MPLETE INSTRUCTIONS IN HOTOGRAPHY

By F. M. NEEDHAM

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COMPLETE INSTRUCTIONS

IN

PHOTOGRAPHY

By F. M. NEEDHAM

A GUIDE FOR THE BEGINNER AND BOOK OF REFERENCE
FOR THE EXPERIENCED PHOTOGRAPHER,
WITH THIRTY-SIX ILLUSTRATIONS

Published by

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CONTENTS.

INTRODUCTION

In this little volume we shall entirely avoid all the complicated theories of the chemistry and optics of photography, and confine ourselves simply to those facts and principles which everyone must be familiar with in order to produce good pictures. There is plenty of time to take up the scientific theories of photography when you have learned the fundamental rules of exposure, development and printing.

Photography undoubtedly offers a more attractive field, either for pleasure or business, than anything else at present open to consideration, and its great popularity is probably due, in no small measure, to the simplification of the various processes, the perfection which has been attained in the manufacture of cameras, dry plates, sensitized paper, and the various other materials and apparatus used, all tending to make the production of photographs a simple and easy matter.

In these days the lover of the beautiful secures in a few moments exact likenesses of the choicest views of nature, which formerly could be obtained only in a slow and laborious manner by those favored few gifted with the ability to draw or paint. What could be more treasured in after years than pictures of friends or family, the old home, with all its fond memories and scenes of past pleasures?

The modern photographic outfit places the ability to make such pictures in the hands of everyone, and we believe that the time will soon come when a person unable to operate a camera will be as rare as one unable to read.

Before taking up the subject of photography in detail, the author wishes to particularly impress upon his readers the importance, in fact, the imperative necessity for the most careful and watchful attention to details. Success in photography is dependent upon the little things. The principles involved are simple and easily mastered, but there is always a right way and a wrong way to do everything. Photography is simply a branch of those great sciences,

chemistry and optics, in which there is no guesswork, no chance, every result being in accordance with fundamental principles and laws which are inexorable. Like causes always produce like results, and when you make a negative which does not prove successful, you may rest assured that in some detail, apparently unimportant or perhaps entirely overlooked, you have transgressed these natural laws, and a repetition of the same difficulty is only avoided by carefully ferreting out the cause of the first failure.

HOW TO SELECT AN OUTFIT.

As this book may fall into the hands of some who have not yet purchased a camera, we have endeavored to give such information as shall make the selection of an outfit easier for those who have had no experience in photography; so if you are about to invest in an outfit, we advise you to carefully read over the descriptions of the different forms of cameras as given in the following chapter, noting carefully what is said in regard to the kind of work for which each style is suitable, and then after carefully studying the description of cameras and complete outfits as given in our catalogue, taking into consideration, also, the amount of money which you wish to invest, you should have no difficulty whatever in deciding which outfit to order.

Many who order cameras without fully investigating the subject beforehand, find, as soon as they become familiar with the work, that some other style, size or kind would have been more suitable for their purpose. We believe, however, that anyone who makes a selection with the aid of the suggestions given here, together with the very complete and careful descriptions of the goods listed in our catalogue, will be sure to get an outfit which will prove entirely satisfactory and perfectly suited to the purpose contemplated.

CHAPTER I.

CAMERAS.

Essentially a camera is simply a light-tight box with a piece of glass, called the lens, in one end and a means of supporting the sensitive plate or film in the other end. Rays of light, reflected from the object to be photographed, pass through the lens and are projected against the plate where they impress upon its sensitized surface the likeness of the object.

The box constituting a camera may be constructed entirely of wood or metal in a rigid manner, or it may be constructed partly of leather, cloth or rubber, in such a way as to permit its being folded into a more compact form when not in use, and it may be fitted with various adjustments and accessories; but no matter how complicated the camera may appear at first sight, a slight examination will demonstrate the fact that essentially it is simply a light-tight box with a lens in one end and a means for holding the dry plate or film in the opposite end.

THE CONLEY SENIOR, A BOX CAMERA.

All cameras may be divided into four general classes, the simple hand cameras, frequently called Box Cameras, the Folding Hand Cameras, View Cameras and Portrait Cameras. There is an infinite variety of makes, forms and styles of cameras, but they can all be classified under one or the other of the above heads.

In taking up for consideration these different forms of cameras, it will be impossible for us to touch upon the details of manipulation, such as the operation of shutters, methods of adjusting, etc., as these details vary in different makes and, moreover, small instruction sheets covering these particular points are always sent with each camera.

Box Cameras

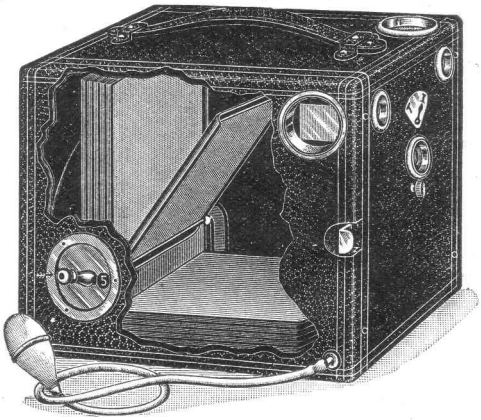
The simple Hand Camera or Box Camera is by far the most popular and most universally used of all cameras. This is undoubtedly due, first, to its simplicity of operation, and secondly, to the low price at which such cameras can be purchased.

Although a box camera is capable of producing fine pictures within certain limits, there are many kinds of work beyond its capacity, and many pictures which cannot be made at all with a box camera are easily made with a camera more complete in its adjustments.

There are two principal forms of box cameras, known as plate holder cameras and magazine cameras. In the plateholder camera the sensitive dry plate upon which the picture is made is placed in what is known as a plate holder, and this plate holder, with the plate in it, is inserted in the back of the camera when a picture is to be made. Each plate holder holds two plates, and the plates must be put into the holder in the dark room.

The Magazine Camera is so constructed that a large number of plates, usually twelve, can be put directly into the camera itself and exposed, one after the other, thus doing away with the use of plate holders.

The most popular and undoubtedly the best magazine camera is the Conley Magazine, and our illustration shows the manner in which the plates are held and manipulated inside the camera.

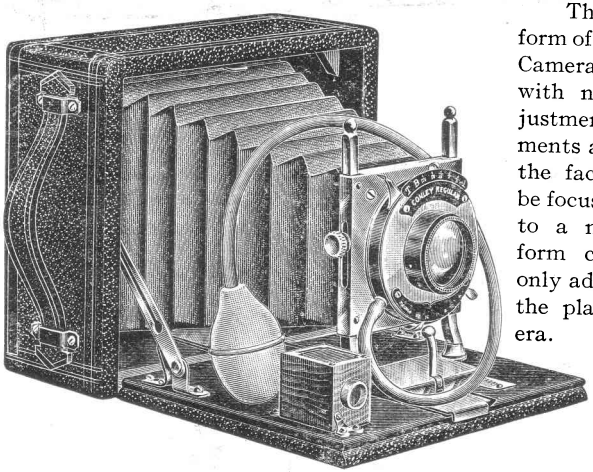


CONLEY MAGAZINE CAMERA, SHOWING INTERIOR ARRANGEMENT.

A Box Camera is about the best instrument for a beginner who desires a simple, yet good camera at a very small expense. Box cameras are usually provided with universal or set focus lenses, that is, lenses not requiring to be focused and therefore mounted immovably in the camera front. Such cameras offer special advantages to the beginner, or to those who do not wish to go too deeply into photography, as it is not necessary to adjust the focus each time a picture is taken.

Folding Hand Cameras

The Folding Hand Camera is the next step above the Box Camera, and consists essentially of a front part supporting the lens and a rear part with adjustment for holding the sensitized plate in position, these two parts being connected by a rubber or leather bellows, which folds like an accordion, making it possible to fold the camera into smaller space for convenience when not in use. The principal and most important advantage of the folding hand camera lies in the fact that the distance between the plate and the lens may be altered at will; in other words, the camera may be focused.



CONLEY A FOLDING CAMERA.

The simplest form of Folding Hand Camera is provided with no special adjustments or improvements and, therefore, the fact that it can be focused and folded to a more compact form constitutes its only advantages over the plain Box Camera.

In the more complete folding cameras, however, is reached the highest degree of perfection attained in the making of cameras, and some of the latest styles, complete with all the most improved adjustments are marvels of mechanical perfection and capable of the difficult work.

We reproduce an illustration of the Conley A Folding Camera, which is an excellent example of the Folding Hand Camera, and which, although not as complete in its adjustments as some of the more expensive cameras, is thoroughly well made throughout and fully meets the requirements of the vast majority of amateur photographers. The highest types of Folding Hand Cameras, complete in every detail and adjustment (some of which are not used once in a hundred exposures), might very properly be called photographic luxuries.

The Folding Hand Cameras are designed to be used either with or without a tripod, and are suitable for any class of work which may be done either with a simple Box Camera or a complete Professional View Camera.

A VIEW CAMERA

View Cameras

Cameras designed for use only with a tripod are called View Cameras and are almost always employed by professional photographers. Although they do no better work than a good Folding Hand Camera, they are more strongly and substantially constructed; convenience in operating, together with strength and durability, being the points kept most prominently in view by the manufacturers, rather than mere elegance of finish or compactness.

The best example of a thoroughly well made, substantial, serviceable View Camera is the Queen City shown in our illustration. A camera like this one can be

used for any kind of work which either an amateur or professional photographer would ever have occasion to do.

We cannot too strongly recommend the View Camera to both amateur and professional for general photographic work. It combines ease of operation, completeness of adjustment, strength and durability to a degree not reached in other styles of cameras. The bellows is made amply long, the swings possess great latitude, the front has a wide range of movement, all adjustments are easy to get at, and therefore convenient to manipulate. The style of construction permits the use of extreme wide angle lenses, or any kind of rapid rectilinear or anastigmat lenses, even the largest sizes, and the ample size and strength of the front even permits the use of the smaller types of portrait lenses. In a View Camera nothing that will add to its convenience of operation, its accuracy and ease of adjustment, in short, to its effectiveness as a picture taking machine, is sacrificed for mere elegance of appearance or compactness.

A View Camera is a businesslike camera for real photographers who are seriously interested in their work and who want an outfit that is, above all other considerations, thoroughly practical in every detail.

Portrait Cameras

Portraits can be made with either a regular View Camera or Folding Hand Camera, and in a limited way even with a simple Box Camera, but the camera designed especially for the purpose has points of superiority for this particular work, and in photographic studios or galleries regular Portrait Cameras are usually employed. As these cameras are designed only to be used in studios, no attempt at reducing them in size or weight is made, so they are always large and heavy, and must be supported on what is known as a camera stand, a device so arranged that the camera may be quickly raised, lowered or tilted to any desired angle, and for convenience in moving the instrument about the gallery, the stand is usually furnished with small wheels or casters.

As before stated, however, just as good portraits can be made with a View Camera as with a Portrait Camera. It is merely a question of convenience in working, and many professional photographers who do both portrait work and outside work and who do not care to invest in two cameras use a View Camera for both purposes. While the View Camera readily adapts itself to either line of work, the Portrait Camera, owing to its size and weight, is suitable for use only in the studio.

CHAPTER II.

LENSES AND SHUTTERS.

