in the air. The planes then gradually pass one into the other, until all the detail is lost in the silvery greyness of the haze.

Tone Rendering.

Colour Values.

The correct rendering of colour by tones should have careful consideration. The term tone here must not be confounded with the same term used in P.O.P. toning. It really means the suggestion of colour by means of varying depths of deposits in the picture. Blue photographs white ; if the subject of the picture be something white and has for its background something blue, the difference between the two will be so slight as to afford no contrast. Again, in the case of a yellow flower if photographed in the ordinary way, it will come very much darker than it appears naturally. Flesh tints suffer also from the same cause. These difficulties are overcome to a certain extent by means of what are

called " Orthochromatic " plates. These are plates that have been chemically treated to render them more sensitive to the less active rays of light as yellow, green and red. The orthochromatic plate is used in conjunction with a yellow screen or filter, which materially lengthens the necessary exposure according to the depth of the colour of the screen ; from three to six times more exposure will be required with it than without it. The screen is fitted up either inside the camera, at the back of the lens, or into the hood of the lens-mount. Working under these orthochromatic conditions with the white object against the blue background, the blue rays of the background will combine with the yellow of the screen to form a green tint. Green, being less active than blue, would photograph darker and give greater relief to the white. The yellow of the flower would combine with that of the screen and it would come lighter. Any yellowness, as freckles, etc., in a face would be less prominently marked from the same reason. The time of exposure on an orthochromatic plate under ordinary circumstances and without a screen is about the same as non-orthochromatic plates, except at evening time, about sunset, when there is a considerable amount of yellow light about ; the ortho-plate is then more rapid than a non-orthochromatic. Orthochromatic plates must be handled with great care in the dark-room, and nothing but ruby light must be used, and the plate should be covered during development by placing a piece of cardboard over the dish.

Colour Photography.

The colour suggestions by tones or different intensities of deposits in prints from negatives of orthochromatic plates must not be confused by the beginner with photo-

graphy in colours ; in this latter there is yet a wide field for research. The farthest advance to the present has been to get colour renderings on the transparency, that is, a positive on glass instead of on paper. These are produced by superimposing films of yellow, blue and red, one upon the other in exact register. The negatives —from which the positives are made—are obtained on three different plates, rendered specially sensitive to the colours mentioned. These plates are exposed separately in a special camera behind suitably coloured screens, and afterwards developed, fixed, washed and dried. Exposures are then made on specially treated lantern or other plates or films to make the positives, and when finished these are bound up in contact. The resulting blending of the colours produces a picture giving the colours of the subject. These are best seen in a stereoscope, or when thrown on a screen from a lantern.

The recently introduced Autochrome plate has materially simplified the operation of colour photography, as it is only necessary to use one plate instead of three. This plate is specially prepared by first coating the glass with a layer of specially coloured starch-granules ; the interstices between the granules are filled with an opaque material. This compels the rays from the object being photographed to pass through the coloured starch granules, which act as a special light filter. This filter is further assisted at the time of exposure by another special screen placed near the lens.

The sensitive emulsion is spread upon the sub-stratum of starch ; during the exposure the light has to pass through the glass and starch screen to reach the sensitive material, therefore the plate must be put into the dark-slide sensitive surface inwards, and great care must be taken not to injure this surface. On account of the

plate being put reversed ways into the holder, it becomes necessary at the time of focussing to have the focussing screen reversed, that is, the ground surface outwards, to ensure a sharp image. The length of the exposure will be according to the class of subject in hand. Experience in the use of the ordinary plate will be helpful. The necessary exposure for an Autochrome plate may be taken as twice that necessary for an ordinary slow plate.

The development is more complicated than ordinary. It consists of seven distinct stages, and each stage is for a stated time ; the plate is washed between each.

The plate is partially developed, then placed in a second bath in which the image is reversed from the negative to the positive state. Further developing is now carried on, and from this bath it is passed to an oxidizing bath and then intensified ; after passing through a clearing bath, it is fixed, washed and dried. Finally, it is bound up in contact with a cover glass, after the manner of a lantern-slide.

On account of the sensitiveness of the Autochrome plate to the rays of coloured light, the filling of the dark-slide and the first stage of development should be carried out with as little photographically inactive light as possible, if not in total darkness ; after this the further stages of the operation may be performed in weak daylight.

The starch substratum causes the attachment between the glass and the sensitive film to be only of a very slight character, and unless some precaution is taken during the process of development, the two will part. This may be avoided by edging the plate with some impervious material to resist the moisture, or by the use of a specially constructed dish for the purpose. Still-life subjects, as flowers, fruit, etc., are very suitable for colour photography.

CHAPTER VII.

PRACTICAL WORK.

FILLING THE CAMERA—ARRANGING THE APPARATUS—EXPOSURE.

ALL the operations in the early stages of photography are carried out with the intention of producing what is called "The Negative" on the plate or film. The negative—see Frontispiece No. 1—shows a reversal of the relative lights and darks of the subject; thus, light things come dark, and darks are represented by nearly clear glass or celluloid. The deposits in the negative resist in varying degrees the action of the light, and in the printing processes the relations of lights and darks are corrected, producing "The Positive"—Frontispiece No. 2.

It is now supposed that the reader has a camera and has read up and considered that portion of this book which relates to its class; that all the necessary sundries have been obtained, and all things are ready for a start.

FILLING THE CAMERA.

The first thing to do is to load the camera with plates or films. This must be done in the dark-room, except in the case of daylight-loading cameras. Light the dark-room lamp and leave it open for a short time, as previously suggested under "The Dark-Room." Put up the window-shutter, close the door and shut up the lamp. In the course of a minute or so the eyes will become accustomed to the somewhat subdued light

of the room. A glance round should be made to ensure that all stray light is shut out; if not, cover up any crevice with a curtain.

To Fill the Dark-Slide.

Open and lay it flat upon the work-bench. Now take the packet of plates and remove the wrapper. Upon opening the box the plates will be found to be further wrapped in sets of four each, or two pairs with their films facing each other. The film side is recognised, when held to the light, by being dull in appearance as compared with the brilliancy of the glass side, or it may be recognised by being slightly rough to the touch whilst the glass side is smooth. Carefully take a plate and with a soft duster or a plush pad lightly wipe it to remove all traces of dust, then put it face downwards into the well of the dark-slide (Figs. 7 and 8, B). Next place in the opaque partition and upon it the other plate, film upwards. Close up and secure the dark-slide.

To Fill the Hand Camera.

Take out all the sheaths and place them that the numbers are in order, 1 to 12. Open the box of plates and put one into each sheath, being careful that the film side is outwards. When all the sheaths are filled, notice if the number of the plate recorder of the camera is at No. 1. Put No. 1 sheath into the camera, seeing that it works freely upon its catches along the stage, otherwise a stoppage may result, when the sheath should fall on being liberated after the exposure. All the sheaths having been properly replaced, the camera is closed up.

To Fill the Folding Camera.

The back of the camera is taken off and an empty spool placed on the pivots in compartment B, Fig. 19. A spool of films is now placed upon the pivots in compartment A in such a manner that the tapering portion of the black paper is as shown in the illustration. If placed the reverse way the film will come on the wrong side of the paper when unwound. The pivots are held in place by springs. When the spool is in proper position the binding label is broken and the end of the black paper is pulled along, passed under the flat piece of wood C and over the metal roller D, across the back of the camera, over the opposite roller D and under the wood C, then threaded through the slot in the empty spool. Two or three turns should now be given to the winding key E. The back is replaced and the winding key turned until the figure appears behind the little red glass window at the back. Some spools of films have a sign which appears as a caution immediately before the figure 1.

When the Magazine or the Folding Camera has been loaded, great care must be taken to avoid accidental exposure by inadvertently opening the lens.

All things being ready for action a subject of a very simple character should be selected for first attempt, as a simple scene, cottage or stile. Don't begin photography by taking the portraits of your family or friends —the result may be satisfactory so far as the operator is concerned, but it may prove a somewhat difficult matter to please the other party.

With the Camera.

After selecting the subject—if the camera is of the stand type—the tripod is fixed up and the camera

opened and arranged that the worker can stand comfortably between two of the legs, to examine the focussing screen. The lens will then be over one of the legs and point at the object to be taken. Further, the camera must be so placed that the sun shall not shine directly into the lens tube, or a " flare " spot will result on the negative. The sun should shine obliquely on the camera from one side or the other—this will give greater relief in the lighting of the subject.

The body of the camera and the head of the worker are now covered with a focussing cloth—which can be made by sewing together two thicknesses of black lining and lined with red material. It is intended to shut away as much light as possible, in order that the image on the focussing screen may be more readily seen. The screen should be examined from a distance of six inches.

The lens is opened, and the inverted and more or less blurred image of the object in front of it will be seen on the focussing screen. The milled screw, Fig. 3, I, is turned gently backwards and forwards and the screen carefully watched during these movements; a position will be found at which the centre of the picture will appear perfectly sharply defined. When the lens is of the rectilinear type a point between the centre and the margin must be rendered in sharp focus; afterwards the definition of the whole image is made sharp by reducing the size of the diaphragm opening.

A Critical Survey.

Before closing the lens it is well to see that all the parts of the view are in the best position to please the worker's taste. This may be done by loosening the screw F, Fig. 4, and giving the camera a lateral turn to right and left, and by raising and lowering the rise-and-

fall front. If it has been necessary to tilt the camera, see that the back is perpendicular, if not, make it so by means of the swing movement. The lens is now closed, the focussing screen is swung out of position, and the plate-holder or dark-slide inserted as shown in Fig. 35. Care should be taken to avoid moving the camera when placing the dark-slide in position—as a precaution it should be steadied by placing the left hand on the corner marked XXX. When the plate-holder is in position its slide on the side facing into the camera should be carefully pulled out as far as it

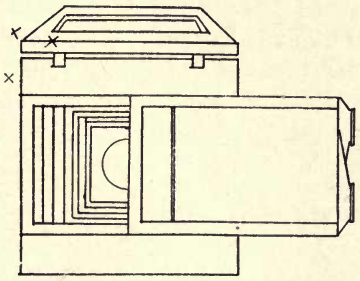

Fig. 35.

will come, and all will be ready for the exposure. This is made by removing the cap or opening the shutter. When sufficient exposure has been given, the lens is again closed and the slide pushed back. It must be carefully remembered which side has been exposed, otherwise the same plate may be inadvertently exposed a second time and thus spoiled. Some plate-holders are numbered—if such be the case make a note of the number. If the holder is not numbered, some mark should be made for guidance.

The Exposure.

The exposure is the most critical operation in photographic procedure, so much depends upon it. Its length is governed by four things.

1. Quality of light.
2. Class of subject (" Open " or " Shut-in ").
3. Speed of plate.
4. Size of stop or diaphragm opening.

With a fairly correctly-exposed plate the operation of development is reduced to a minimum. Experience obtained by observation and practice is the best teacher.