As previously explained, the lens is the piece of glass in the front of the camera and is the most expensive and the most important part of the outfit. The quality of work done with a camera depends entirely upon the lens, and therefore, in selecting your outfit care should be exercised to secure one containing a good lens. As the quality of the lens cannot be judged in any way by its appearance, and as a beginner in photography is entirely incapable of judging a lens, even by an actual trial, it is usually necessary to take the dealer's word regarding this point and thus the advisability of dealing with a house whose goods are known to be exactly as represented is apparent.

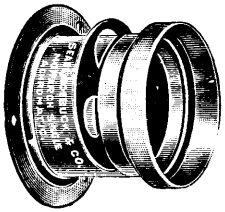
Photographic lenses may be divided into five general classes, single lenses, double or rapid rectilinear lenses, anastigmat lenses, wide angle lenses and portrait lenses.

Non-Achromatic Single Lenses

The cheapest photographic lens made is a single convex lens, just like a common magnifying glass or like the lenses in spectacles which very old people wear. Such lenses are used only in the very cheapest cameras and as they are not accurately ground and not properly corrected, they distort the picture, and as they are not achromatic they separate the rays of light into colors, thus blurring the picture.

Achromatic Single Lenses

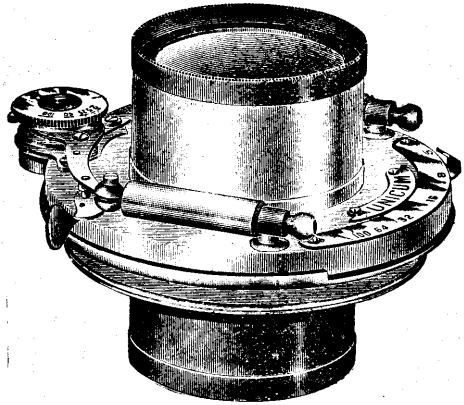
The Single Achromatic Lenses are composed of two simple lenses, one double convex, the other plano convex, cemented together, thus apparently forming a single lens. Such a lens does not separate the rays of light into colors and will therefore form a sharp, clear picture. Such cameras as the Conley Sr. Box, or the Conley Magazine Camera are provided with single achromatic lenses.



SINGLE ACHROMATIC LENS WITH REVOLVING DIAPHRAGM.

Rapid Rectilinear Lenses

A Rapid Rectilinear Lens, which is a double lens, consists of two single achromatic lenses mounted in opposite ends of a brass tube. They are called rectilinear because they render the straight lines of a picture without distortion, the word rectilinear being derived from the Latin words for straight and line.



THE CONLEY F.8 RAPID RECTILINEAR LENS.

A rapid rectilinear lens, as already explained, consists really of two lenses which are spoken of as "combinations," the lens in the front of the tube being known as the "front combination," the other as the "rear combination." The better grades of rectilinear lenses are so designed and constructed that the separate combinations may be used alone, which is a desirable quality, as the single combinations possess a much greater focal length than the complete lens, and the efficiency of a photographic outfit is much increased by having available lenses of different focal lengths.

Each combination of a double lens consists of two or more pieces of glass which are firmly cemented together with an invisible cement (balsam), thus apparently forming a single lens.

In a general way, rapid rectilinear lenses are divided into two classes, "symmetrical" and "convertible." A symmetrical lens is one in which the front and rear combinations are of the same style of construction and the same focal length; in other words, the front combination and rear combination are exactly alike, and it is from this fact that the lenses are spoken of as symmetrical. In a symmetrical lens the single combinations usually have a focal length of about double that of the complete lens.

Convertible lenses are lenses in which the front and rear combinations are of different construction and consequently of different focal lengths, and with a convertible lens the user has at his command three different focal lengths, namely, the complete lens, the

front combination alone, and the rear combination alone. Of course, in different lenses the relative focal lengths differ, but taking the lens furnished with the Conley Double Extension Camera in the 5x7 size, we have an example of a rectilinear lens of the convertible type in which the focus of the front combination is 18 inches, the rear combination, 14 inches, and the complete lens, 8 inches.

Next to an anastigmat lens a good rapid rectilinear lens of the symmetrical or convertible type is the best lens to use for general all around photographic work.

Wide Angle Lenses

Wide Angle Lenses are much the same as rectilinear lenses in general construction, but the two combinations are mounted more closely together and for this reason a wide angle lens is capable of including a much wider extent of view, hence the name wide angle.

These lenses are not very suitable for landscape or outside view work, although in certain cases, such as the photographing of buildings, where it is impossible to get far enough away to include the whole of the building with a rectilinear lens, the wide angle lens becomes a necessity.

MONARCH WIDE ANGLE LENS.

Wide angle lenses are especially desirable for photographing interiors; in fact, they are practically indispensable for this work, as a single achromatic or rapid rectilinear lens does not include a sufficiently wide angle of view to make a good interior.

Anastigmat Lenses

Anastigmat Lenses represent the highest degree of perfection in lenses and possess points of superiority over the rapid rectilinear lenses which make them very desirable. As compared with rapid rectilinear lenses, the anastigmat lenses possess greater speed, better definition, and entire freedom from astigmatism. Definition is that property of a lens which enables it to make sharp, clean cut pictures, and while fine definition may be obtained with an ordinary rectilinear lens by using a small diaphragm, which, of course, necessitates a longer exposure, the anastigmat lens will give good definition even with the full opening. Anastigmat lenses are suitable for all kinds of photography and may be described as "universal" lenses, as they are adapted to landscape work, architectural subjects, interiors, groups, portraits and copying. The large working aperture makes them particularly suitable for very rapid instantaneous exposures and for

portrait work. A few years ago anastigmat lenses could only be purchased at very high prices, placing them beyond the reach of many photographers, but during the last few years these lenses have not only been still further improved in quality, but the competition between different manufacturers has gradually brought the prices lower and lower until now it is possible to purchase a strictly high grade genuine anastigmat lens with an effective aperture as great as F.6.8 at prices for the 4x5 and 5x7 sizes ranging from $20.00 to $35.00, including shutter. Lenses of this style and quality a few years ago could not be purchased for less than $50.00 to $75.00. The modern anastigmat lens is in every way a triumph of optical and mechanical skill.

Portrait Lenses

Portrait Lenses are also very similar in construction to rectilinear lenses, but are so made that they are very rapid, that is, they require very short exposures. Portrait lenses usually have a long length of focus in proportion to the size of the plate and the great rapidity with which they work makes them especially suitable for making portraits.

A PORTRAIT LENS.

Portrait lenses are not to be recommended for anything except actual portrait work indoors. As before stated, all other good qualities are sacrificed in order to obtain great speed and they are not very rectilinear and do not possess much depth of focus. Good portraits can be made with rapid rectilinear or even with single achromatic lenses, the only disadvantage being that a slightly longer exposure must be given than would be necessary with a regular portrait lens.

Focal Length of Lenses

The focal length of a lens is the distance from the ground glass to the optical center of the lens when focused on some distant object. The greater the focal length, the narrower becomes the angle of view, hence the single lens, which usually embraces a narrow angle of view, has a long focal length, and the wide angle lens, which embraces a large extent of view, has a very short focal length.

When the focal length of a double lens is mentioned, it is always understood, unless otherwise specified, to be the equivalent focus, by which is meant the distance from the optical center of the lens to the ground glass when it is focused on a distant object. The optical center of the lens is not usually the same as the actual or mechanical

center except with simple convex single lenses; hence, the term "equivalent" focus as applied to double lenses, meaning that the lens has a focal length equivalent to that of a single lens which would produce on the ground glass an image of a given object at a given distance exactly the same size as would the double lens. In the case of portrait lenses, which are very large and bulky, the back focus is often stated so that purchasers can readily tell whether the camera on which the lens is to be used has sufficient bellows capacity to accommodate the lens. The back focus is the distance from the back of the lens to the ground glass when focused on a distant object.

Diaphragms or Stops

The Diaphragm or Stop is the means of regulating the amount of light which passes through the lens during an exposure. Usually in the old style single lenses or wide angle lenses, there is a round piece of metal with a number of holes of different sizes in it, so placed that any one of these holes or openings may be revolved to the center of the lens and the size of the opening regulates the amount of light admitted. Such stops are known as revolving diaphragms, because they are revolved to bring the desired opening into position.

Rectilinear lenses of the old style were usually provided with a set of loose diaphragms or stops, that is, separate pieces of metal, each with a hole in the center, which were inserted in a slot in the lens tube. Loose diaphragms are known as Waterhouse diaphragms.

Another style, known as the Iris diaphragm, is an ingenious device of thin metal or hard rubber leaves inside the lens tube, so arranged that a round opening is left in the center, the size of which can be varied as desired by turning a lever on the outside. The Iris diaphragm is, of course, the most convenient and satisfactory style, as there are no loose pieces to lose or mislay, and it can be instantly adjusted to any desired size The effects produced by the different styles of diaphragms, Revolving, Waterhouse or Iris, are, of course, identical, and the only differences are matters of convenience in operating or elegance of design and finish.

Use of Diaphragms

The use of diaphragms can best be illustrated by an experiment. Set the camera up and with the largest stop, or none at all, in the lens, focus sharply upon some object about 20 or 25 feet away. Upon carefully observing the image upon the ground glass, you will note that objects quite close to the camera, and probably, also, objects at a considerable distance away, are blurred, that is, not sharply focused. Now, put a rather small stop in the lens and probably the first thing you will

observe is that the image is not nearly as bright as it was. There is less light coming through the lens. But look closer and you will find another change: those portions of the view that were before out of focus or fuzzy are now sharp and distinct.

A little experimenting here will show you that the smaller the stop is, the sharper, clearer and more distinct the picture is, and this may lead you to ask, why not use the smallest stop all the time? In reply, we will call your attention to the fact that the image, although sharp, grows correspondingly darker and dimmer as the stop is made smaller, and as it requires a certain invariable amount of action by light in order to produce the picture, you can readily understand that the smaller the stop is, the longer the exposure must be. It therefore becomes practically impossible, except under very unusual conditions to make a snap shot or instantaneous exposure with a small stop or diaphragm.

Size of Diaphragms

The size or diameter of the stop is usually designated by its relation to the focal length of the lens. For example, if the focal length of the lens is 8 inches and the diameter of the largest stop is 1 inch, the focal length divided by the diameter of the stop gives us eight and the stop is called F.8; F. standing for focal length. In a lens having the largest stop F.8, the next size is F.11, that is, equal in diameter to one-eleventh of the focal length, and the next size is F.16, etc.

There is another system of designating the stops, known as the U. S. system, in which a stop equal in value to F.8 is called No. 4. F.11 equals No. 8, etc.

The following table gives the relative values of the F. system and the U. S. system of making stops:

F.4 equals	No. 1	F.22 equals	No. 32
F.5.6 equals	No. 2	F.32 equals	No. 64
F.8 equals	No. 4	F.45 equals	No. 128
F.11 equals	No. 8	F.64 equals	No. 256
F.16 equals	No. 16		

The size of each successive stop is such that it will require just twice as long an exposure as the one preceding it; for example, if for the No. 4 stop the correct exposure is 2 seconds, the No. 8 will require 4 seconds; No. 16, 8 seconds; No. 32, 16 seconds; No. 64, 32 seconds; No. 128, 64 seconds, etc.

A knowledge of the values of the different stops and their relation to each other is necessary in determining correct exposures and should be carefully studied by anyone using a camera.

Depth of Focus

The experiment of focusing on a certain object with the largest diaphragm in the lens and finding other objects which are closer to or farther from the camera, out of focus, will also illustrate another qualification of lenses, known as depth of focus, or the extent to which both near and far objects can be brought into focus sharply at the same time.

Depth of focus depends entirely on the size of the diaphragm and the focal length of the lens. The smaller the diaphragm is, the greater will be the depth of focus, and the shorter the focal length of the lens is, the greater the depth of focus will be. Conversely, the larger the diaphragm or the longer the focal length, the less depth of focus the lens will possess. An increase in the focal length or in the size of the diaphragm is necessarily accompanied by a corresponding decrease in the depth of focus. Lenses, even of entirely different styles of construction, always possess depth of focus to exactly the same extent if they are of the same focal length when used with stops of the same size. For instance, if we take an ordinary rapid rectilinear lens with a focal length of 8 inches and make a negative with it, using, for example, stop F.32, and at the same time we make another negative with a fine anastigmat lens of 8 inches focal length, again using stop F.32, both negatives will show depth of focus to exactly the same extent. If we take two lenses of unequal focal lengths and use them both with stops of the same value, say for example, F.16, the lens having the shorter focal length will show the greatest depth of focus. If we take two lenses of the same focal length and use one with a large stop and the other with a small stop, the picture made with the small stop will show the greatest depth of focus.

Depth of focus, which is the capacity of a lens to give sharp images of objects situated at different distances from the camera, must not be confused with definition. Depth of focus depends only on focal length and size of stop, and is the same with all lenses where these two factors are the same. Definition, which is the ability of a lens to produce sharp, clear, crisp detail, is a test of quality and is possessed to a much greater degree by fine lenses than by cheap lenses. The finest definition is yielded by the modern anastigmat lenses. Rapid rectilinear lenses give good definition, but not as good as does the anastigmat lens.

From consideration of the foregoing statements, it is apparent that any increase in the working aperture of a lens must necessarily be accompanied by a corresponding decrease in depth of focus, or, in

other words, the larger the stop, the less the depth of focus will be. It is also evident that great depth of focus is easily obtained with any lens by using a very small diaphragm; but this, as explained in the next paragraph regarding speed of lenses, means a corresponding increase in the length of exposure.

It must also be borne in mind that great depth of focus is not always desirable. For example, when photographing a group, it is much better if the background is not sharp. Only the figures themselves in the group should be in sharp focus, and the background and other non-essential details should be made as inconspicuous as possible by having them out of focus. Many landscape pictures are much more artistic if only the important or interesting portion of the picture is sharply defined, and other parts, possibly the extreme distance, are slightly out of focus, thus giving greater prominence to, and emphasizing the essential or important parts of the picture.

The Speed of Lenses

The length of exposure, light and other conditions being equal, depends entirely upon the size of the opening in the lens as compared with the focal length, and this naturally brings us to the consideration of one of the most important qualifications of a lens, viz., its speed or rapidity. It will be readily understood that the lens with the largest opening in proportion to its focal length will be the most rapid, that is, will make pictures with the shortest exposures, and speed is a very desirable feature. The largest opening, sometimes called the aperture, of a single achromatic lens is usually from F.12 to F.15, while a good double or rectilinear lens usually has its largest opening about F.8; so it is very apparent that a rectilinear lens is much faster, that is, requires much shorter exposure than a single lens. To put it into plain figures, a lens working at F.8 will require less than one-third as long an exposure as one working at F.15, all other conditions being equal. This, of course, applies only when working with the largest stop. If both lenses are stopped down to the same size opening, say F.32, for example, then the same exposure is required with each.

The largest opening of a wide angle lens is usually about F.15, and sometimes as small as F.22; so wide angle lenses are necessarily slow.

Anastigmat lenses are much faster than rectilinear lenses, the most popular types usually working at F.6.8, which makes them about 30 per cent faster than the ordinary rectilinear lens working at F.8. In actual practice they make an even better showing than this as

compared with rectilinear lenses, because, owing to their better defining power and flatter field, they can be used at full aperture in cases where the rectilinear lens would be still further stopped down.

Portrait lenses are the fastest of all lenses, all other qualities being sacrificed for the sake of speed, and usually work at from F.3½ to F.5½, which is from two to six times as fast as rectilinear lenses, from ten to fifteen times as fast as single achromatic lenses, and fully twenty times as rapid as the average wide angle lens.

Speed in a lens is especially important when making snap shot or instantaneous exposures, as the extreme shortness of the exposure must be made up or compensated for by an ability to admit a large volume of light, owing to the short time in which the light is allowed to act upon the plate.

Bearing in mind the extremely short time in which light is allowed to act upon the plate in an instantaneous or snap shot exposure (only a small fraction of a second), and remembering that a certain amount of action by light is absolutely necessary in order to impress the picture upon the plate, the necessity of using a rapid lens, that is, one with a large opening, thus admitting lots of light, will be apparent. The fact that a shorter exposure is necessary with a lens which admits a large volume of light may be illustrated in a crude way by the operation of filling a vessel with water through a pipe. The vessel can be filled entirely full with a small pipe, but it will take a much longer time to do it than would be required with a large pipe. In other words, the pressure of water being the same, the larger pipe will fill the vessel much more quickly than the smaller pipe. In the same way a picture can be made in a very much shorter time with a lens having a large aperture than it can with a lens having a smaller aperture.

Single achromatic lenses are rapid enough for ordinary snap shot work when the light is brilliant, but a double or rectilinear lens is, of course, better, and there are many occasions when the light is not quite bright enough to make a good snap shot with an achromatic lens and yet bright enough to make good negatives with a rectilinear lens. The still greater rapidity of the anastigmat lens makes it possible to secure fully timed negatives on dark, cloudy days when snap shots would be impossible, even with the best rapid rectilinear lenses.

With a wide angle lens snap shots can only be made under the most favorable circumstances. In spite of the fact that the wide angle lens is slow, it is a very valuable addition to an outfit, being

especially suited to photographing interiors. As time exposures must be made anyway, when photographing interiors, the slowness of the wide angle lens is no disadvantage, and the wide extent of the view embraced is a great advantage, as single achromatic and rectilinear lenses do not embrace a wide enough angle to show all that is usually desired in an interior view. Owing, however, to the wide angle embraced, these lenses, to a certain extent, distort and spoil the perspective of the view.

Actual Diaphragm Values

In the preceding paragraphs we have explained that the speed of a lens depends upon the size of the aperture as compared with the focal length, but we cannot measure the effective aperture and focal length directly with a rule except in the case of simple lenses, consisting of only one piece of glass or one combination. With a perfectly simple convex single lens we will assume that the diameter of the largest stop or diaphragm is 1 inch and that, when the camera is focused on some very distant object, the distance from the optical center of the lens to the ground glass is 16 inches. We then say that the value of the largest stop, that is, the full aperture of the lens, is F.16; in other words, the diameter of full aperture is equal to one-sixteenth of the focal length and, therefore, this lens is said to have a speed of F.16.

Now, this same principle holds true when we come to double lenses of the rectilinear, wide angle, anastigmat and portrait types, but with double lenses the F. value of the opening cannot be determined correctly by direct measurement with a rule in inches or fractions of an inch. To appreciate this fact, we must remember that the speed of a double lens depends upon the amount or volume of light which it transmits. A single lens transmits a volume of light exactly equal to the diaphragm in diameter, but a double lens transmits a volume of light that is actually greater in diameter than the diaphragm through which it passes. This is due to the fact that the rays of light, as they enter the lens, are refracted, causing them to converge, and the diaphragm, which is located between the front and rear combinations of the lens, allows a cone of light to pass through, which, before its refraction, was greater in diameter than the diaphragm itself.

With single lenses the diaphragm is placed in front of the lens and only the actual volume of light which passes through the diaphragm can be transmitted by the lens, but in double lenses the

diaphragm is placed inside the lens between the front and rear combinations, and the light passes through the front combination first, which by refraction converges it before it reaches the diaphragm and enables it to pass through an opening of less than its own original diameter.

Now, to determine the speed of a lens, we must have these two factors: first, the exact equivalent focus of the lens; second, not the exact diameter of the diaphragm itself, but the diameter of the cone of light which it will transmit. The equivalent focus of a lens is the distance from the optical center of the lens to the ground glass when the lens is focused upon a distant object. With simple lenses we can measure this directly with a rule, because the optical center and the mechanical center coincide, but in a double lens the optical center and the mechanical center do not, as a rule, coincide, and while the actual optical center can be determined by a complicated mathematical computation, it is unnecessary to do so, as there is an easy and simple way to determine the equivalent focus of a double lens and also the actual F. value of the opening, which we will now explain.

To Measure the Speed of Lenses

To measure the speed of a double lens, in other words, to determine the true F. value of the largest opening, we proceed as follows: first, focus very carefully and accurately on a very distant object and mark on the bed of the camera the exact point to which the bellows is extended; second, focus on some small article at a distance which will enable you to make the image on the ground glass exactly the same size as the object itself, and perfectly sharp, with full aperture. A strip of white paper or a rule forms a handy object for this purpose, and great care must be exercised to make the image on the ground glass absolutely the same size as the object itself and perfectly sharp. Now, again, mark on the bed of the camera the point to which the bellows is extended, and the distance between this point and the point to which it was extended previously when focused on the distant object, is the exact equivalent focus of the lens.

It will readily be understood that this work requires a long bellows camera, such as the No. 1 Conley View, or the Conley Double Extension Camera, and to insure accuracy in marking the points to which the bellows is extended, some point on the bed of the camera must be selected where a small mark or scratch can be made on the movable portion to exactly coincide with the immovable part. Then

when the bellows is extended and the second mark made, the exact measurement between the two marks is easily secured.

Third, make a small round hole with a needle exactly in the center of the septum of your plate holder, and put the holder into the back of the camera, the same as when making an exposure, but without the slides in and remove the ground glass. Extend the camera and clamp it tightly at the point where it is in focus on a very distant object (this point being already marked on the camera bed), and see that the camera front is so adjusted that the lens is exactly opposite the hole in the septum of the holder, that is, exactly centered. Now take the camera into the dark room, place a bright light right back of the hole in the septum and accurately measure the diameter of the circle of light which will be seen on the front of the lens. The equivalent focus of the lens, obtained as above directed, divided by the diameter of the circle of light gives the exact F. value of the opening.

This circle of light may also be measured by placing the back of the camera opposite a bright window and covering the front end of the camera with a focus cloth, the same as when taking a picture, the circle of light being visible only when all other light is cut off so far as possible, the same as when viewing the image on the ground glass.

Example: Suppose that by the method just described we find the equivalent focus of a lens to be 9⅝ inches and the circle of light on the front of the lens 1⅜ inches in diameter with full opening. 9⅝ divided by 1⅜ equals 7; hence, the speed of the lens is F.7. As another example, suppose the equivalent focus is 8½ inches and the circle of light 1¼ inches in diameter. 8½ divided by 1¼ equals 6 4-5, or written decimally, as is customary, 6.8; that is, the speed or full working aperture of the lens is said to be F.6.8.

Air Bubbles in Lenses

Purchasers of fine anastigmat lenses are sometimes unnecessarily alarmed by finding a number of small air bubbles in the glass, but these bubbles should occasion no misapprehension, as they do no harm whatever.

In the manufacture of anastigmat lenses, very special qualities of Jena glass are used, varieties of glass which differ widely in optical qualities and chemical composition from the ordinary flint and crown glasses used in the construction of cheaper lenses. The manufacture of these special grades of Jena lens glass is attended with great technical difficulties, and it has been found practically impossible to produce glass of the required qualities entirely free from small air

bubbles, but as these air bubbles have no influence upon the optical qualities of the lens, they are not regarded as faults.