1.—QUALITY OF LIGHT.—The most active light is when the sun is shining, a blue sky, and some white clouds about. These conditions are slightly more vigorous after rain, the air being freed from dust. When the sun is shining, but no white clouds about, the light is not quite so vigorous. The reverse of the above is when there is a dull, heavy sky, or when storm-clouds obscure the sun. Then, again, the time of day and also of the year materially affects the time of exposure. The light gradually gains in strength from morning, reaching its maximum about 12 o'clock, after which it commences to weaken slowly until evening. From the early part of the year until about the middle its strength slowly increases, and then decreases until it gets to its weakest again, at the end of the year.

2.—CLASS OF SUBJECT.—An " open " view, that is, one in which there are no objects in the immediate foreground to shut out much of the light, requires less exposure than one which is more or less " shut in." As an example of an " open " view, we might take a

river scene with a stretch of open country ; for a closed " shut-in " view, that in which a house, building or some such object occupies a position somewhat near the camera. Clouds and seascapes require short exposures.

The colour of the object to be portrayed also must be taken into consideration. A red-brick building would require longer exposure than would a whitewashed one. Interiors require considerably longer than exteriors, depending largely upon the amount of light admitted and colour of glass in window. The light in a room may be apparently as bright as outside ; it must, however, be borne in mind that the glass only allows a certain amount of light to pass through it, retains some, and reflects the other, hence the difference in the activities.

3.—SPEED OF PLATE.—Information respecting the speeds of plates will be found under " Sensitive Materials," " Degrees of Sensitiveness of Plates."

4.—DIAPHRAGM OPENING.—When the subject is focussed up at full aperture, and if the diaphragm opening is reduced, owing to the light being shut out, the focussing screen will appear much darker, and it naturally follows that when the light reaching the plate is reduced more exposure must be given.

As a guide for the beginner, it will be supposed that a slow-speed plate is being used and the lens stopped down to f/32, on a well-lit subject about midday in the brightest part of the year. The subject might be a house. In working upon such a subject, always try to include a bit of the side as well as the front—an exposure of three seconds might be given ; if the exposure

be made towards evening instead of midday, the increase in time must be two or three times as long. This will be a basis for the worker to begin upon ; practice and observation will do the rest.

A little experimental work is most useful, For instance, if the worker will select a subject near home, and expose, say, three or four plates upon it, for the first count one second, for the second two, and so on ; quickly exposing one plate after another, working with the camera in the same position and same stop in each exposure. After developing the plates in the same strength solution, using a fresh portion for each plate, there will be a marked difference in the resulting negatives ; or to keep down expense, if working with a large-size plate, a row of houses may be selected. After focussing up and placing the plate-holder in position its slide may be drawn out for a quarter of its length, and one second exposure given ; close the lens and draw the slide to half its length, expose for another second ; repeat the operation for the third and fourth time. After development there will be four well-marked strips for comparison. Care must be taken not to move the camera in any way whilst making the exposures. Again, further experimental exposures should be made at different times of the day, and under varying conditions of light. Careful notes should be made for reference, and also the best negatives resulting kept as a type to work to. Much valuable knowledge will be gained in this way, and drive practical facts home in such a manner as it is impossible to do in any other.

It is well for the novice to accustom himself to form some idea of the activity of the light by the brightness or dullness of the image on the focussing screen. Attention to this will often help one to judge fairly accurately what length of exposure is necessary.

The exposures made when using a hand camera must be of short duration, being expressed in fractions of a second. The variation in the times of exposure is made by altering the speed of the shutter ; if this be not possible, owing to the shutter having only one speed, then it is done by altering the size of the stop. In the very brightest weather good results are obtainable on plates of medium speed ; at other times it is necessary to use the fastest.

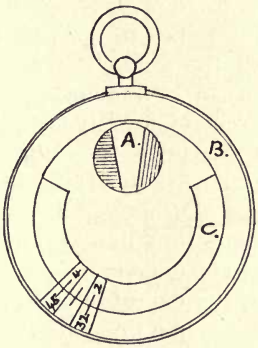

Fig. 36.

Exposure Meter.

Mechanical means, such as an " Exposure Meter," may be used to assist in estimating the strength of the light, and from it the length of the exposure that will be necessary. There are several kinds of exposure meters on the market.

These instruments test the activity of the light by the length of time it takes a piece of sensitive paper to assume a given colour, and the exposure is made accordingly. Fig. 36 illustrates one of the watch-shape meters. In the small circle A on the dial there are

three divisions, the two outer ones are tints, the centre one is occupied by the sensitive paper. In the outer circle, B, there is one set of figures representing the speed numbers of the plates, and on the inner circle, C, another set of time numbers.

One tint in A is four times darker than the other and is for out-door work. The paler one is for interiors. The working of the instrument depends upon the darker tint, therefore the result given by the paler one requires to be multiplied by four. With the actinometer or exposure meter is issued a chart giving the various speed numbers of the different makes of plates. The instrument is worked by moving round the back part to bring a fresh piece of sensitive paper into the middle of A. The time this takes to assume the same colour as the standard or darker tint is carefully noted. When this is ascertained the speed number of the plate is turned and brought into line with the time number. All that remains to be done is to look for the diaphragm number at which the exposure is to be made, and the exposure time will be in a line with it. Thus, supposing it requires four seconds for the sensitive paper to colour when the instrument is held in the shadow of the body away from the sun and the speed number of the plate is 45, the time number 4 is brought into a line with 45. If the exposure is to be made with the diaphragm of the lens closed down to 32, the figure in the time circle C will be 2, and the required time for the exposure will be 2 seconds.

These instruments are exceedingly useful, and quickly save their cost by reducing the number of waste plates from faulty exposing.

CHAPTER VIII.

DEVELOPERS AND DEVELOPMENT.

MAKING THE SOLUTIONS—CHEMICAL ACTIONS—BRINGING OUT AND FIXING THE IMAGE.

AFTER a plate has been exposed it should be taken to the dark-room for development. Before describing this operation the developing solutions shall be explained.

THE DEVELOPING SOLUTIONS

consist essentially of two parts—"The Reducer" and "The Accelerator." The reducer will not develop a plate without assistance, the excitant is the accelerator. Unless, however, a third element be introduced, the action of the air and other oxidizing bodies would be so great that the solutions would quickly spoil and the plate would become stained; therefore, a preservative is used—this is generally dissolved with the reducer. Further, it sometimes becomes necessary to slow down or restrain the activity of the solution. This is effected by the addition of another chemical called the "Restrainer."

The plate makers invariably publish instructions for making developing solutions suited to their plates. The most practical thing for the worker to do is to get a clear understanding of the nature of the chemicals and their actions, as it will be found that a slight variation in the proportion of the active ingredients of the developing solution will not appreciably affect their actions on the various makes of plates. A good plan is to practically ascertain the best working strengths of the

active ingredients in grains per ounce of a solution. The solution may then be made up ready for use, or may be concentrated and diluted as required. In this way the working of any recipe may be reduced to utter simplicity. To give an example of how to reduce a recipe to grains per ounce, an ordinary hydroquinone developing solution will be taken as a model. It is always advisable, if the solutions are to be made up and kept for any length of time, to make them in two portions; the reducer and preservative in one, the accelerator and restrainer in the other, and call them either A and B solutions or Nos. 1 and 2, and mix as required.

Solution A.		Solution B.	
Hydroquinone ..	80 grs.	Caustic soda	40 grs.
Sodium sulphite..	160 ,,	Potass. bromide..	20 ,,
Water	10 ozs.	Water	10 ozs.

To reduce this merely requires the amounts dividing by 10, or remove the nought, and we get :—

Solution A.		Solution B.	
Hydroquinone	8 grs.	Soda caustic	4 grs.
Soda sulphite	16 ,,	Potass. bromide....	2 ,,
Water	1 oz.	Water	1 oz.

We must not, however, stop here, because when working with the solutions we use equal parts of A and B, and one ounce of such mixture would be made up of half-ounce of each of the two. So that we should express our working formula as :—

Hydroquinone	4 grains.
Soda sulphite	8 ,,
Potass. caustic	2 ,,

Potass. bromide 1 grain in each oz. of solution.

The construction of this formula is : hydroquinone, the reducing agent ; sodium sulphite acts in the double

capacity of preservative for the solution by retarding oxidation, and also prevents staining of the film during development; caustic soda is the accelerator; and bromide of potassium the restrainer. The tendency of the reducer is to give density, representing contrast and brilliancy, and the accelerator to keep it back, thus lowering the contrast and inclining to flatness.

Chemical Actions.

The reducing chemicals in the developing solutions vary in their action upon the haloid salts in the emulsion on the plate or film, and negatives of slightly different colours result.

HYDROQUINONE is a somewhat slow worker. It builds up density, giving plucky blackish negatives which yield strong prints. Its best accelerator is a caustic alkali, as soda caustic. It will work with the alkaline carbonates of soda and potash, but much more slowly. The solution above described will be found to be of a good working strength.

METOL works exactly opposite to Hydroquinone. It gives detail very quickly and density only very slowly. The unwary or inexperienced worker is sometimes trapped by it and transfers the plate to the fixing bath too soon, with the result that a thin, weak negative is produced; therefore, when working with Metol allow a sufficient length of time for density to form. Metol is, however, not often used alone, but more generally in combination with Hydroquinone, and the blending produces a very excellent working solution, embracing the strong characteristics of the two chemicals, namely, the density-giving properties of the one with the detail-

giving properties of the other. The resulting negative is of a greyish-black colour. The alkaline carbonates of potash and soda are used as the accelerator, both for the Metol and also for the combination. The working strength of Metol will be found below.

PYROGALLIC ACID is without doubt the best developer for plates and films, producing negatives of a greenish tint which give excellent prints. The working strength of the solution lies between two and four grains per ounce, according to the class of negative desired. The two-grain solution gives a negative that is soft, but full of detail, the four-grain solution gives one of stronger contrasts. A preservative for Pyro solution is potash metabisulphite—with this it will remain colourless for some time. Sodium carbonate is the accelerator, and twelve grains per ounce will be found a useful strength. Liquid ammonia is also sometimes used as the accelerator, but the carbonate is the one most frequently employed.

The three reducers above mentioned are those in most general use. The other reducers, with their accelerators, are given below, if the reader at any time should like to try them. The proportions have been reduced from the makers' formulæ.

	Grs.	A. Grs.	Oz.
1. Ortol	7	Metabisulphite potash	$3\frac{1}{2}$ Water 1
2. Metol	$7\frac{1}{2}$	Sulphite soda	54·7 ,, 1
3. Eikonogen	$7\frac{1}{2}$	,, ,,	29 ,, 1
4. Adurol	$8\frac{1}{2}$	,, ,,	$76\frac{1}{2}$,, 1
5. Glycin	$9\frac{1}{3}$	,, ,,	$43\frac{3}{4}$,, 1
6. Paramidophenol	$8\frac{1}{2}$	(Use 1 part A and 2 of B)	,, 1
7. Pyrocatechin	9		,, 1
8. Amidol	$2\frac{1}{2}$	Soda sulphite	22 ,, 1

B.