In considering the matter of bubbles in lenses, we must bear in mind these facts: first, in making anastigmat lenses it is absolutely necessary to use these special and peculiar grades of lens glass; second, these special varieties of glass always contain at least a few small air bubbles; third, these bubbles have no practical effect upon the working quality of the lens. From a consideration of these three facts, it is evident that the presence of air bubbles in a lens is of no importance whatever and may be entirely ignored by the user of the lens.

In the manufacture of ordinary rapid rectilinear lenses, single achromatic lenses, wide angle lenses, etc., it is possible to use the commoner varieties of crown and flint optical glass, the making of which is a more simple matter than the production of the special glass for anastigmat lenses, and no difficulty is found in producing these cheaper glasses without bubbles.

While occasional pieces of the special Jena lens glass are found free from bubbles, such pieces are rare, and a complete lens entirely free from air bubbles (if sold as an anastigmat lens) might well be regarded with suspicion, as complete freedom from bubbles would indicate that a cheaper glass had been used in its construction and that it was not a genuine anastigmat lens.

Kind of Lens to Purchase

It is an excellent plan to have more than one lens, but if you are limited to one, let it be an anastigmat, unless such a lens costs more than you care to invest, in which event a good rapid rectilinear should be selected. A wide angle lens makes a very valuable addition to an outfit, but is, of course, suitable for only certain classes of work, and, although it will enable you to make many pictures which your regular lens would not make in a satisfactory manner, it could not be depended upon for all around work.

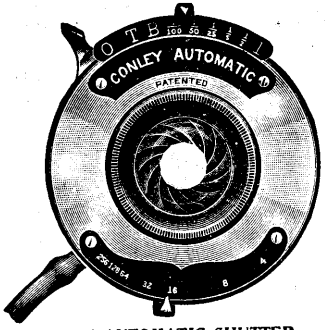
Portrait lenses, being suitable only for portrait work, are seldom used by any but professional photographers, and then only in the studio.

The Shutter

The Shutter is the mechanism or device, by means of which the opening to admit light through the lens is opened or closed in making an exposure. There is an infinite variety of shutters on the market, almost every manufacturer having a different style, but the object attained in all cases is the same;

simply a device for admitting light through the lens to make the exposure.

The shutters on simple hand cameras are usually operated by pushing a button, and on the folding hand cameras the same result is obtained by the more convenient method of squeezing a rubber bulb. A shutter operated by a bulb is said to have pneumatic release, and this method of operating the shutter is not only very convenient in all cases, but is particularly desirable when making time exposures, as the danger of spoiling the picture by jarring the camera is avoided.



CONLEY AUTOMATIC SHUTTER.

The Conley Automatic Shutter, which we show in our illustration, is one of the latest and most complete shutters now made, being provided with Iris diaphragms and giving, with one pressure of the bulb, automatic exposures of from 1-100th of a second to a full second, or, by two pressures, time exposures of any desired length. The shutter of an ordinary hand camera should be as simple in construction as possible, to avoid the danger of becoming out of order, and should be arranged to give either time or instantaneous exposures, and, if possible, should be automatic to the extent of resetting itself after each exposure, so that it will always be ready for business.

Care of Shutters

Shutters are rather delicate pieces of apparatus, and must be handled with due care. Even the very best of them, owing to the more or less complicated mechanism and the delicacy of the various adjustments, is liable to become out of order. When a shutter gets out of order it is almost invariably best to return it immediately to the maker without attempting any repair work on it. Even a good mechanic, unless he has had actual experience in the repairing of shutters, is very apt to do one of these instruments more harm than good.

Never put oil on any part of the shutter. At first thought it may seem unreasonable not to oil a piece of mechanism when it fails to work freely. It seems natural to suppose that oil will make any mechanism work more smoothly and freely, but oil produces quite the opposite effect when applied to a photographic shutter. Among the most important parts of a shutter are the pumps, sometimes

spoken of as the valves. If oil is applied to the pump of a shutter it makes the pump practically airtight and completely prevents it from working. If oil is applied to the inner mechanism of the shutter it will within a short time inevitably reach the thin hard rubber wings, and as soon as these two wings have a little film of oil on them they adhere tightly together and the shutter cannot be operated until it is taken all apart and every trace of oil carefully and laboriously wiped off each individual piece.

Once more we caution every user of a camera not to put any oil of any kind on any part of the shutter. It cannot possibly do any good and is almost certain to do great damage. The inside mechanism of the shutter is properly lubricated with a graphite lubricator when the shutter is made, and it is very seldom necessary, at least not until the shutter has been in use several years, to apply any further lubricant of any kind, but when it is necessary to lubricate the shutter nothing should be used but the best graphite lubricator. If the valves or pistons stick in the pumps and fail to work smoothly, the pistons should be removed and carefully cleaned or polished with a cloth and a little rouge. If the pistons are much corroded it may be necessary to polish them on a buffing wheel, but care must be exercised not to scratch them, as they must fit very perfectly and nearly, but not quite, airtight. After polishing them a very small amount of graphite may be applied as a lubricant. The easiest way to do this is to simply rub the pistons a little with the lead of a soft lead pencil. Just make a few marks on them with a soft lead pencil, and this will put enough graphite on to make them work smoothly. Do not oil the shutter.

CHAPTER III.

ADJUSTMENTS OF CAMERAS AND HOW USED.

Box cameras are provided with no adjustments whatever, aside from the shutter, so this chapter will be of interest only to those having folding or view cameras, or to those who contemplate purchasing such cameras later.

The adjustments most commonly in use are the vertical swing, the side swing, the rising and falling front, the sliding front, the rack and pinion focus movement and the reversible back.

The Vertical Swing

The most important adjustment of a camera is the Vertical Swing, or swing back, as it is frequently called.

In Fig. 1 we illustrate a camera tilted upward, as is frequently necessary when photographing buildings, and it will be noted that the back of the camera has been swung forward, so that it is still in a perfectly vertical position, that is, straight up and down. In Fig. 2 we show the camera pointed downward with the vertical swing again brought into play, so that the back is still perfectly straight up and down.

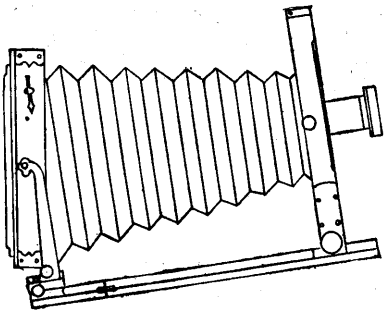


FIG. 1.

When a camera is provided with vertical swing only, and not the side swing, it is said to be single swing

Sometimes in photographing a building it is necessary to tilt the front of the camera up in order to get all the building on the plate, and if the camera is not provided with a swing back, you get a distorted picture, as shown in Fig. 3; the sides of the building converging toward the top. If provided with a swing back, this difficulty may be entirely avoided, as, no matter how the camera is tilted, the back can be adjusted until it is perfectly straight up and down, that is, parallel with the building, and the picture will then be without distortion.

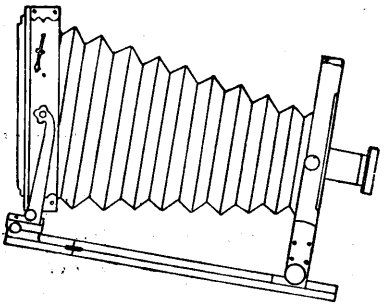


FIG. 2.

The Side Swing

The Side Swing is an adjustment of the camera, whereby the back may be swung sidewise, that is, either one side or the other brought closer to the lens.

Fig. 4 is a top view of a camera, showing the back swung to one side, thus illustrating the movement known as side swing.

Sometimes in photographing a landscape, or more especially when photographing street scenes, one side of the picture will be very much closer to the camera than the other. In such cases it becomes difficult to focus the entire view sharply, as when the near part is sharply focused, the distant part will be out of focus and vice versa.

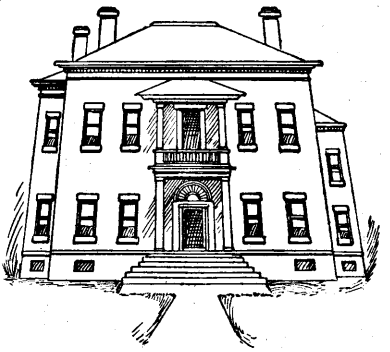


FIG. 3

The side swing enables us to focus the entire view sharply, as we can bring that side of the ground glass containing the distant part of the view a little closer to the lens. The side swing is frequently valuable when photographing interiors, as one side of the view is very apt to be closer to the camera than the other.

The Double Swing

When a camera is provided with only one swing it is always the vertical swing and the camera is spoken of as single swing. If it has both the vertical swing and the side swing it is called double swing.

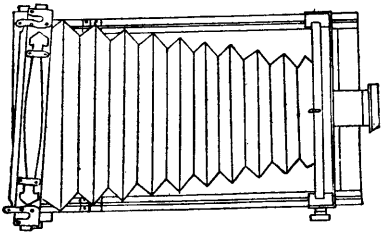


FIG. 4.

The vertical swing is very much more frequently used than the side swing, and many photographers consider the vertical swing sufficient for all ordinary purposes. A double swing camera, however, is very convenient at times, particularly in architectural work, interiors, and the photographing of small articles, such as merchandise, etc., where considerable maneuvering is sometimes necessary in order to get the subject exactly true on the plate.

The Rising and Falling Front

The rising and falling front is an adjustment which permits the front of the camera carrying the lens to be moved up and down, as shown by the dotted lines in Fig. 5. When the front of the camera is raised or lowered in this manner, the picture on the ground glass moves with it, and as the camera itself remains level, the picture is not distorted, and the arrangement of the camera, which may have been carefully leveled up, is not disturbed. The rising and falling front also enables the operator to regulate the relative amount of sky and foreground, upon which the artistic appearance of a picture frequently depends.

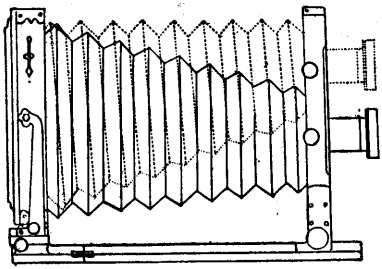


FIG. 5.

The Sliding Front

This movement of the camera front, while not a very important one, is at times very convenient. It enables the operator to move the front from side to side, and just as with the rising and falling front, the picture on the ground glass moves with it. In this way objects on either one side or the other of the view may be included or excluded without disturbing the camera.

The Rack and Pinion Focus Movement

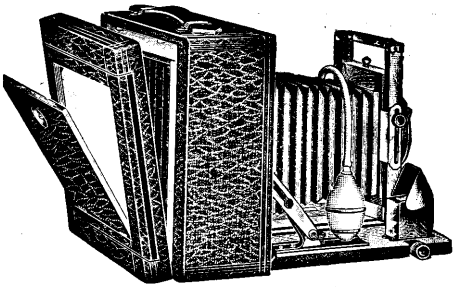
The Rack and Pinion Focus Movement is a device to afford a convenient means of focusing, the operation being accomplished by turning a milled head screw, instead of sliding the front or back of the camera by hand. Focusing by rack and pinion is much more convenient and accurate than by the sliding movement, although the results obtained are, of course, no better.

Cameras which are focused by moving the back are called back focus, and those in which the front is moved are called front focus. The Conley No. 2 View Camera is a back focus camera, and the Conley No. 1 View Camera is both back focus and front focus, with rack and pinion focus movement.

The Reversible Back

Next to the vertical swing, the Reversible Back is one of the most desirable adjustments with which cameras are provided. Nearly all cameras take pictures which are longer one way than the other, the most common sizes being 4x5, 5x7, 6½x8½ and 8x10. As ordinarily used, the picture is taken the long way of the plate. For example, in the 5x7 size the picture is 7 inches wide and 5 inches high.

It is frequently desirable, however, to make the picture the other way of the plate; that is (again taking the 5x7 as an example), 5 inches wide and 7 inches high, and it is in making this change, from horizontal to vertical views, that the reversible back is brought into use. The back of a camera is that part of the camera into which the plate holder is inserted, and a reversible back is one which is detachable from the camera and so made that it will fit in either a vertical or horizontal position. This enables the operator to change quickly from vertical to horizontal pictures, or vice versa, without disturbing the adjustment of the camera.



THIS ILLUSTRATION SHOWS HOW THE REVERSIBLE BACK IS DETACHED WHEN CHANGING THE CAMERA FROM HORIZONTAL TO VERTICAL PICTURES.

CHAPTER IV.

THE DARK ROOM.

In getting ready to take up photography, the first and most important subject for consideration, aside from the selection of the outfit itself, is the Dark Room.

Any work in photography in which it is necessary to handle dry plates, whether it be merely loading the holders or developing the plates, must be done in a perfectly dark room, lighted only by a ruby lamp. Any room which can be made perfectly dark will answer, but a closet with no windows and only one door will usually be found the easiest to make perfectly dark. An ordinary room, with the doors closed and the curtains down, although apparently quite dark, will not do for photographic work, as the light streaming in through cracks in the door or elsewhere will instantly ruin the plates. The room must be absolutely dark. At night an ordinary room may be made dark enough by closing the doors and drawing the curtains; but even then, care must be taken to see that moonlight or light from street lamps does not get in, as it takes very little white light to ruin the plates.

Method of Lighting the Dark Room

We must, however, have some means of lighting the dark room sufficiently to see what we are doing, and fortunately, the dry plate is only very slightly sensitive to red or yellow light, so what is known as a ruby lamp, or dark room lantern, is used. This is simply a lamp or lantern provided with a deep red or ruby glass, and made perfectly tight so that no white light can get out. Light which affects the dry plate is called actinic, and light which does not affect the dry plate is called non-actinic. Both red and yellow light are practically non-actinic, therefore either a red or yellow glass is used in the dark room lantern, or sometimes both red and yellow, which is better still. It must be remembered, however, that there is no such thing as light which is absolutely non-actinic. Even the red and yellow light affects the plate slightly, and therefore, care must be

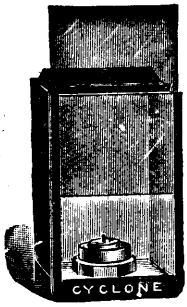


FIG. 6.

taken not to expose the plate even to the light of a ruby lamp, any more than is absolutely necessary.

Some photographers, instead of using a ruby lamp, make a small window with ruby or yellow glass, thus using daylight for the illumination of the dark room; but this is not a good plan, because the progress of development is always judged by looking through the negative toward the ruby light, and as the intensity or brightness of daylight is constantly changing, it becomes difficult, almost impossible, to properly judge the negative, and the result is, that some negatives will be over-developed and some under-developed. When using a ruby lamp, the light is always of the same strength or intensity, and you soon become so accustomed to it that the progress of development can be more accurately judged.

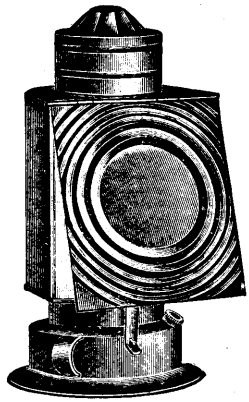


FIG. 7.

Some ruby lamps are made to use candles, and others are made to burn ordinary kerosene or coal oil. Many prefer the candle lamps, as they are cleaner than oil and never smoke.

Fig. 6 illustrates a very convenient candle lamp, and Fig. 7 shows a very popular form of oil lamp. An oil lamp should be well ventilated to avoid risk of smoking and so arranged that the flame may be turned up or down from outside.

Water in the Dark Room

If you have running water in the house and can put a sink in your dark room, by all means do so, as the work then becomes much simpler and easier. In the process of developing, fixing and washing negatives, it is necessary to use plenty of water, and if you can have running water and a sink in the dark room, you can work more rapidly and to better advantage. Place a table opposite the sink to work on, and put up some shelving on which to keep trays, chemicals, bottles, etc. Have a place for everything and keep everything in its place and, above all, keep everything absolutely clean.

If you cannot secure the luxury of running water in the dark room, a large pail full of water may be kept on the floor in which to rinse the plate after development, and another large pail or regular washing box kept to wash the negatives in after fixing.

Briefly, the dark room must be perfectly dark, lighted only by a ruby lamp, fitted up with some shelving, a table, and provided with running water, if possible, or if not, with two or three large pails.

CHAPTER V.

THE DRY PLATE AND THE PLATE HOLDER.

The Dry Plate

The Dry Plate, upon which the picture is made, consists of a piece of very perfect glass, coated upon one side with a thin film, which is extremely sensitive to the action of light.

When this plate is placed in the back of the camera, the rays of light from the object which is being photographed pass through the lens of the camera, and, striking against this sensitive surface or coating of the plate, form an exact image or likeness of the object.

This coating upon the dry plate is formed of gelatine, together with certain salts of silver and other chemicals and is often called an emulsion. It is of a light yellow or cream color, and is not only very sensitive to the action of light, but is also easily injured by finger marks, scratches, etc., so that in handling dry plates great care must be taken not to expose them to light and also not to touch in any way the delicate and sensitive surface.

The side of the plate which is coated is usually called the face side or the film side, and the other side, upon which there is no coating of any kind, is called the back of the plate or the glass side.

We would suggest that, before making an exposure, you carefully open a box of the plates in the dark room, in the light of the ruby lantern, take out one plate, put the cover back on the rest, and take this one plate out into the light. It will, of course, be absolutely ruined, but you can afford to spoil one plate at the start for the sake of learning more about them. After you have examined the plate by daylight, you will know just what it looks like, and will find it easier to handle them properly in the dim light of the dark room.

After examining the plate by daylight, take it again into the dark room, hold it about 2 feet from the lighted ruby lamp, and on the glass side you will see a very good reflection of the lamp, almost as

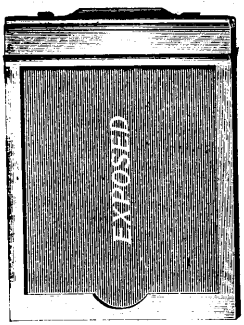
good as in a mirror, but the film side gives a poor reflection. This is the easiest way of telling in the dark room which is the film side, and in loading your plate holder it is absolutely necessary that you know which is the film side of the plate.

How Plates Are Boxed

Before proceeding with the operation of loading the holder, let us consider one or two points in reference to the box of plates. You will notice that the box is tightly sealed by paper pasted all around it and this paper must be cut all around before we can open the box. Upon removing the cover we find a second cover, which you will notice is put on from the opposite side. Upon removing this second cover we find one or more thicknesses of perfectly opaque black paper, showing how extremely careful the manufacturers are to prevent any possible chance of light getting to the sensitive plates. The plates are not only wrapped in black paper, but the box is provided with two covers and after the first cover is put on, the box is turned over and the second cover is put on from the other side, so that light in order to reach the plates must turn two corners and light is very averse to turning corners.

The Plate Holder

There are innumerable styles of Plate Holders on the market, but they are all alike in general principles, being simply small, light-tight devices designed to carry the dry plates, and so arranged that they fit into the back of the camera and hold the plate in position during the exposure. The ordinary plate holder, as a rule, holds two dry plates, one in each side, although there are holders made which hold only one plate, such holders being known as single plate holders, and are seldom used nowadays. Upon examination of your plate holder, you will find that it is provided with some kind of an arrangement, such as a spring in the bottom or small buttons at the top, by means of which the plate is prevented from falling out, even when the slide is drawn, and a very few minutes' study of the matter will show you how the plate may be placed in position in the holder.



CONLEY PLATE HOLDER.

Looking at the slides of the holder carefully, you will find that one side is different from the other in some way; perhaps the color

is different, perhaps the word "exposed" is printed on one side and not on the other, or if the slides are made of hard rubber (which is difficult to mark in any way), you will probably find that one side of the wooden end piece is painted black and the other side is light colored. The object of this is to enable you to tell, when making pictures, which plates have been exposed and which have not, thus avoiding the unfortunate error of making two exposures on the same plate. If the slides of your holder are marked on one side "exposed," you place the marked side in when loading the holder, then after making an exposure you replace the slide with the word "exposed" out. If your holder has hard rubber slides, put the slides in with the black side of the wooden end piece out, and after an exposure replace the slide with the black side in. Thus you will always know at a glance whether the plate has been exposed or not.

Loading the Plate Holder

The operation of putting the dry plates into the plate holder is usually spoken of as loading the holder, and while a complete description of so simple an operation may seem at first thought unnecessary, even so simple a thing as loading the holders must be done exactly right, for success in photography depends upon the little things.

Experiment a little with the plate holder in daylight, before attempting to load it in the dark room, and learn all about it. Take the plate you spoiled in learning what a dry plate was really like, put it into the holder and take it out several times, taking care not to touch the film side, and then it will be just as easy to do it later in the ruby light of the dark room.

The plate must be put in with the film side out, that is, toward the slide and not toward the inside of the holder, then when the holder is placed in the camera, the film side will be toward the lens, so that when the light comes in through the lens it will strike the sensitive film instead of the back of the plate.

After putting a plate in one side of the holder, replace the slide, being sure to put the proper side out, and repeat the operation with the other side of the holder. Don't forget to cover up the rest of your plates before opening the dark room door, and be sure to put the covers on properly, turning the box over before putting the second cover on. Now you have two plates in the holder and are ready for that momentous time in the photographer's experience, making the first exposure.

Inserting Slides in Plate Holder

Right here we want to explain a little matter that may save you considerable trouble later. In the narrow slit, through which the slide is pushed into the holder, there is a valve which closes after the slide is drawn and prevents any light coming in, which would, of course, ruin the plate. Now, in replacing this slide in the holder, it is very natural to start it cornerwise, as it will probably go in easier that way, but just as soon as the corner of the slide touches the valve it opens it clear across, and from the time that the corner opens the valve until the whole of the slide is in the slit, the light has a chance to come in, and very promptly does so, and then you wonder how that plate was spoiled. In putting the slide into the holder it must be started squarely, and when you have it once started it must be pushed clear in quickly.

If the Conley Flexible Valve Plate Holders are used, this extreme precaution in inserting the slides becomes unnecessary, the construction of these holders being such that no light can enter in any way

CHAPTER VI.

MAKING AN EXPOSURE WITH A BOX CAMERA.

We shall devote this chapter entirely to the simple hand camera, or box camera, such as the Conley Sr. and Conley Magazine. These instructions will apply to any of the numerous box cameras on the market, the general methods of working being the same with all, and the slight differences in details of shutters, etc., are fully explained in the direction sheets which come with the cameras. We will take it for granted that you have studied the direction sheet and, by experimenting with your camera, become thoroughly familiar with the details of its workings, especially the shutter and plate holder.