	Grs.		Grs.		Oz.
1. Soda carb.	54½	Soda sulphite	76½	Water	1
2. ,, ,, ...	76½	Potass. bromide....	1	,,	1
3. ,, ,, ...	23	.....		,,	1
4. Potass. carb.	54½	.....		,,	1
5. ,, ,, ...	43¾	.....		,,	1
6. ,, ,, ...	26½	Soda sulphite	26½	,,	1
7. Soda carb.	44	,, ,, ...	22	,,	1

Amidol works without a caustic alkali or an alkaline carbonate, the sulphite being sufficient for the purpose.

A few words about weights and measures may be helpful. Chemicals are bought by the avoirdupois weight of 437½ grains to the ounce. One fluid ounce of distilled water at mean temperature of the atmosphere (*i.e.* 60 deg. Fahr.) weighs 437½ grains; 60 minims equal 1 fluid drachm; 8 drachms 1 fluid ounce, and 20 fluid ounces 1 pint. One minim weighs practically nine-tenths of a grain. A ten per cent solution by weight is made by counterbalancing a wide-mouth bottle on a scale; weigh into it one ounce of the required substance and nine ounces of water.

The solutions must be carefully compounded. If the worker cannot do this it should be done by a capable person, or the ingredients obtained in a form in which they are carefully weighed out and merely require the addition of water.

Development.

Development of Plates.

The reader will now have a general idea of the nature of the developing solutions. The next thing to consider is the development of the exposed plate, which is done in the red light of the closed-up dark-room. The solutions A and B are first mixed in a graduated

measure, as in Fig. 37. The plate is taken from the dark-slide and carefully dusted with a piece of soft silk, or a tuft of cotton-wool, to remove any dust. Place it

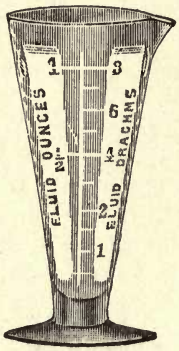

Fig. 37.

coated side upwards in a developing dish, as Fig. 38. The dish should be held in the left hand and the measure in the right, with the lip of the spout resting on the edge at the right end of the dish. With a sweeping motion

Fig. 38.

flood the solution evenly over the plate as the measure is passed along the dish; now gently rock the dish to keep the solution moving.

It will be noticed that the plate when taken from

the dark-slide is exactly of the same appearance as when it was put in and as if nothing had happened; but something has happened: the image is, however, latent or invisible, and requires to be brought out by the developing solutions. As soon as the solution comes in contact with the plate it commences to act upon the silver compounds—which have been affected by the light—in proportion to the light's action. The "High-lights," these are the brightest portions of the subject, as clouds or white objects, make their appearance first, next come the "Half-tints," and lastly the "Darks" or shadow portions. The shadows will appear in the finished negative as nearly clear glass; owing to the light's action having been very weak the emulsion may be very slightly affected and will dissolve away in the fixing bath.

Tentative Development.

It is a somewhat critical operation to make up one's mind just when to stop development. If the plate is kept in too long it will be over-dense, if not long enough a thin negative will result. Much depends upon what exposure the plate has had. If the exposure has been about correct, development is carried on without hesitation, but if there be any doubt it is advisable to start with 2 parts of A and 1 part of B. This is called "Tentative" development.

In a correctly exposed plate the image begins to make its appearance gradually all over the plate. Such being the case, pour the developer back into the measure and add the other part of B; return to the dish and gently rock to and fro; the image will then gather density. The plate should from time to time be taken from the dish, and its back examined; when the image can be fairly well seen at the back it has been developed

long enough ; the plate should then be rinsed and placed in the fixing bath.

In over-exposure, the image makes its appearance very rapidly all over the plate, and unless checked will soon become black and lost. To prevent this, the solution is returned to the measure, and about ten to twenty drops of a 10 per cent solution of potassium bromide is added to it, then returned to the dish. This, acting as a restrainer, will slow down the action, and development is proceeded with until the image appears at back. A negative thus produced will probably be very dense, and require reducing. See " After-Treatment of the Negative."

In under-exposure, the highest lights of the subject will appear first, and will gather density out of proportion to the darker or shadow portions of the picture. To assist this, to the solution poured back into the measure, add two more parts of B, return to dish, and gently rock. Development is then carried on until all obtainable is seen on the back. Care should be taken not to over-develop ; that is, as soon as the detail ceases to appear development is as complete as can be got under the circumstances, and keeping the plate in the solution will only tend to increase contrasts without any gain in detail. Although the negative may be thin and weak, it may possibly be improved by intensification. See " After-Treatment, etc."

Factorial Development.

Some workers find it useful to work to a factor. This depends upon the time at which the image first shows itself after the plate has been placed in the developing solution. Thus, supposing the image appears in just ½ a minute, the complete development of the image to suit the worker's idea may take 5 times

as long—2½ minutes—in this case the Factor 5 is taken. The worker then uses the figure 5 when developing with the same solution and if possible at the same temperature, and multiplies the length of time elapsing before the appearance of the image by it.

Fixation. When development is complete the image has to be fixed. The plate is rinsed with water and then placed in the "Fixing bath," which is made up of four ounces of hypo-sulphite of soda, commonly called "Hypo," to a pint of water. It is kept in the fixer until the creamy-looking substance to be seen at the back is dissolved away. Fixation must be complete, and to ensure this the plate should be left in the fixer for a short time longer, say half as long again as it has taken to clear; or better, transfer to a fresh fixer.

Washings. When the plate has been thoroughly fixed, it has to be well washed, to completely remove all traces of the fixing salt "Hypo." If only one or two plates are under treatment the washing may be done in the developing dish, by changing the water about every 10 minutes for an hour or so. The elimination of the Hypo is materially assisted by giving the plate about half a dozen quick changes of water as soon as fixed, and then proceed as directed.

When there are more than a couple or three plates to be washed, a washing tank, Fig. 39, will be found the most useful. The plates are first put in the rack, B, by sliding them into the grooves. The rack is then placed in the tank, A, which has been previously filled with water. The tank works on the siphon principle, that is, the water runs in at the top and as it rises in the tank, as soon as it reaches the level of the curved tube on the outside, the water rising up the left tube

from C, immediately passes down the right tube and out at the bottom, D. The plates being in an upright position, as the fixer is dissolved out of the gelatine it falls to the bottom and passes out through the siphon.

Drying. After washing, the plate is put away to dry, in a place where no dust can settle on it. The plate, while drying, should stand on its end, to allow the water to drain off. A "Draining rack" is easily made by driving some long nails into a piece of wood at such a distance apart that two will support a plate with one corner pointing down-

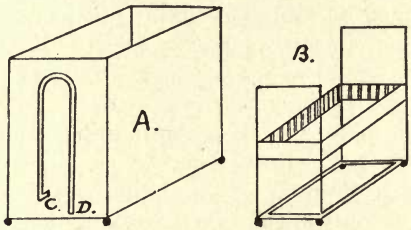

Fig. 39.

wards; this allows the water to drain down to that corner. When the plate is dry we have a "NEGATIVE."

The Development of Films. Rollable and other films are developed in precisely the same way as a plate. A strip of rollable film of six or twelve exposures may be developed at one time, provided the exposures have been nearly the same so far as quality of light at time of exposing and the length of exposure are concerned. If, however, the exposures are uncertain, it is best to cut them into their proper sections, and treat each one separately. Care must be taken to unroll

the spool in the proper manner. It is held in such a position that it will unwind as shown in Fig. 40. The black covering paper, A, will be on the outside and the film, B, on the inside ; as the unwinding proceeds the film will make its appearance. The two must be held and unwound together. As soon as the white sectional marks, C1, show themselves the unwound portion should be cut away, by means of scissors, and the spool further unwound until the second marks, C2, appear ; this is cut off and constitutes the first exposure. This is proceeded with until the whole of the six exposures

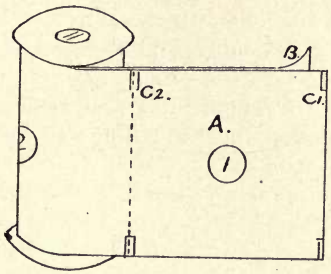

Fig. 40.

have been cut up. Each one is now treated as a plate—except that it must be first soaked in water to make it lie flat in the developing dish. If the film is to be developed in the length, the same precaution need not be exercised. The spool is merely unrolled and the film detached from the paper. Again, in this case, the film must be soaked in water, otherwise the developer may hang on the film and form markings. The length is developed by passing it backwards and forwards through the developing solution in a specially arranged dish for the purpose ; that is, one having some contrivance

by means of which the film is held beneath the surface of the solution as it passes to and fro. After fixing and washing the films are hung to dry by attaching them to spring clips or by pinning to corks, to which a piece of loose string or a ring is attached.

Machine Development.

There is new apparatus arranged for the development of films in the strip, and the work may be performed in an ordinary room and not necessarily in a dark-room. The apparatus consists of a wooden cabinet fitted up inside with mechanism, by which the film is wound off its spool into a light-tight celluloid apron. When enveloped in this apron, the film is quite protected from the light, and the two are transferred to a developing cell containing the solution, in which it is allowed to remain for a specified time. The solution is removed and the fixing solution poured in.

CHAPTER IX.

AFTER-TREATMENT OF THE NEGATIVE.

REDUCTION—INTENSIFICATION—MECHANICAL.

SOMETIMES the negative, from causes already mentioned, may not be quite up to printing standard and may require slight modification, either from over-denseness by reduction, or building up from being thin and flat by intensification. These operations may be conducted in daylight.

Reduction. It may happen, through over-exposure, a negative is produced which takes a long time to print, owing to the density of the deposit. This may be remedied by treatment in a "Howard-Farmer" reducer, which is prepared by adding a ten per cent solution of ferricyanide of potassium, drop by drop, to solution of hyposulphite of soda, one part in five of water (ordinary fixing bath), until the latter assumes a lemon tint. The soaked negative is placed in this and the action carefully watched, taking it out for examination from time to time. As some reduction goes on in the first stages of washing, the negative should be removed just before sufficiently reduced. Thoroughly wash the negative after reduction.

The second reducer to be considered is ammonium persulphate. If a negative be too "Contrasty," that is, gives chalky lights and intense darks, it may be corrected to a certain extent by immersing in a two per cent solution of the persulphate, removing just before completion, and checking the reducing action by im-

mersion in a weak solution of sulphite of soda. Afterwards well wash.

Intensification.

If from under-exposure or insufficient development a negative is obtained that is weak in contrast and gives a hazy-looking print, matters may often be improved by intensification. The mercuric-chloride and ammonia intensifier will be considered first. The negative is soaked in water to soften the gelatine, and then transferred to a solution made of perchloride of mercury, 20 grains ; hydrochloric acid, 5 drops ; water, 1 ounce. It should be kept in this until the film is bleached through, that is, it will be white front and back. Wash for about a quarter of an hour in several changes of water ; then flood it with a weak solution of ammonia (about half drachm or so of strong solution of ammonia ·880 to two ounces of water). The dish containing the negative and solution should be gently rocked until the film is thoroughly darkened to a brownish black. Well wash and dry.

A word of caution must be given here. Owing to the intensely poisonous nature of the perchloride of mercury, extreme care must be exercised in its use. It should always be kept strictly out of the way when not wanted. In the case of young and inexperienced workers, this class of intensification should be entrusted to some competent person to perform.

As the second intensifier, the uranium one will be considered. This combination is very useful, but requires care.

Uranium nitrate .... 6 grs.	Ferricyanide of potass. 12 grs.
Water ..... 1 oz.	Water ..... 1 oz.
Glacial acetic acid, 20 minims.	

Use equal parts, mix as required. They do not keep satisfactorily when mixed. The negative must be thoroughly washed, to remove all traces of hypo.

The intensification results by an altering of the colour of the negative from a black to a reddish ; from which cause it acquires a greater light-resisting power. After intensification wash the negative slightly : too much washing destroys the effect. One advantage of this method is, if the result is not as desired, it may be brought back to its original condition with a weak ammonia solution, and the operation repeated, after the negative has been soaked in a dilute solution of acetic acid. If the water used for washing be at all alkaline, it will work as the ammonia and weaken the intensifying action. The best results are obtained when the solutions are slightly acid.

Advantage may be taken of this reducing effect of an alkali to bring about local reduction by applying a weak solution of carbonate of soda by means of a pledget of wool to any part of the negative, where desired. The negative should be held face downwards, the solution applied to the part, and then quickly rinsed under the tap.

Mechanical.

By Paper. The printing quality of a negative may also be assisted by mechanical means, as coating the back with "matt varnish" or paper (either tracing paper or Papier Minéral) and working upon these with lead pencil. The varnish is applied by pouring a portion on the centre of the glass, then gently tilting the plate to allow the varnish to flow to the edge, and by further tilting conduct it round until the whole surface is covered. The varnish

will quickly dry. Ordinary negative varnish to protect the film is applied in the same way over the face of the negative, which must be first slightly but carefully warmed before pouring on the varnish.

The paper is attached to the back of the negative in the following manner. It is cut to the same size, or, if anything, a fraction smaller than the negative. The cut paper is placed in water to soak, and while it is soaking a narrow band, about $\frac{1}{4}$ inch wide, of adhesive paste is applied all round the negative on the glass side. The paper is then taken from the water and all the superfluous moisture removed by pressing with a cloth; it is laid upon the glass and dabbed into contact, commencing at the centre and working towards the margins. The paper, when dry, will stretch very tightly upon the glass; it may then be worked upon with lead pencil to strengthen any high-lights, or made transparent by rubbing in a little vaseline to strengthen the shadows.

Retouching. Retouching on the front of the negative with lead pencil, to strengthen the high-lights or to remove unnecessary dark portions from the print, is sometimes resorted to. This, however, requires a lot of practice and skill to do it successfully. A liquid known as "The Retouching Medium" is applied and gently rubbed in with the soft part of the finger or with a piece of soft silk stretched over the tip of the finger. When it becomes dry the surface will be in a condition to receive the marks from the pencil, which must be hard and have a sharp point. The pencil must be applied with a very light touch, either as crosses or dots with tails like a comma. Small, over-dense portions of the negative may be scraped away by the skilful use of the retouching knife.

CHAPTER X.

PRINTING AND TONING.

PRINT-OUT PAPERS.

THE print is made from the negative and forms the POSITIVE.

GELATINO-CHLORIDE PRINT-OUT PAPER, OR P.O.P.

will receive first consideration. This paper belongs to the " Daylight " group of sensitive materials, as it can be handled with safety in weak daylight. It should not, however, be exposed too long at the time of filling the printing-frame, or the light will affect the surface to a degree which will result in the degrading of the whites of the print.

The articles required for printing are the negative, a piece of P.O.P. and the printing-frame. The latter consists of a framework of wood, furnished with a movable back ; this is made up of two parts hinged together, each part having its spring to hold it firmly in the outer frame, Fig. 41.

To prepare for printing, the back is removed and the negative, film upwards, is placed in the frame. Upon this is laid a piece of P.O.P., the shiny, sensitive side next to the film ; replace the back, and fasten in with the springs.

The frame is now placed in a position where it will be exposed to a well-lighted portion of the sky ; but not in direct sunlight, unless the negative be a very dense one. After about five minutes the frame is taken into a room, and at some little distance from the window

the print is examined. One portion only of the back of the printing-frame is unfastened, and turned back; then with care, and without pulling, the paper is lifted up. It will be noticed that the outlines of the picture are making their appearance upon the paper. In fastening up the back again care must be taken not to move the paper, and never at any time unfasten the two portions of the back until printing is complete, otherwise a blurred picture will result from the movement of the paper, because it is almost impossible to replace it in the same position when once it has been moved.

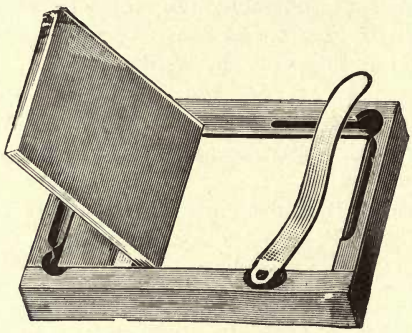

Fig. 41.

When the print has acquired a fairly dark brownish purple colour it is removed and put in a suitable place out of the light, such as a box or between the leaves of a book, to await toning. It will keep in this condition for some time, provided active light is kept from it; if, however, light does get to it, the sensitive surface gradually becomes darker, until the image is entirely lost. To prevent this, and to ensure greater permanency, the image must be fixed; but as mere fixation produces an unpleasant colour, the print is

passed through a toning bath containing gold, and afterwards fixed.

Toning.

Toning consists of depositing another metallic body on the print to combine with the silver salt and so produce a more pleasant colour in the finished result. There are several chemicals, as gold, platinum, etc., which will effect this. The gold toning bath, which is the most frequently used, will be here explained.

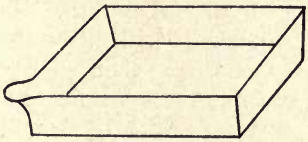

Fig. 42.

Separate Bath.

Of this variety there are two classes, namely, the "Separate" bath, in which the print is first toned, then fixed; and the "Combined," where the operations of toning and fixing take place simultaneously. Several kinds of chemicals are used in conjunction with gold to bring about toning. The usual bath, gold and sulphocyanide of ammonium, will be described.

It is advisable to treat from six to twelve prints at one time when toning. For the process will be required two or three deep porcelain dishes (Fig. 42) a size or two larger than the print, to allow of free handling. One of the dishes should be kept entirely for use with the fixing bath, and marked in some way for distinction. The work may be done in weak daylight or gaslight. Endeavour to always tone in the same class of light,

or difficulty may arise in knowing when to leave off; for when one gets accustomed to toning in daylight, it becomes somewhat difficult to gauge the proper colour when toning in artificial light.

The prints have to be first well washed; for this purpose two of the dishes are nearly filled with clean water. Into one quickly place the prints face upwards, one by one; at first they will curl up, but as they become moist will flatten out again. By the time all the prints are in, it will be noticed that the water has become milky; now quickly transfer them singly, face downwards, to the other dish. Reject the water from first dish, replace it with some clean, and return the prints. These three changes should be made quickly; afterwards the washing may be carried on more leisurely; it will be complete when the water remains clear, which takes half a dozen or more washings and about a quarter of an hour to perform.

The Toning Bath.

A very good bath is made up of one grain of ammonium sulphocyanide and one-tenth of a grain of gold to each ounce of water, or a bath sufficient to work 12 quarter-plate prints, or their equivalent of either smaller or larger sizes may be made by adding to 10 ounces of the ammonium sulphocyanide solution one grain of gold chloride. This bath, however, will be found to work more quickly if the quantity of water be reduced to 8 ounces, or even 6. The last allows half an ounce of solution for each print, which will be ample, but the active ingredients must be at full strength. One important item must be kept in mind, that is, the gold must always be added to the sulphocyanide. If this order of mixing be reversed the gold will be thrown down as an insoluble precipitate.

The toning bath having been prepared and put into one of the dishes, into it are placed all the prints, one by one, as quickly as possible, giving the dish a shake from time to time, so as to flood the solution over them. When they are all in, the bottom one is taken and placed on the top, then the next, and so on until all have been turned.

A good plan to adopt is to put the prints into the bath, film upwards, and then when turning to place the film downwards ; this ensures each getting a turn. When the prints are first put into the toning bath they become brighter in colour, then gradually change, first to reddish brown and then from brown to purplish.

Care must be taken that the prints do not lie too solidly one upon the other for too long, because if the toning solution cannot circulate freely over the entire surface of the print the colour will be uneven, as the portions near the margin will tone more quickly than those near the centre, where the solution cannot reach.

The process is carried on until, upon examining the print by holding it between the eye and the light, the deep shadows are of a chocolate-brown colour. They are then rinsed in clean water, and placed in the fixing bath. They should again be turned in the same manner as when in the toning bath. Fixation is complete in about ten to fifteen minutes ; a little longer will not hurt them.

Fixing.

The fixing bath is made by dissolving three ounces of hyposulphite of soda in one pint of water. A word of caution : always keep the fixing bath well out of the way—until actually required—during toning operations with the

"Separate" bath, as the least particle of hypo will completely upset the whole affair.

In very hot weather it is advisable to pass the prints before toning through an alum bath (one ounce alum to twenty ounces of water) for a few minutes, take out, thoroughly rinse in water, and transfer to the toning bath. The sulphocyanide has a softening action upon the gelatine: from this cause and also from the temperature of water being high in hot climates, the hardening bath becomes an absolute necessity if the film is to be kept upon the paper at all. Even then, it is necessary to perform the toning operations in the coolest part of the day.

Washing.

After fixation the prints have to be well washed, either in running water or by changing from dish to dish, as in washing before toning. They must be washed for at least one hour. It is a good plan to give them half a dozen quick changes from dish to dish with plenty of water as soon as they are taken from the fixing bath; they should then be placed in running water, or changed every ten minutes for the remaining time. It is very important that all traces of fixing salt be washed from the prints.

Fig. 43 illustrates a Siphon print washer—the tank being round and the water entering at an angle from the jet A, passes with some force down the side and round the bottom, producing a circular motion, which causes the prints to be constantly moving. The water rises up the tube, B, and falls down C, in this way setting up a siphon action, by which means the tank is freed from the water impregnated with hypo. After washing, the prints are laid face upwards on a cloth to dry in a place out of the way of all dust.

The Combined Bath.