The View Finder

The View Finder must also be fully understood before we commence operations. On the side of the camera near the front end will be seen a small piece of ground glass, and upon looking at it closely you will see an exact copy or a reproduction of whatever may happen to be in front of the camera. If a bright light is shining directly onto the ground glass of the finder it may be difficult or impossible to see the picture there, but by shading the ground glass with the hand the image is easily seen.

Selection of Subject

We would suggest that a pretty landscape be selected for the first trial, and having decided from which point the most pleasing view is obtained, point the camera toward it and look at the ground glass of the view finder, where you will see an exact likeness of the picture as it will appear later on the plate.

Instantaneous Exposure

We will assume that the sun is shining so that the landscape is brightly lighted and will therefore make an instantaneous exposure. You will find that by moving the camera about you can change the appearance of the view, and having decided just what position of the camera gives the best effect, draw the slide from the holder, press the button and the exposure is made.

If your shutter is of the kind that requires to be set before making the exposure, don't forget to attend to this and be sure to draw the slide from the holder before making the exposure. If your shutter is automatic, it is always set, and it is only necessary to see that the pointer indicates whether it is ready for a time or an instantaneous exposure.

Time Exposure

If the sun is not shining brightly, or if the view is to be taken indoors or in the shade, out of doors, a time exposure must be given, and in making a time exposure the camera cannot be held in the hand, but must be placed on some steady support. If you have a tripod for the support of the camera during a time exposure, so much the better, but if not, the camera must be placed on a table, a post or anything firm and steady that may be convenient. Set the shutter for time exposure, put the plate holder in position, draw the slide and make sure that the picture shows on the view finder just as you want it to appear in the finished picture. Now decide how long the exposure is to be and push the button, which will open the shutter. Allow it to remain open the required length of time, then push the button again, which closes the shutter, and the exposure is ended.

We will take up the question of the proper length of time exposures more fully in another chapter.

If you are using a magazine camera, such as the Conley Magazine, the same instructions will apply, excepting, of course, the references to the plate holder, the plates in a magazine camera being carried in small metal holders inside the camera and dropped into position by turning a button each time an exposure is made, according to the directions which come with the camera.

CHAPTER VII.

MAKING AN EXPOSURE WITH A FOLDING CAMERA.

In using a folding hand camera the process of making an exposure is somewhat more complicated than with a simple hand camera, as we have more adjustments to deal with. Having first become thoroughly familiar with the working parts of the camera, loaded the plate holder as described in the previous chapter and selected a suitable subject, we are ready for the first picture, which for convenience we will assume to be a house, and the exposure an instantaneous one.

Instantaneous Exposure Without Tripod

Hold the camera firmly in both hands, pointed directly at the house, and observe the picture as seen on the ground glass of the view finder. Probably it will not appear just as you want it at the first trial, but by moving around a little you will soon find a point from which a satisfactory view is obtained. If the house appears too small in the picture, as seen in the view finder, move up closer, when it will become larger; or perhaps at first you will get so close to the house that you cannot get it all to show in the view finder, in which case you must select a point farther away from which to make the picture.

On the left hand side of the camera you will observe a small piece of white celluloid with numbers marked on it. This is the focusing scale, and the numbers stand for the distance in feet between the camera and the subject to be photographed. Estimate the distance from the camera to the house and move the camera front out until a small pointer attached to it is opposite the mark on the focusing scale corresponding to this distance. Adjust the shutter for an instantaneous exposure, the quickest speed, if the day is extra bright or sunny with little or no shade in the view; see that the largest diaphragm or stop is in position, set the shutter and draw the slide from the holder. After drawing the slide, hold the camera so that the house shows in the view finder, just as you want it to appear in the finished picture, press the bulb and the picture is taken.

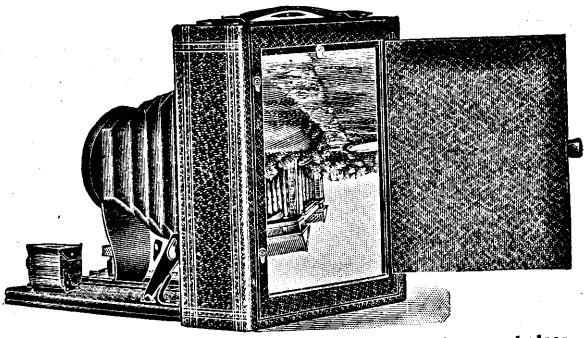
Replace the slide in the holder, being sure to start it in squarely, and you are ready to take the plate to the dark room for developing.

Use of Camera With Tripod

In making a picture, as above described, with the folding hand camera, we have not utilized all of the adjustments with which it is provided. In fact, we have used it practically just as a simple hand camera could be used, and it will probably be wise to make a few pictures this way until you have become accustomed to the use of the instrument.

If you have no tripod to use with your folding camera, we advise you to get one at once, by all means, as it is really impossible to do the best work without it.

Assuming that you have a tripod and have already had some experience in handling the camera, as described in the preceding



This illustration shows how the picture is seen on the ground glass.

paragraphs, we will again endeavor to take a picture of the house, but this time we will go about it more scientifically.

Put the camera on the tripod and set it up at the point from which you obtain the best view of the house.

Focusing

Set the shutter for a time exposure and press the bulb once to open the shutter, in order to admit the light through the lens so that you can see the image on the ground glass while focusing the camera. Open the back of the camera so you can see the ground glass, throw a focusing cloth over your head and the camera, and look at the ground glass. Don't try to look through the ground glass, but look directly at it and you will see the picture there. Probably it will be blurred or fuzzy because it is out of focus, and you must move the front part of the camera backward or

forward, as the case may require, until the picture on the ground glass is sharp, clear and distinct. The picture, as seen on the ground glass, is, of course, upside down, but you will soon become accustomed to this.

When the camera is carefully focused in the manner just described, you are not only able to make perfectly sure that the picture is sharp and distinct, but you are also absolutely certain of getting just exactly what you want in the view, as the finished picture will contain just what showed on the ground glass, no more and no less. After thus focusing the picture, the plate holder is placed in position, the shutter is reset for either a time or an instantaneous exposure, as may be required, and the exposure is made in the same manner as before described.

Exposure With View Camera

In using a view camera, such as the Conley No. 1, the process of making an exposure is just the same as described for the folding hand camera, except that view cameras are always used on a tripod and always focused by the ground glass, not being provided with either focus scale or view finder. View cameras are frequently used without any shutter at all, the exposures in such cases being made simply by removing and replacing the lens cap.

CHAPTER VIII.

THE PROCESS OF DEVELOPMENT.

After a plate has been exposed, it might naturally be expected that its appearance would be changed in some way. It might even be expected that the picture would show on its surface, but such is not the case; in fact, an exposed plate looks just exactly as it did before the exposure. There is absolutely nothing about it to indicate that it has ever been exposed, but the picture is there just the same, and only needs the wonderful chemical action of the developer to bring it out in all its delicate details of light and shade.

The Developer

In developing the first plate we will assume that you have purchased what is usually termed a ready prepared developer, that is, practically ready for use just as it comes. If in powder form or in tablet form, it must be dissolved in water; or if in liquid form, probably it must be diluted with water before using. Full directions regarding these points are always sent with every package of developer, and after reading the directions you can make ready a sufficient quantity of developer, say about two or three ounces if you have a 4x5 plate; three or four ounces if a 5x7 plate; and about six or eight ounces for an 8x10 plate.

The Fixing Bath

Next prepare the fixing bath, which is simply a solution of Hyposulphite of Sodium, or as photographers always call it for short, "Hypo." This is a chemical which comes in the form of large or small white crystals, or sometimes in the form of a powder, which is simply the crystals ground up. To prepare the fixing bath, we weigh out one ounce of hypo and dissolve it in four ounces of pure water. If this amount, that is, one ounce of hypo and four ounces of water, does not make a sufficient quantity of fixing bath, any desired quantity may be prepared by simply keeping this same proportion of hypo and water. For example, two ounces of hypo and eight ounces of water, or four ounces of hypo to sixteen ounces of water. Liquids are measured

in a graduate or measuring glass, which you will note is marked in ounces and fractions of ounces. If the crystals of hypo are large it may take quite a while for them to dissolve, but the operation may be hastened by crushing the crystals before putting them into the water. Put the developer in the graduate or measuring glass and the fixing bath into one of the trays, first making sure that the trays are perfectly clean. All of the work thus far may be done in daylight or by bright lamplight, so that you can see exactly what you are doing, as light does not affect the chemicals in any way.

Developing the Plate

After preparing the developer and fixing bath we will again shut ourselves in the dark room. Set the tray containing the fixing bath at the opposite side of the table, or on another table, as it is extremely important that not the slightest trace of the fixing bath get into the developer in any way. If you have handled the tray containing the fixing bath, or had your fingers in the bath, do not touch the developer, or anything else, until you have carefully washed your hands.

Place one of the trays, first making sure it is perfectly clean, in front of the ruby light; remove the exposed plate from the holder and lay it film side up in the tray; now take the measuring glass containing the developer and pour it quickly and evenly over the plate. It is very important that the entire surface of the plate be covered with the developer at once, as any portions which may be left dry for a few seconds at the beginning will commence to develop later than the rest of the plate, and when development is finished will show up as defects. After pouring the developer over the plate, the tray must be gently rocked, so that the developer is kept in motion, and after a little time, probably from 15 seconds to perhaps a minute or more, depending upon the kind of developer you are using, the picture commences to show a little. First the sky appears, then the lightest colored or most brightly lighted objects in the view, and, finally, after several minutes, all the details in the picture show distinctly. But it is not finished yet. Lift the plate from the tray, hold it in front of the ruby lamp, and you will find it is still more or less transparent; you can see the light through it plainly; so we put it back into the developer and keep on rocking it for a little longer. Soon the details of the picture commence to slowly fade away, the plate becomes almost black all over; but it is all right; this is as it should be; and perhaps it isn't quite done, even yet. Lift it from the tray again, look through it at the ruby light, and if it seems to be almost entirely black, so you can hardly see the light through it at

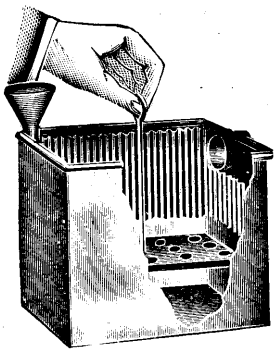
all, it is probably developed far enough, and should be rinsed with clear water. If you have running water in your dark room, hold the plate under the tap for a few minutes to rinse all the developer off; or if running water is not at hand, rinse the plate in a large pail of clean cold water.

Fixing the Plate

After rinsing the plate, lay it carefully in the tray containing the fixing solution, and now you can open the dark room door or turn on the light, for after the plate is once in the hypo it is no longer sensitive to white light. Before the plate has been long enough in the fixing bath to change it any, let us take a look at it. Lifting it from the tray we find the back, or glass side, is of a light cream or whitish color, but if we examine it from time to time while in the fixing bath, we find this white color disappearing; in fact, this is exactly what the fixing bath is for. After the white appearance has entirely disappeared from the back of the negative (the plate has now become a negative), it should be left in the fixing bath about two minutes longer, to make sure that it is thoroughly fixed; and it is then ready for the final washing.

Washing the Plate

The final washing must be very carefully and thoroughly done, as its object is to entirely remove from the film all traces of hypo, which, if not entirely removed, will completely ruin the negative later.