This reduces the process of toning to a very simple matter. The permanency of the print is regarded as not being equal to those toned in the separate bath and then fixed. However, if the toning is carefully carried out and the bath not forced, that is, a sufficiency of gold is used, and fixation is complete, afterwards well washing, prints will be produced that will keep for a considerable time.

Most of the baths contain lead ; this will tone of its own accord, but lead-toned prints will, after a short

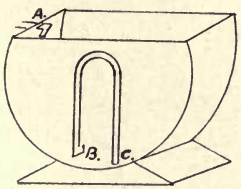

Fig. 43.

time, assume a peculiar yellow tint ; this is why a full proportion of gold is necessary.

A combined bath may be made up as follows :—

1.		2.	
Hyposulphite of soda .	2 oz.	Gold chloride ...	3½ grs.
Alum	1½ oz.	Lead acetate ...	16 ,,
Hot Water	20 oz.	Water	2 oz.
Borax	½ oz.	For use : 8 parts No. 1.	
Dissolve and allow to stand 24 hours. Pour off clear solution.		1 part No. 2.	
		No. 2 should be well shaken	

The working capacity of this bath—upon the basis of one grain of gold chloride to each 12 quarter-plate prints or equivalent—is 42 prints. It is not often desired to tone so many at one time, therefore the bath should be

apportioned out for the number of prints to be toned, and that portion rejected after use.

The prints should be somewhat darker than for the "Separate" bath. They are put into the toning solution without washing, and turned in a similar manner to that previously described. When toning is complete, thoroughly wash in the same way and for the same length of time as before suggested. Ten minutes may be regarded as the shortest time for a print to fix, so that if the required colour be obtained in less than ten minutes the fixation should be completed in a plain hypo bath. No harm can be done by immersing in a plain fixer, if the

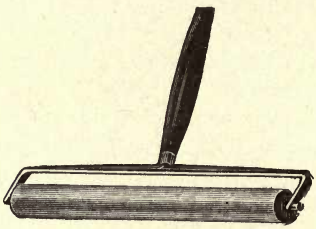

Fig. 44.

operation of toning takes longer than ten minutes. It is as well to err on the right side if at all.

"Surfacing" the Print.

A highly-glazed surface may be given to a P.O.P. print by pressing it down upon a piece of polished plate-glass by means of a squeegee (Fig. 44.) The glass must be first thoroughly cleaned, and when quite dry should be rubbed over with French chalk; this is wiped off, and the glass finally rubbed with a clean soft duster. Before treating prints in this manner, it is necessary to pass them through an alum bath (one ounce of alum to one pint of water), in which they

should remain a couple of minutes. If this precaution is not taken, they will adhere to the glass after drying. Should the print fail to leave the glass when dry, one corner may be raised by means of a penknife, and then by taking hold of it the print can be gently pulled. Mounting these prints is referred to under the chapter on "Mounting." If it be desired to make the glossy surface of P.O.P. dull or "Matt," this is done in precisely the same manner as above, only, in place of polished plate-glass, a piece of finely ground glass is used.

COLLODIO-CHLORIDE AND ALBUMENIZED P.O.P.—The printing, toning and fixing may be carried out in exactly the same way as the gelatino-chloride variety.

SELF-TONING P.O.P—This paper is printed in exactly the same way as the other print-out papers, but should be printed rather more deeply. The Emulsion contains the necessary chemicals for the purpose of toning, and the paper merely requires fixing. If the colour be too warm, or red, it may be rendered cooler, or purplish, by immersing the print in a salt bath—common salt one ounce, about, to one pint of water—before putting it into the fixing bath.

CHAPTER XI.

PRINTING AND DEVELOPING.

BROMIDE—PLATINUM—AND CARBON PAPERS.

Bromide Paper.

This paper belongs to the dark-room group of sensitive materials. They are, however, not quite so sensitive as plates, and can be safely handled in yellow or orange light.

Winter daylight is of very weak activity, and printing on P.O.P. becomes a tedious operation. An excellent substitute as a printing medium is provided by Bromide Paper—under which heading fall Gaslight Papers, too. The printing of these papers can be conveniently done by exposure to artificial light, either gas or a paraffin lamp.

Unlike P.O.P., the image on bromide paper—as previously mentioned under "Sensitive Materials"—remains invisible, and requires to be brought out by development. The negative which gives good results with P.O.P. generally does so with bromide papers. The character of the print may be slightly varied according to the amount of exposure given. Thus, by slight under-exposure a well-contrasted and vigorous one may be obtained, while by slight over-exposure one tending to flatness will result.

The paper is sold in two speeds (fast and slow) and two surfaces (rough and smooth), and of different colours—white and cream. The emulsion in the latter variety is spread upon tinted paper, the result is a black image on a cream ground instead of the usual black on white, which is by far in the greatest demand.

There is at times some difficulty in determining which is the sensitive side of the paper. A quick method of finding out which is the sensitive surface is to moisten the thumb and finger and with them hold just a corner of the paper for a second or two; the gelatine will soften and stick, indicating the coated side. A second method is to allow the paper to be exposed to the air in the dark-room, it will curl inwards to the sensitive side. A third is to pass the finger over the surface of the paper; the sensitive side is indicated by the edges being a little rough, caused by the gelatine lifting a little when cut through at the time the paper is cut up into pieces.

Exposure.

The negative and paper are placed in the frame, film to film, in exactly the same manner as for the other printing processes.

For the exposure it is advisable to always use the same source of illumination and at the same intensity. Then, by grouping the negatives according to their density, a fairly certain result will always be obtained. To get an idea of the printing values of different negatives, a little experimental work is recommended. Select three negatives, one thin, one medium and one dense. Working with the thin one first, it is placed in a printing-frame and upon it a piece of slow bromide paper; the back is then put in and fastened down. Cover the front of the frame with a piece of thick brown paper or cardboard. It is now taken to a lighted gas jet and held at a distance of about twelve inches from it. About one-third of the frame is uncovered and an exposure of five seconds given; another third part is uncovered and a further five seconds given; lastly the whole of the frame is uncovered and another five seconds counted. The frame

must then be quickly covered up and taken to the dark-room. The exposures will represent five, ten and fifteen seconds respectively, and will be indicated on the print after development.

The other two negatives should be treated in the same way, but for the negative of medium density begin with ten seconds, and for the dense one fifteen seconds. With the information gathered from the results of these experimental exposures, it should be fairly easy to refer any negative to its respective class and expose accordingly. This experimental treatment may be carried out to ascertain the correct exposure for any negative, and the result should be noted in a book for future reference. Such notes greatly facilitate work if prints are required from the same negative at different times.

If a lamp is used as the source of illumination, the exposure must be longer than for gas ; with incandescent gas the exposure will be about half that of the ordinary gas.

Distance from the illuminant materially affects the length of exposure. If a certain exposure were required at a foot from the light, at two feet it would be four times as long, and at three feet nine times. A useful piece of apparatus is an exposure-board, marked off in distances of six-inch intervals ; this allows the easel to be quickly adjusted at any distance from the gas jet. Fig. 45 shows how an exposure-board may be arranged —it can be made any length. A is the baseboard along which the easel travels, and which may be divided into spaces as above suggested. B is the gas jet arranged with the tap close at hand to be under immediate control ; the tube is connected by india-rubber tubing with the gas-fitting of the room. C is the easel against which the printing-frame is placed.

Development.

The paper must not be exposed to active light until after development and fixation. The process of development is the same as for films. The paper must be soaked in water for a short time before the developing solution is poured on. It will then lie flat in the dish and the solution will flow more evenly over it, with less risk of air bubbles-forming. The Hydroquinone Developer given on page 70 will be found useful for bromide paper, but it must be diluted with an equal

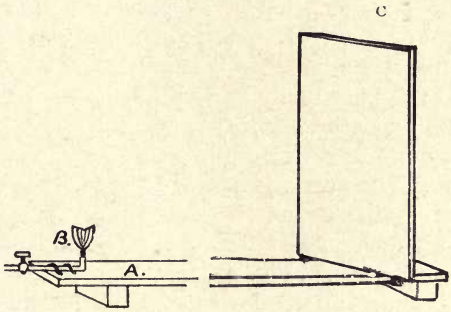

Fig. 45.

quantity of water. The fixing bath is the same as for plates.

After the developer is poured on, the dish must be gently rocked and the print carefully watched. The image makes its appearance gradually, and continues to grow. As soon as it has acquired nearly its full strength, it should be immediately transferred to the fixer, in which it will acquire slightly more strength. If it were carried to its full strength in the developer, the increase in the fixer would render it slightly overdone.

Fixing. The prints are allowed to remain in the fixer for at least ten minutes—fifteen minutes will do no harm. It is best to err on the side of safety, and it is not possible to judge the extent of fixation from the appearance of the surface, as is the case with plates. After fixing, the print must be thoroughly washed in the same way as P.O.P. prints.

Gaslight Papers.

These are really a variety of slow bromide papers. They require a much longer exposure, but develop up much more quickly. Therefore, it is possible to handle them in very subdued artificial light in an ordinary room, and not necessarily in a dark-room—as a precaution the filling of the printing-frame and the developing should be done in the shadow of the body, or behind a sheet of yellow or canary-coloured paper.

The fixing-dish should be covered with a piece of cardboard. This renders the work safe and convenient.

The printing-board, Fig. 45, may be used for gaslight-paper printing, and if the easel be sufficiently large it will protect the paper, if the printing-frame is filled behind it.

The Exposure. This is carried out on exactly the same lines as bromide paper, and the necessary length of the exposure may be experimentally found in the same way, but instead of seconds the time may be one, two and three minutes at six inches from the flame. With any yellowness in the negative—as sometimes met with where pyro has been the developer—the exposure must be considerably increased. Incandescent gas is very useful for gaslight papers. Daylight may be used as a means for printing,

but the exposure will be only a few seconds. A handy daylight-exposing arrangement can be made if the window-flap, B, Fig. 48, is weighted, so that it will work freely. The frame is filled in weak yellow light, and placed at a distance of eighteen inches or two feet from the opening. The exposure is made by opening and closing the flap. When the correct exposure is found, any quantity of exposures can be made before development is carried out.

Development.

A useful developer may be made from the following formula: Metol, 1 grain; Hydroquinone, 3 grains; Sodium sulphite, 35 grains; Sodium carbonate, 35 grains; Potassium bromide, ½ grain; Water, 1 ounce. Dissolve in the order given.

Development is as for bromide papers; the image comes up at first in a somewhat streaky manner, but rapidly assumes its normal appearance, and unless it is critically watched it will be quickly overdone. The print should be removed just before it reaches its full strength, and allowed to finish in the fixing-bath. It should be rinsed in water previous to going into the fixer, and when in the latter it must be kept below the surface, otherwise it may become stained. It is advisable to cover the fixing-dish with a piece of cardboard. After fixing, the prints must be thoroughly washed and dried.

Toning Bromides.

The normal colour of bromide papers is black and white. The matt surface paper gives an effect very similar to platinum paper. The colour of the sensitive surface may, however, be changed by toning.

RED.—This is obtained by using the ordinary uranium intensifying bath, given on page 82.

BROWN.—The print may be converted to brown by immersing in a bath made of Hypo (ordinary fixing salt) and alum dissolved in boiling water. The bath is used hot, but not too hot.

Another method is to bleach the print in a bath of Potassium ferricyanide, 2 grains ; Potassium iodide or bromide, 2 grains ; Water, 1 ounce. It is then rinsed and placed in a bath of sodium sulphide, 5 grains to the ounce. Afterwards thoroughly washed.

BLUE.—A blue colour is imparted by immersing the print in a bath of Ammonio-citrate of iron, 5 grains ; Acetic acid, 5 drops ; Potassium ferricyanide, 3 grains ; Water, 1 ounce.

GREEN.—A bluish green may be obtained by treating the print first in the uranium ferricyanide bath for two or three minutes, until it is of a yellow-red colour, then transferring to the blue bath, in which, after some time, it will become green. The print should be washed in half a dozen changes of water, the superfluous moisture mopped off, and put to dry.

Platinotype Paper.

This beautiful process is frequently regarded by those who have not tried it as an expensive and difficult one. With care, it may not necessarily be so. A certain amount of judgment is required when printing to know exactly when to stop ; this comes with practice, and if the worker will only persevere for a short time the difficulty will be overcome. The paper should always, as far as possible, be examined at about the same position in one room, where there is an even but not strong light. Some form of print-meter may be used if desired.

The sensitive surface of the paper is of a pale yellow colour. Owing to the tendency of the paper to become damp it must be stored in suitable tins. These tins are divided up into two compartments, the one being separated from the other by a piece of perforated zinc. The chamber on one side of the partition is small, and is for storing a small piece of dried chloride of calcium, which absorbs moisture very readily, and so keeps the interior of the tin dry ; on the other side of the partition is the chamber for the paper. If the calcium becomes moist and soft, it may be warmed in an oven to drive off the moisture, when it will become hard again. If the tin has been standing empty for some time, before putting a fresh quantity of paper into it it should be held near the fire. The paper will give dull, mealy prints if allowed to become damp. It may be purchased with a rough or smooth surface to yield sepia and white, or black-and-white prints, also for hot or cold development.

We shall here consider the " Cold-bath " variety, as it is the simplest for the beginner to handle. When obtained from the dealer, it is in hermetically-sealed tins. When opened, it should be immediately transferred with the calcium wrapped with it to their respective compartments in the storing tin.

The printing is done in daylight, after the manner of P.O.P., but unlike it in this respect, that when sufficiently printed there is but a very faint image, and the paper will require to be developed to bring it up to its full strength.

The negative should be of a fairly plucky quality, but not too thin in the shadow portion. It is put into the printing-frame in the usual manner, and then the paper; between this and the frame back must be placed a piece of material impervious to moisture, such as a rubber

pad, or a piece of oilcloth, smooth surface to paper. As the surface of the paper is rather more sensitive to light than P.O.P., the operation of filling the printing-frame should be performed in a room, but at the corner farthest from the window. Before printing, the worker should ascertain which is the densest portion of the subject-matter of the negative. The frame is now exposed to a well-lighted part of the sky. The paper is examined from time to time, and as soon as there is the faintest suspicion of detail on the paper which comes immediately under the densest part of the negative, the printing may be considered complete.

To Develop.

The solution for developing up the image is made by dissolving neutral oxalate of potash in water. To this may be added phosphate of potash; the solution will, however, work without the addition of the latter. In making up the solution it is best to have it concentrated, so that it can be diluted by the addition of water to suit any requirement. A useful concentrated bath may be made up as follows :—

Neutral oxalate potash	1 oz.
Phosphate of potash or soda	¼ ,,
Boiling soft water	3½ ,,

Let this stand to get cold.

For use, take one part of solution and dilute with an equal quantity of water for vigorous prints, and with double the amount for prints of a softer and more delicate grey tint. It is advisable not to be too sparing with the solution; a sufficiency to half fill a deep porcelain dish a size or two larger than the print will be convenient.

The paper is drawn in a sweeping manner face downwards into the solution, or it may be dropped face up-

wards on the solution, and the dish rocked, so as to quickly cover it. The image will rapidly develop up to its full strength. The print is then placed for several minutes in a clearing bath made of one part of pure white hydrochloric acid to sixty parts of water. The diluted acid is rejected, and a fresh portion poured on. This should be repeated for at least three times. When cleared, the print must be washed in several changes of water for from twenty to thirty minutes. Then allow to dry. By using the developing solution slightly warm it produces a somewhat warmer-toned print.

The " Hot-bath " paper is worked upon similar lines to the " Cold-bath " paper, excepting that the strong solution is used without dilution, and its temperature is maintained at from 150 deg. to 180 deg. Fahr., which necessitates the developing being carried out in well-enamelled iron dishes.

The sepia papers are of the " Hot-bath " variety. The ordinary black-and-white papers may be rendered a warm sepia colour by treatment with perchloride of mercury.

Carbon Printing.

The carbon and platinotype processes are regarded as the most permanent of all the photographic printing processes.

Carbon admits of a long range of colours, as black, brown, purple, red, and green. It depends for its effect upon the action of light on gelatine sensitized by immersion in a solution of bichromate of potassium. The colouring matter is incorporated with the gelatine previous to coating the paper.

When once sensitized the paper will not keep for any length of time—for about a couple of weeks ; therefore

it should only be bought in the coated and sensitive condition in such quantities as will allow of its being quickly used up, or in the coated but insensitive state, and sensitized as required. The beginner will do well to obtain his paper ready prepared for use for early attempts, and as proficiency is acquired to sensitize his own; ultimately, in special cases, he may even prepare the coating for the paper.

To print, take a piece of plain glass and attach, by means of paste or gum, a strip of opaque paper about a quarter to half-inch wide round the margins. This is to make what is called a "Safe Edge." When the paste has dried, this piece of glass is placed in a printing-frame paper side up; upon it is laid the negative to be printed from, then a piece of carbon tissue, and lastly the back. It is preferable to put a pad between the paper and back, the same as suggested under the heading "Platinotype Printing," and for the same purpose.

It is now put out to print in a good light. Carbon—unlike P.O.P. and platinotype—cannot be examined during printing, so that it becomes necessary to have some kind of guide, by means of which it can be ascertained when the tissue has had sufficient exposure. One way is to select a negative having similar characteristics to the one from which a print is to be made. Under this second negative expose a piece of P.O.P. Place the two frames side by side to print. Examine the P.O.P. from time to time, and when sufficiently printed the carbon may be considered so too. A few experiments on these lines will soon put the worker in possession of some practical knowledge for future guidance. The other and usual way is to use some form of actinometer, or print-meter, of which there are several kinds on the market.

To Develop.

This is done in weak light, preferably in the evening, by gas or lamp light. The tissue, having been printed, has to be developed to bring out the image. For this purpose will be required two or three deep porcelain dishes, a squeegee, a piece of glass, hot and cold water, a saturated solution of alum, and a piece of "Single-Transfer Paper." This latter should be obtained at same time as the tissue; the sheets of paper are generally cut a little larger than the tissue, and have a prepared surface.

The piece of glass is placed at the bottom of one of the dishes, which is nearly filled with cold water. Put in a sheet of single-transfer paper and let it soak for two or three minutes, then put in the printed tissue, which will curl inwards; as soon as it flattens out bring the two surfaces of paper and tissue together by lifting up the plate of glass from the bottom, drain off superfluous water, adjust the tissue in centre of the paper, place on the developing table, and squeegee into absolute contact.

Now place between several thicknesses of blotting-paper, and allow to remain for a quarter of an hour or so under pressure. At the end of this time they are immersed in hot water (about 100 deg. Fahr.). In a short time the soluble coloured gelatine will begin to make its appearance from between the paper and tissue. Now take hold of the two at one corner, and whilst keeping under the water carefully pull them apart; if they do not part easily, wait a little longer and try another corner. When they have separated, the support, which has until now carried the pigmented gelatine, may be rejected, as its place has been taken by the single-transfer paper. Development is completed by pouring the hot water over the print. The print when dry is darker than when wet, so that development

should be stopped just before the required depth of colour is reached. Place in the dish of cold water for a few minutes, and then transfer to the solution of alum ; afterwards wash and dry.

The single-transfer process reverses the position of things on the print. If an item of interest occupied a position to the right of a picture if printed on P.O.P. it would be on the left in a single-transfer carbon.

In many landscapes, if required for pictorial purposes only, this would not matter in the least. In other cases, however—such as buildings, etc.—it is necessary to have things in their right places ; to get this, " Double-transfer " has to be resorted to. Films for use in cameras are very useful for carbon printing, because, owing to their thinness, it is possible to print from the back as well as the front, and so obviate the necessity of double-transfer.

Double-transfer Process.

This is carried out on the same lines as the single, only, instead of using the single-transfer paper, a temporary support is used in its place. These temporary supports may either be rigid or flexible. Ground opal is used for the former. This has to be first rubbed over with French chalk, dusted, and then coated with weak collodion.

The flexible supports have to be prepared by waxing with a solution of beeswax and resin in a solvent, as turpentine. From the temporary support the print is transferred to a final support, which is purchased ready prepared.

" Gum Bichromate," and " Ozotype " belong to the same class as carbon.

CHAPTER XII.

TRIMMING AND MOUNTING.

SELECTION—TRIMMING—MOUNTING—MOUNTS.

MUCH ultimate success of the photograph depends upon careful and judicious trimming.

The operation in its simplest form consists of merely cutting away the white edges surrounding the print, produced by the rebate of the printing-frame shielding the paper during printing.

SELECTION.

Much more, however, lies behind the trimming of a print than appears at the first glance ; in many instances the making or marring of a good pictorial photograph depends upon this operation. If the cutting away of half the print will benefit the picture, do it. A good axiom is " Little, but good." Many of the most beautiful photographs to be seen on the walls of the leading exhibitions are obtained by first enlarging a photograph of small size and then drastically trimming down. Here—as suggested under " Treatment of the Subject " —comes the final effort in making a photographic picture. To help in the selection of the portion of the print to be retained, two pieces of brown paper are cut in the shape of the letter L and laid on the print as shown in Fig. 46. These form a frame, and should be moved about in all directions, until that portion is found which pleases the most. The print is then marked by pin-pricks at each corner of the opening showing the view ; it is then ready for trimming.

Trimming.

A piece of plate-glass or zinc about 12 or 18 inches square, a cutting-knife and cutting-shape are required for the operation of trimming. An old negative from which the film has been washed off often suffices for a cutting-shape or guide for the knife. A shoemaker's knife is useful; it must have a keen edge and sharp point.