ZINC WASHING BOX.

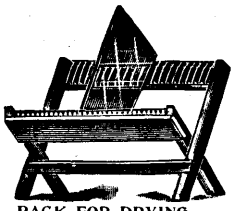
The simplest, easiest and best way of washing a negative is by means of a washing box, such as is shown in the illustration. These boxes are made of zinc, which does not rust, and are not only very convenient, but as they insure thorough washing, are really more of a necessity than a luxury. If you have running water, the faucet is connected to the lower inlet tube of the washing box, and when the water is turned on there is a constant current of clean water passing through the box, which soon soaks all the hypo out of the film and carries it off. In washing a plate in this manner with running water it should be allowed to run at least one-half hour. If you have no running water, the box can simply be filled and emptied about ten or twelve times, allowing it to stand four or five minutes between

each change. Rinse the plates in clean water before putting them in the washing box, and after removing them from the washing box rinse again and set the plates up in a negative rack to dry.

Plates may also be effectively and thoroughly washed in any convenient vessel, such as a large dish, a pail or a wash bowl, but it is essential that the washing water be changed at least a dozen times, and the plates should be washed at least one hour.

Drying the Negative

Negatives should be dried as quickly as possible, but drying should not be hastened by putting them near a hot stove or by standing them in the sun, as the film melts very easily when it is wet, and a very little heat will thus absolutely ruin the negative. Stand the wet negatives in some place where there is a slight draft, and be careful that no dust blows against them, as it will stick to the wet films and cannot be removed after they are dry. The length of time required for negatives to dry depends a great deal upon the weather. In warm or very dry weather 4x5 negatives will be entirely dry within a couple of hours, but if the weather be very damp it may require as much as ten or twelve hours to dry. Large size plates, of course, require a correspondingly longer time. You can very readily tell by the appearance of the plate when it is dry, and under no circumstances must the surface of the film be touched before it is thoroughly dry. The negative commences to dry around the edges at first, and gradually the drying proceeds until finally the entire surface of the plate is free from moisture. As soon as the negative is dry, it is ready for the next operation in the making of the photograph, namely, printing.



RACK FOR DRYING NEGATIVES.

CHAPTER IX.

THE PROCESS OF PRINTING.

Just as soon as the negative is thoroughly dry it is ready to print from, and for this operation we require only a printing frame and some sensitized paper. There are a great many different processes of printing, but in this chapter we will confine ourselves to the consideration of the method in most general use, viz., printing upon gelatine printing-out paper.

The Sensitized Paper

Such papers as Du Voll's, Albuma, Solio, Lithium, etc., are known as gelatine printing-out papers, and the general method of printing and finishing pictures made upon gelatine printing-out papers is the same with all the various kinds.

Gelatine printing-out paper is a very fine grade of tough white paper, with a shiny coating on one side. This coating is composed of gelatine with chloride of silver and certain other chemicals in it, which possesses the property of turning dark colored when exposed to light. This gelatine coating on the paper is called a film, just the same as in the case of dry plates.

Sensitized paper comes put up in light-tight boxes, containing one gross (12 dozen sheets), or in envelopes containing one dozen sheets, but you will observe that the manufacturers do not take such great precautions to protect paper from light as they do in the case of dry plates, and it is not necessary that they should, as paper is not nearly so sensitive to light as dry plates are.

Action of Light on Sensitized Paper

It is not necessary to go to the dark room when handling printing-out paper; it may be handled without injury in the ordinary subdued light of the house, or even out of doors in the shade, if you are careful not to leave it out too long. Take a piece of sensitized paper from the package, cut it into three or four pieces, and then hold one of these pieces where the sun can shine directly on it, see how quickly it begins to turn brown, and finally almost black. Take a second piece and hold it exposed to the light out of

doors, but in the shade. It soon begins to turn brown, but not nearly so quickly as when held in the sun. Now try a piece in the house with the curtains down. It takes a long time to show any effect of the light, and thus you can easily determine for yourself just exactly how much light the paper will stand without injury. If the paper does not turn brown it is not injured; in fact, this brown color is the only injury which can result to paper from exposure to light. When sensitized paper is placed under a negative, the sun shines through the negative, and where the negative is most transparent it makes the paper the darkest color; but the black parts of the negative protect the sensitized paper so much that it is left quite or nearly as white as it was in the first place, and between these two extremes the light affects the paper to corresponding degrees, and thus leaves on the sensitized paper an exact copy of the picture which is on the negative.

Making a Print

Before printing be sure that your negative is perfectly dry all over; if it is not it will stick to the paper wherever it is not dry, and thus spoil not only the paper but probably the negative as well.

Remove the back from the printing frame, lay the negative in face up, and lay on the negative a piece of the sensitized paper with the film side, that is the coated side, down or next to the negative. This brings the film side of the negative and the film side of the paper together. Replace the back of the printing frame, clamping it securely, and with the negative held thus in the frame rub the glass side with a slightly dampened cloth until it is perfectly clean. Next, stand the printing frame out in the sunlight, placing it in such a way that the sun shines squarely against it.

A few minutes after placing the frame out in the sun, bring it into the shade and open one side, which will permit you to bend the paper back and see how much it is printed. Perhaps the first time you examine it in this way the picture will show only faintly, and you, therefore, close the frame up and set it out in the sun again. It should be allowed to print until it is considerably darker than the finished print is desired, as it will bleach and fade to a certain extent in the process of toning and fixing.

How Long to Print

It is impossible to state how long a time will be required for the printing, as it depends entirely upon how dense, that is, how black the negative is, and how bright the sunlight is. With a negative which has been exposed and developed exactly right, the average time required for printing in

bright sunlight is from five to ten minutes. With a thin negative, that is, a very transparent negative, as short a time as two minutes may be amply sufficient; and on the other hand, with a very dense negative or a dark day, it may require several hours to make one print. It will thus be seen that it depends entirely on the negative and the light; the blacker the negative or the weaker the light, the longer the time required for printing. For this reason we do not attempt to time the printing in any way, but simply allow the printing to proceed until it is done.

Making Several Prints at Once

As it takes no longer, and is just as easy to tone a dozen prints at once as one print, we advise you to print as many as you wish to finish before starting to tone them. If you have several negatives from which you desire prints, it is an excellent plan to have several printing frames, so you can then put them all out at once, thus saving a great deal of time. With six negatives, all printing at once, you can make six times as many prints in the same length of time as you could with only one frame.

As fast as the prints are made, they must be placed for safe keeping where the light cannot injure them until you are ready to tone them. An ordinary box will do for this purpose, and a convenient way of keeping prints before toning is to place them between the leaves of a book.

Remember that the sensitive surface of the paper is very delicate and must be carefully handled, as finger marks will show on the finished picture and cannot be removed.

CHAPTER X.

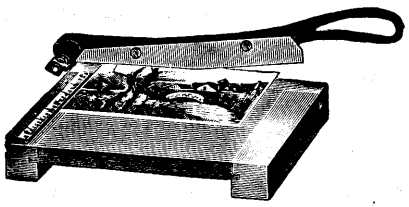
TONING AND FIXING PRINTS.

The process which gives a print the proper or desirable color is called toning, and the process of rendering them no longer sensitive to light is called fixing.

Before toning the prints they must be trimmed, as the printing frame leaves a white margin all around, which does not look well in the finished picture.

Trimming the Prints

The best and easiest way of trimming prints is by means of a trimmer, such as we show in our illustration. The method of using such a trimmer needs no explanation, and as it cuts the prints squarely, quickly and easily, it is a very acceptable addition to any photographer's outfit. The next best way to trim prints is by means of a sharp knife and a ruler or straight edge. Place the print face up on a smooth board or, better still, on a piece of glass and trim the print by running the knife along the ruler. Don't be afraid to trim your print liberally; almost any picture is usually improved by cutting away part of it. Perhaps there is too much foreground or too much sky to look well; perhaps there are things included in the view which actually detract from its beauty; trim them off; cut the print down until you get the most desirable effect.



PRINT TRIMMER.

Be sure to trim the prints before toning, as it is very hard to trim wet prints; and as they must be mounted before they are dry, there is no chance again to trim them after they are once in the toning bath.

Combined Toning and Fixing

In the simplest method of toning and fixing, the two operations, toning and fixing are accomplished in one operation, the bath used for this purpose being known as a combined toning and fixing solution. There are several different brands of combined toning and fixing baths on the market, the one in most universal use being supplied in liquid form and requiring only to be diluted with water in order to make it ready for use. Another is in powder form and is simply dissolved in water before use. Full directions regarding the diluting of liquid toning and fixing baths or the dissolving of toning and fixing powders are always given with each package, and as we can give no directions upon this point which will apply to all kinds, we will refer you to the instructions on the packages.

Having made the bath ready for use according to the directions with it, it should be poured into a large tray, and if this tray is several sizes larger than the prints, so much the better, as it will be much easier to work with. The tray used for toning prints by this process must never be used for any other purpose.

Take the prints, one at a time, and put them face down into the bath, and as soon as a print is thoroughly wet all over, turn it face up and brush off any air bubbles that may have formed on the surface, replacing it again face down in the bath. If these air bubbles are not promptly removed, right at the start, the prints will have bad looking yellow spots wherever the bubbles were. Be especially careful not to touch the face of the prints before they are thoroughly wet, but after they are once in the bath and wet all over, you can handle them without injury.

When the prints are all in the bath and all face down, draw out the bottom print and transfer it to the top, turning it face up. Repeat this operation with the next print, and so on until each of the prints in turn has been brought from the bottom to the top and turned face up; then start again with the bottom print, transferring it to the top and turning it face down; keep this up as long as the prints are in the bath, the object being to keep them constantly in motion during the entire time of toning, and by turning them first face up and then face down, each time, we always know which print was moved last, and thus make sure that each one receives its proper share of handling.

If the prints are allowed to lie quietly in the tray without being constantly separated and moved about, they will tone unevenly, and

disagreeable streaks or spots will appear, completely ruining the picture.

About ten to fifteen minutes will be required to properly tone and fix a print, although we do not judge the progress of toning by timing, but by watching the appearance of the print. When it is first put into the bath, it quickly turns to a rather unpleasant yellow color, but as the toning progresses it slowly improves in color, growing darker, and the white parts becoming clearer and cleaner. As soon as each print reaches the exact shade or color desired, remove it from the bath and place it in a vessel of clean water.

Washing the Prints After Toning

When the whole batch is toned, they must be thoroughly washed in order to remove every trace of the hypo and other chemicals contained in the toning and fixing baths. If these chemicals are not thoroughly removed, the prints will fade, discolor and deteriorate very rapidly. As the chemicals have, during the process of toning, worked right into the gelatine film, they can only be removed by a very thorough and careful washing.

One of the ways to wash a batch of prints is to provide two vessels of clean water, the prints being placed in one vessel and then transferred, one at a time, to the other vessel. The first vessel is then emptied, refilled with fresh water and the prints again transferred, this operation being continued until the prints have been transferred from one vessel to the other, each time into fresh water, at least twelve to fifteen times. If only one vessel is used to wash the prints, they must be kept in motion by transferring them, one at a time, from the bottom to the top, just as in toning, and the water changed frequently. This changing of the water and keeping the prints constantly in motion is very important and if not done properly, the prints will not be thoroughly washed, and as a result will soon fade and discolor. After the prints are washed sufficiently, they are ready to squeegee, or mount, as described in the following chapter.