The print is laid face upwards upon the glass or zinc, and the cutting-shape upon it in such a manner that the top and one side may be conveniently cut away. The

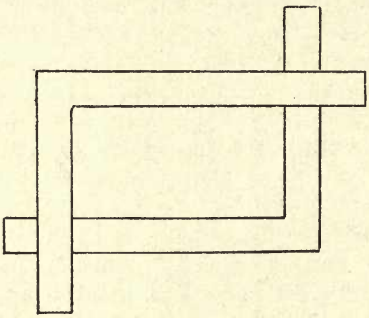

Fig. 46.

print is then turned round, the shape replaced, and the bottom and other side removed. Care must be taken to see that the top and bottom are quite parallel, and that the sides are too. Often the back edges of the guide help in this direction. It should be noticed if these are parallel with the already trimmed sides.

The portion to be removed must be cut away with one clean sweep of the knife, which should be pressed lightly against the cutting-shape, upon which slight pressure is exerted to prevent movement. In this way all ragged edges will be avoided.

Mounting.

The print is laid face downwards on a piece of clean paper. It should be kept down by pressure of the fingers of the left hand, so placed that the margins shall not turn in. The mountant is first applied to the margins, so that they will become soft and lie flat, and is afterwards well brushed in all over.

This method of handling will be found convenient on sizes up to a quarter-plate. When mounting prints of larger sizes than this, say up to 10 by 8, the following method is very useful :—Two pieces of glass, which, when placed side by side on the back of the print, will leave an inch margin all round, are used. This margin is first well coated with mountant, then one piece of glass is removed and the place where it has been lying coated, and finally the other glass is taken away, and the paste brushed all over. In this way the tendency for the paper to turn in and smear the face of the print is obviated.

When the mountant has been applied, the print is carefully laid on the mount and pressed into contact. This is best done by laying a piece of waxed paper, as found round P.O.P., upon the surface of the print, and commencing at the centre with a circular motion, carefully rub down towards the margins. See that the edges of the print are in close contact with the mount, otherwise they will stick up when dry, and look unsightly.

Before attempting to mount very large prints they should be soaked in water, then laid face downwards on wet glass to receive the mountant ; afterwards place on the mount and press into contact with a wetted roller squeegee, or cover with a piece of fluffless blotting-

paper and rub gently. There are several ready-made mountants on the market; these more or less have starch as a basis.

It is an easy matter to make mountant by putting a teaspoonful or so (one part of starch in ten parts of water is a good working strength) of starch into a cup, making it into a stiff paste with a small quantity of cold water, then gradually adding boiling water until it turns into a nearly clear jelly. When cool it is ready for use. Starch paste is not suitable for mounting P.O.P. prints which have been highly glazed on plate-glass, as the surface would be affected. These are best mounted in this way: while the print is still upon the glass, a piece of backing paper, one-eighth of an inch smaller each way, is attached by means of thin gelatine mountant (one part of thin gelatine dissolved by heat in ten parts of water). When the print leaves the glass it is trimmed, and fixed to the mount by the gelatine mountant applied to the margins to the extent of half an inch all round.

Mounts.

Ordinary cardboard must not be used, as it may contain substances which may affect the print after it is mounted. Proper photographic mounts must always be obtained. Dealers generally hold a large assortment in various colours, shapes, and sizes to select from. They may be either "Paste-on" or "Slip-in." In the former the print is attached by mountant; in the latter it is merely slipped in. Again, the mount may be the same size as the print; that is, it will only show just a bare margin, or it may have a border. Mounts of this description are made to standard

sizes, and are arranged for the various sizes of plates and films.

The worker, as progress is made, may find it inconvenient to be bound by fixed sizes, and the desire may arise to prepare a mount to a size more suitable for the print, and by which it will be helped and set-off. Berlin mounting boards—grey or white—are the most useful for this purpose. Sizes from 7 inches by 5 inches to 15 inches by 12 inches will be found most satisfactory in the substance known as "6-sheet." This class of board will be adapted for use when the print is to be pasted on. If, however, it is thought that the print would look better behind a cut-out opening in the mount, the substance of the board should be "12-sheet" —this allows for a good bevelled margin. The "12-sheet" boards can be bought in large sizes up to 54 inches by 36 inches, but boards half this size, or even less, will be found easiest to handle.

Very effective results may be obtained by facing the mounting boards with tinted papers, which may be bought in various shades of grey, brown, and green, or by superimposing one tint upon another to give margins of varying widths round the print. The blending of tints and arranging of margins must be done with caution. A cold-toned print will be made to appear colder by comparison if mounted upon a warm-tinted (brown) mount, and *vice versa*. A long, narrow print will be made to appear longer if mounted upon a mount having the margins somewhat extended lengthways instead of the same width as at top and bottom.

TO FACE MOUNTS WITH TINTED PAPER. The paper is cut the same size as the mount and placed in water to soak.

It must be remembered that paper slightly increases in size by expansion when wetted. During the time the paper is soaking the mount must be sponged over with water. The paper is taken from the water and dabbed with a cloth to dry off the superfluous moisture. The mountant is then applied, and the paper is carefully laid in position on the card and pressed into contact with a cloth, commencing at the centre and working out towards the margins. As the paper dries it will contract and become stretched tightly upon the cardboard, and further than this it will cause it to warp. This may be overcome by applying a piece of ordinary paper to the other side to act as a "Counter Pull."

TO PREPARE A "CUT-OUT" MOUNT. Cut the mount to the size required from a piece of "12-sheet" cardboard. The size of opening will be regulated by the size of the print. It must, however, be about a quarter of an inch less each way in order that the margins of the print shall be covered. The size of the opening having been decided upon, it is necessary to find the centre of the cardboard; this is done as follows: The mount is represented in Fig. 47. A, B, C, and D are the corners; to find the centre lay a rule across from A to D, make a pencil mark about an inch or so long near where it is thought the centre will come; then draw a similar line after laying the rule across from B to C. The centre will be where the lines cross. Through the centre draw a line parallel with A B, and one crossing it parallel with B D. Upon these two last lines the measurements for the opening are set out. Supposing the opening is to be 6 inches long by 4 inches wide: for the length 3 inches should be measured off on either side of the centre on the horizontal line, and for the

width 2 inches on either side on the vertical. Faint pencil lines drawn through these points will give the outlines of the opening E F G H, upon which the cutting-guide will be laid.

The cutting-guide is made from hard wood, and should be from 18 to 24 inches long and have one edge bevelled to an angle of 45 degrees, and the other a straight edge. The dotted lines shown at C give a sectional view of the guide. The card must lie upon a piece of zinc, and upon it the cutting-guide with the bevelled edge to the pencil line E F. The cutting-knife is laid flat upon the

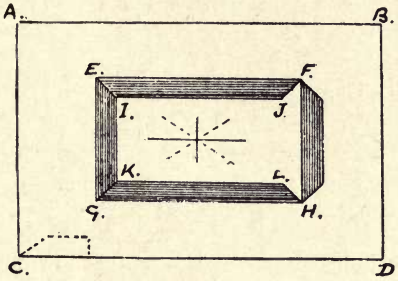

Fig. 47.

bevel of the guide with its point on the card at F. Hold the whole firmly in position and make a strong cut along the line to E. Repeat until the card is cut through. Do this on each of the lines, and the portion may be removed. The corners may require a little trimming out.

If the cut-out mount is to be faced with tinted paper, it is done in the same way as the plain mounting board. When the paper has been attached to the card the whole is turned over on its face on the zinc. A portion of the paper is cut away as indicated by I J K L. Further

cuts are made at the four corners, as E to I, and so on. The paper is then folded back upon the mount as shown at F H. This is done all round; it is then pressed into contact. The print is first mounted on an ordinary plain mount, and afterwards glued behind the opening of the cut-out mount.

CHAPTER XIII.

ENLARGEMENT MAKING.

BY DAYLIGHT—BY ARTIFICIAL LIGHT—TRANSPARENCIES.

THIS may be done in one or two ways, either by daylight or artificial. The enlargement may be made either from a small negative direct upon bromide paper, or by making an enlarged negative and printing in the ordinary way upon any of the papers, as P.O.P., Platinum, Carbon, etc.

DAYLIGHT METHODS.

This is carried out by means of an ordinary camera in the dark-room, or in a properly constructed enlarging camera.

By the Ordinary Camera.

This is within the reach of anyone who possesses a camera with bellows and preferably a lens of short focal length (about 6 inches). By reference to "Daylight as the Source of Illumination for the Dark-room" it will be found that mention was made regarding the position of the frame, A, Fig. 30, in the window-shutter, if there were likely to arise at any time a desire to make enlargements by daylight. A ledge is necessary to support the camera exactly in front of the window-shutter opening; as this ledge must be attached to the framework, it will, to a certain extent, regulate the position of the opening. If the opening in the window-shutter is larger than the negative from which the enlargement is to be made, the negative must be supported in a carrier. This is a second frame of thin

wood having an opening, into the rebated portion of which the negative will exactly fit. Fig. 48 shows a side-view of the arrangement of the camera and surroundings placed ready for making an enlargement. A is the ledge to support the camera, which, after removing the back, must be pushed up to cover the opening C, in which the negative has been placed with the film side

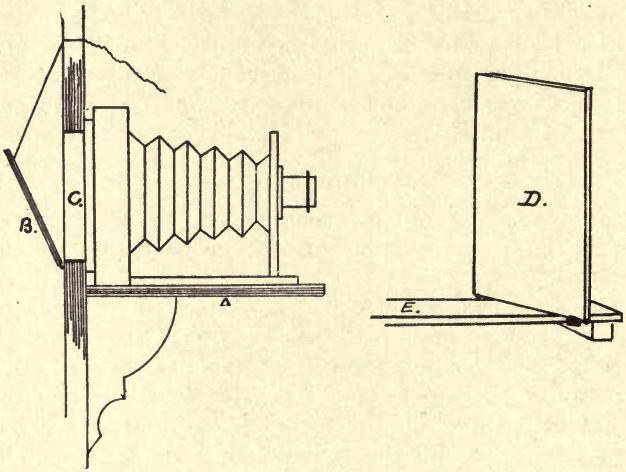

Fig. 48.

into the room. If any stray light should make its appearance between the opening and the camera, it must be shut out by wrapping the dark-cloth round. B is a reflector of white cardboard carried on wood hinged to the window-shutter, that it may be manipulated from inside by means of a piece of string. This reflector is to catch the light from the sky and throw it back through the negative, otherwise uneven illumina-

tion will result, and a portion of the sensitive paper will be over-exposed and the other under-exposed. The image from the negative, after passing through the camera, will be received on the easel, D, upon which a piece of white paper has been pinned. The support, E, may be either a continuation of the ledge, A, or a separate piece. The camera and easel must be held firmly in position by some means or other after the focussing has been done, also the reflector moved up and down to ascertain if the best possible illumination has been obtained.

Focussing.

The following applies to all the enlarging apparatus. When a lens is equidistant between the negative and the easel and the focus has been obtained, the image will be equal in size in both cases. This should be remembered when wishing to copy a photograph. When the lens is brought nearer to the negative, it will be found that the easel must be placed farther away and the image will be increased in size.

The Exposure.

This will depend entirely upon the quality of light prevailing at the time. Trial-exposures on a slip of bromide paper are recommended. The lens must be closed: then fasten a strip of fast bromide paper down the easel; this should be covered with a piece of brown paper. When an enlarging apparatus is used the trial strip is placed in the dark-slide. Uncover a third part of it, and give half a minute exposure; uncover another third part, and give a further half-minute, and then remove the covering entirely, and expose for half a minute again; this will then represent, half, one, and one and a half minutes' exposure. The exposed paper is then developed in a normal hydroquinone or other

suitable developer. The times given above are merely suggestive ; a correct exposure may be obtained in less time, or it may require longer. When the correct time has been ascertained, the large sheet of sensitive paper is put in position, the exposure made, and the development, etc., carried out exactly as for ordinary bromide paper.

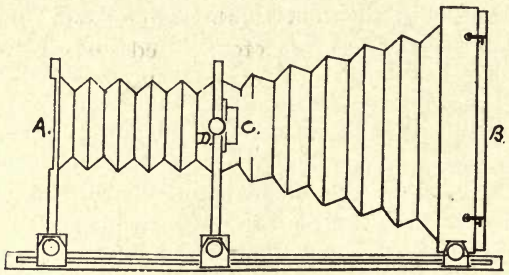

Fig. 49.

The Daylight-Enlarging Camera.

In this the same principle is involved, only, being self-contained, no window arrangement is necessary. Fig. 49 represents a section of the apparatus. It consists of two chambers, one large and one small. The negative is placed in the opening at the end of the small one at A ; the end B of the large one is provided with a ground-glass movable focussing screen, which is replaced by a dark-slide containing the bromide paper. The lens C is attached to the middle support. It should be provided with a shutter working close to it, and operated by the milled-edge screw, D, from the outside.

The work—with the exception of filling the dark-slide

—should be done preferably in the open, where the negative may get an uninterrupted and even light from the sky, by tilting the enlarger at the time of the exposure. The focussing is done by moving the various parts about until the image is quite clear. This operation may be materially helped by having a piece of white card placed at an angle to the negative; the image on the focussing screen will then be better seen. The same experimental exposures as suggested

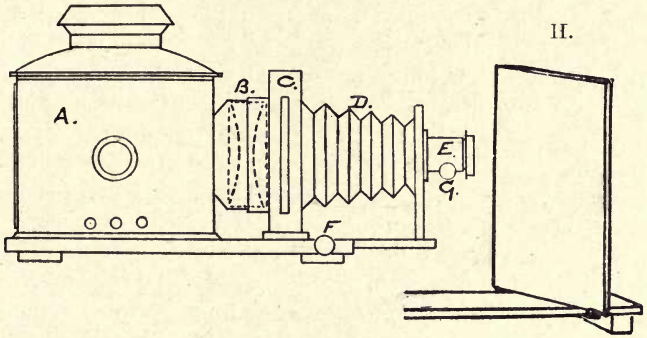

Fig. 50

above should be made before putting the large sheet of bromide paper into the dark-slide.

Enlarging by Artificial Light.

This is usually done by means of a lantern, as shown in Fig. 50. The system consists of a lantern, A, for the illuminant, a condenser, B, a carrier for the negative at C, and a camera-like arrangement, D, with the lens, E. The illuminant may be ordinary paraffin or incandescent gas. In either case, the rays must be concen-

trated by means of a condenser. This consists of two plano-convex lenses mounted in a brass cylinder, as indicated by the dotted lines in the condenser chamber, B. It collects and passes the rays to the negative. True centring of the light must be obtained, indicated by a bright even disc on the easel, otherwise an uneven exposure will result. The paper is carried on the easel, H, in the ordinary way. If the lens is provided with a yellow glass cap, focussing may be done direct upon the bromide paper when in position. The cap will then merely require taking off to make the exposure.

Experimental exposures should be made, and when the correct one is found it should be noted, to facilitate work on any future occasion, because, as the illuminant is under control, it is always possible to obtain certain results. Grouping the negatives in their various densities, as thin, medium and thick, will materially assist in the estimation of the necessary exposure.

Enlarging by Artificial Light must be done in a dark-room. The illuminant should be lighted, and the lantern allowed to remain open to warm and for any condensation moisture to pass off, or wiped from the condenser. In the meantime the negative is placed—film side facing into D—in the carrier, and this pushed home through the opening in C. The image will appear more or less blurred upon the paper on the easel, H. It is roughly focussed by means of the milled-screw, F, and the final fine adjustment of focus made by the lens screw, G. The daylight-enlarging apparatus, Fig. 49, may be used for artificial light with magnesium ribbon. The ribbon is burned in a reflector made from metal bent to a half-circle. The inside of the reflector is polished and the ends turned to screen all light, except that reflected from the polished surface. The light must be diffused

by being made to pass through a piece of white tissue paper or ground-glass placed between it and the negative.

After the exposure has been made, the development of the paper is carried out in the same way as with other bromide paper of small sizes. Enamelled metal dishes may be used for the purpose. The paper must be well soaked before pouring on the developer, and the appearance and growth of the image closely watched, as the large sheets of bromide paper are somewhat expensive. A tuft of cotton-wool lightly passed over the surface of the paper, after pouring on the solution, will break up and remove any air-bells that have formed. After development the print must be thoroughly fixed, washed and dried.

Enlarged Negatives.

Enlarged negatives may be made in two ways, either by making a small transparency (or positive on glass) and enlarging up directly from it on the large plate, or by making a large transparency from the small negative, and from the transparency a large negative by contact.

For the small transparency a plate should be used which has a fine grain ; such plates are specially prepared for the purpose, and these should be obtained. It is laid upon the negative, placed in a printing-frame and exposed to a lamp or gaslight. If to the latter, only about one second exposure will be required at a foot. The development must be carefully carried out with the idea of obtaining an image full of detail without any heaviness. When the transparency has been fixed, washed and dried, it is placed in the enlarging apparatus and the enlarged negative made therefrom. The enlarged negative having been obtained, any printing medium may be used. Negative glass is usually thin, and the precaution should be taken of having a piece

of good ordinary glass placed in the printing-frame first and the negative laid upon it during printing.

The Transparencies

may be used for decorative purposes if they are bound up in contact with a piece of finely-ground glass, by means of lantern-slide binding material. It is then hung that light may pass through it.

Negative paper or even bromide paper may be used for enlarged negatives in place of plates. These have to be treated with something such as vaseline to render them more transparent before being used for printing.

CHAPTER XIV.

LANTERN-SLIDE MAKING.

BY CONTACT—BY REDUCTION—FINISHING.

LANTERN plates may be bought to give either warm or cold tones. The size of the lantern plate is $3\frac{1}{4}$ inches square, therefore it is somewhat smaller lengthways than a quarter-plate; but it frequently happens that the sacrificing of this odd inch when working with a quarter-plate negative does not affect matters, and very effective lantern slides can be made from this popular size.

All operations until after fixation must be carried out in the dark-room.

Lantern slides are made either by contact or reduction.

By Contact. Supposing, then, a quarter-plate negative is to be printed from, it is laid in the printing-frame in the usual way, and upon it a lantern plate; care should be taken not to scratch the one with the other. Hold up the frame so that the light from the dark-room lamp may pass through it. Carefully move the lantern plate to and fro until it includes the portion of negative that will make the best picture. Replace the back, and all is ready for exposure; if the frame has to be taken from the room for this purpose it must be covered up.

The length of exposure will depend upon the character of the negative and source of light. As a first attempt, it will be as well to select a fairly strong negative to the working of which in other printing media the worker is accustomed, and make trial exposures. A fast (black-

and-white) lantern plate exposed under it at a foot from an ordinary gas flame might be given five, ten, and fifteen seconds' exposure by uncovering in the usual way. When the correct time is found, a lantern plate should be exposed, developed and fixed. By experimenting in the early stages in this way, the worker will soon acquire a fair idea of how long exposure to give with the general run of negatives.

By Reduction.

When a lantern slide is required from a negative larger than a quarter-plate, it must be done by reduction. This operation may be regarded as just the reverse of making an enlarged positive. The negative is placed in the opening of the window-shutter and the camera is brought some distance along the support or ledge ; this time it is turned with the lens pointing towards the negative. For the time being the easel is moved out of the way, as it is not required, the ordinary back and dark-slide of camera taking its place.

The dark-slide should be provided with a carrier to hold the lantern plate, and the focussing screen marked with pencil in such a manner that the markings will come exactly in front of the spot to be occupied by the plate. Evenly illuminate the negative by means of the reflector outside the window-shutter. Rack out the camera, and move it along the support backwards and forwards until the image is sharp, and the marked portion of the focussing screen is occupied with the desired amount of the picture. If not as required, any alteration necessary should be made. When all is ready, the lens is closed and the dark-slide put into position.

The exposure will depend upon the light, and again trial exposures are recommended by drawing the shutter so that a plate of fast speed may receive three distinct

exposures of ten, fifteen and twenty seconds. The final exposure may then be made, and the other operations proceeded with.

As in enlarging, if a room cannot be had, the slides can be made in a reducing or lantern-slide camera, as Fig. 49, used in a reversed way.

Development.

The development is proceeded with exactly as for plates. A developer giving strong contrasts is the best, as the one of hydroquinone with caustic soda as the accelerator. The development is carried on until the high lights begin to veil; aim at getting good density with thin high light and crisp detail. Judging the proper density requires some experience, as sometimes a slide which looks well in the hand does not throw a good picture in the lantern.

Finishing the Slide.

When the plate has been developed, fixed, washed and perfectly dried, it must be bound up with a piece of thin glass to form a cover and protect it from damage. Before binding, the slide should be made perfectly dry by gently warming.

A piece of lanternslide binding sufficiently long to go round all the four sides is damped. The slide and cover-glass (which must be quite clean) are put squarely together; place the edges upon the binding with gentle pressure when contact is made, turn on the next side, press, and repeat until all the four sides are covered. Now press down the overlapping portions of the binding on the opposite sides, and set aside to dry. The operation is more conveniently performed in a lantern-slide binding-clamp, Fig. 51, which holds the slide and cover-glass together while the binding is applied.

Masks of various shapes may be bought for placing between the slide and glass to render the appearance more effective. These masks are spotted to indicate the correct way of the slide. Each slide should be carefully titled.

Toning Lantern Slides.

The normal colour of the lantern slide is black and

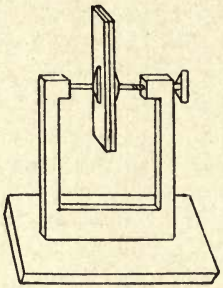

Fig. 51.

white—like a negative—except in some specially made lantern plates, which give a brown deposit. These latter may be toned in a combined toning and fixing bath to a purple tint. The ordinary ones may be treated with the same toning baths as given under the heading "Toning Bromide Papers," with practically the same resulting colours.

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