Temperature of Combined Bath

Be very careful, especially in warm weather, to have the combined toning and fixing bath cool. If it is too warm it will not work properly, and many a photographer who has completely ruined a fine batch of prints in hot weather, has claimed the bath or the paper at fault, when the trouble was entirely due to the fact that the bath was too warm. It may be necessary sometimes, in the summer, to

put a small piece of ice in the bath in order to keep it at the proper temperature, but in winter the temperature of the bath is usually about right, without any special precaution.

An all glass dairy or bath thermometer, which can be purchased very cheaply, will prevent any trouble on account of the bath being too warm or too cool. The combined bath should be kept at a temperature of from 55 to 60 degrees.

Separate Toning and Fixing

While the method of toning and fixing prints by the combined bath process, as just described, is in almost universal use by amateurs, it is not the best way of toning and fixing and, as a matter of fact, is never used nowadays by professional photographers. The principal reason for its being used so universally by amateur photographers lies in the fact that it is the easiest way. There is less work about it, but it is not the best way, because the prints are not sure to keep, they are very apt to fade or assume a disagreeable greenish yellow or brown color after a little time. Sometimes they keep for a long time, but no matter how carefully the work is done, you cannot be sure of them and they are pretty certain to spoil sooner or later.

For this reason the professional photographer always tones and fixes his prints in separate baths, that is, the toning is done in a toning bath and the fixing is done in a fixing bath, two separate operations. In each package of paper which you purchase there are formulae for the toning bath and fixing bath for separate toning and fixing, and on general principles we advise you to follow these directions which come with the paper, as they are always very carefully prepared with special reference to the particular paper with which they come.

First Washing

In working with separate toning and fixing baths the print must first be washed through several changes of water, and the tray or other vessels used for this first washing must never be used for any other purpose. Place the prints, one at a time, into clear water and keep them moving, transferring one print after another from the bottom to the top, and in a few minutes the water will have a white or slightly milky appearance. Pour this water off and refill the tray with clean water, keeping the prints in motion as before, and this second water will soon be slightly milky, but probably not so much so as the first. Pour this off and again

fill the tray with clean water, repeating this operation until the water no longer shows any trace of milkiness. The object of this washing is to remove the free silver from the prints, as this silver would interfere with the toning if not washed out.

Toning Now place the prints, one at a time, into the toning bath (prepared according to the directions which come with the paper), and keep them constantly in motion, transferring each print separately from the bottom to the top, or if the tray is large enough, from one side to the other. The prints will soon commence to change color, and in about eight minutes will be sufficiently toned. If they do not tone sufficiently in eight minutes, the bath should be made stronger by adding a little more of the gold solution, and if the prints are fully toned in less than eight minutes, the bath should be made weaker by adding a little water. The best results are obtained when the bath works in about eight minutes. Watch the prints carefully while toning, keeping them face up most of the time, and as fast as they reach the desired color, transfer them to a dish of clean water. When all the prints are toned and in the clean water, change this water once or twice, moving them about just as when toning, and then transfer them one at a time to the fixing bath (prepared according to the directions which come with the paper).

Fixing It is very important to keep the prints constantly in motion in the first washing water and in the toning baths, but it is even more important to keep them constantly in motion in the fixing bath. The prints must not be allowed to settle down in a mass at the bottom and must not be allowed to lie closely in contact with one another. Keep them shifting about continually, transferring one after the other from the bottom to the top, turning them first face up and then face down, and keep them in the fixing bath just fifteen minutes. We cannot tell by the appearance of a print when it is sufficiently fixed, but we know from practical experience that fifteen minutes is the proper length of time to leave the prints in, and when the fifteen minutes are up, the prints must be transferred, one at a time, to a dish of clean water and then we are ready for the final washing, which is done just as thoroughly and in just the same way as previously described in the combined bath process of toning and fixing. As soon as the prints are thoroughly washed, they are ready to be mounted or squeegeed, as directed in the following chapter.

Kind of Trays to Use

Never use an iron or tin dish of any kind for the first washing, the toning, the fixing or the final washing, or any operation connected with the process of toning. If you do you will find spots and stains on the print which cannot be removed. Japanned or enameled metal trays may be safely used when new, but just as soon as there is the least little break, crack or imperfection in the japanning, the chemicals can act upon the metal itself, and then look out for spots on your prints. Always have separate dishes for the first washing, the toning and the fixing, and never use these dishes for any other purpose.

The best dishes for toning and fixing are those made of compressed fiber, hard rubber, glass or porcelain, as they are easily kept clean, and are not acted upon by the chemicals.

CHAPTER XI.

MOUNTING AND SQUEEGEEING.

If the prints, after being toned and washed, are simply allowed to dry, they will curl up into irregular shapes and be almost worthless. It is, therefore, necessary to finish them either by mounting or squeegeeing, in order to keep them in good shape.

Mounting

Mounting, as the process of pasting the print to the card is called, is the next step after toning, fixing and washing is finished, and must be done while the prints are still wet. For this work you will need a jar of paste, a paste brush, a print roller, some blotters and a large piece of clean glass.

Method of Applying the Paste

Lift the prints, one at a time, from the last washing water and lay them face down upon the glass. Do not place them in an even pile, but lay them irregularly, one overlapping the other, no two prints at exactly the same angle. Now, run the print roller over them, applying a little pressure, which will squeeze out all surperfluous water, and then stand the glass upon edge for a minute, so that the water can drain off. If the prints are still pretty wet, it may be well to press a folded towel down on them, as too much water on them thins the paste, so that it will not stick properly.

Take a little of the paste, say a teaspoonful, from the jar and put it on the glass near the edge, far enough away from the pile of prints so that it will not get on them. Now, with the paste brush apply a thin coating of paste to the top print. Do not put on too much paste, just a thin coating, evenly applied, is sufficient, and be careful that no bristles from the brush or small lumps in the paste are left on the prints. The paste can be spread on freely, allowing the brush to go clear past the edges of the print, as the print, being wet, sticks closely to the other prints beneath it, and there is no danger of the paste getting under and thus injuring the face of the print.

In this connection it may be well to state that there are two kinds of paste brushes; one being tin bound and the other being hard rubber bound. The latter brushes are by far the best, as the bristles, being very firmly set in the hard rubber, will never come out.

When using the tin bound brushes, the tin always becomes more or less rusty, and if small particles of rust are left on the back of the print, they will, in time, cause bad looking spots on the face of the picture. The rubber bound brushes are, of course, free from this objection.

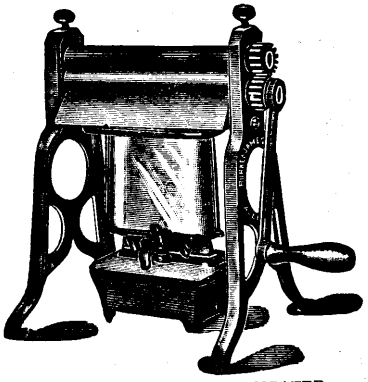
Mounting the Print

After applying the paste, insert the point of your pocket knife under one corner of the print to start it, and lifting it up lay it on the card mount. Be very careful to get the print exactly in the middle of the card, leaving an even margin all around, as the print sticks at once to the card and it is more or less difficult to move it in case you do not get it on exactly straight at first. A little practice, however, will soon enable you to place the prints squarely on the card the first time.

Next place a piece of blotting paper over the print to protect it and run the print roller over it several times, applying considerable pressure, which will smooth the print down tightly to the card. Do not use ordinary blotting paper for this purpose, as it is very apt to contain chemical impurities which would cause the print to discolor sooner or later. Use the regular photographic blotting paper which is manufactured expressly for this use and, in addition to being chemically pure, is also free from the objectionable features possessed by ordinary blotting paper of leaving lint on the face of the print.

Burnishing

As soon as the pictures are perfectly dry, they are ready to burnish, which is the operation of passing them between the smooth steel rollers of a burnisher, in order to give them a polish and to straighten the card, which usually curls up as the print dries. Before running the picture through the burnisher, take a soft woolen cloth, rub it on a piece of pure white castile soap and then go over the face of the print carefully. This will leave a thin coating of soap on the face of the picture. It must be very thin, however, not enough to see. The object of thus soaping the prints is to prevent them from sticking to the roller of the burnisher, and also to give them a higher gloss.



BURNISHER WITH OIL HEATER.

There are many different styles of burnishers manufactured, but they are all alike in general principles, consisting simply of a machine with two steel rollers, one very smooth and highly polished, the other rough, and so arranged that the prints can be passed between them, very much the same as clothes are run through a wringer. In order to produce a high gloss or finish on the prints, the smooth roller is heated, some burnishers being provided with an oil heater burning ordinary kerosene oil, others having gasoline heaters, and still others being provided with gas heaters which burn ordinary gas. If you have gas in the house, a burnisher with a gas heater is, of course, the most convenient, but if you cannot obtain gas, oil or gasoline must be used.

After soaping the prints, light the burnisher heater, and when the roller is hot pass a print quickly through, the face of the picture next to the smooth roller, and as the picture comes through on the other side catch it with the left hand and bend it upward. This bending of the print as it comes through the rollers gives it a higher gloss. Put each print through about four times, first endwise and then sidewise, bending it back each time as it comes through, except the last time, when the bending may be omitted, in order to leave the finished picture flat or nearly so.

Be careful to have the burnisher hot enough, and yet not too hot. If not hot enough, a high gloss on the prints cannot be secured, and if too hot the pictures will turn a disagreeable reddish brown color. A little experience will soon enable you to tell when the roller is hot enough, by touching it with the moistened finger just as the housewife tries her flatirons.

See that the distance between the rollers is so adjusted that they exert considerable pressure on the card as it passes through, and yet not so much pressure as to make it difficult to get them through. Clean the rollers very carefully with a soft cloth before using.

Run the pictures through the burnisher rapidly, and never stop turning the crank while a picture is between the rollers, as this will leave a mark on the picture which cannot be removed.

Pictures printed on gelatine paper, such as Du Voll's, possess a fair amount of polish without burnishing, and many who do not wish to invest in a burnisher are satisfied with this natural finish.

Squeegeeing

A very popular method of finishing prints that are to be kept unmounted is known as squeegeeing. For this purpose we require one or more ferrotype plates, called also squeegee plates or ferro plates. These are thin metallic

plates with one side highly enameled. Lift the print from the last washing water and lay it face down upon the smooth side of the ferro plate and run the print roller over it, to press out all the water or air bubbles, thus bringing every part of the face of the print into close contact with the plate. Stand the ferro plate up on edge and leave it until the prints are thoroughly dry. Sometimes the prints will drop off the plate of their own accord as soon as dry, but, if they do not, they can be started at one corner with the finger nail or knife blade and then stripped off.

The process of squeegeeing the prints on ferrotype plates gives them a very brilliant gloss, even more brilliant than can be secured by burnishing. Usually prints are only squeegeed when they are to be kept unmounted, as it is very difficult to mount a print when dry, and if the print is wet up, in order to make it easy to mount, the high gloss obtained by squeegeeing is entirely lost. The attempt to mount a dry squeegeed print usually results in an unsatisfactory job.

If the surface of a squeegeed print shows small dull spots, it is because the prints were not rolled down tightly enough to the ferro plate, and wherever it was not in close contact with the plate it failed to receive the high polish, and a dull spot is the result.

To Prevent Prints Sticking

Sometimes prints will stick to the ferrotype plates, and occasionally so tightly that they cannot be removed without entirely ruining them. There is no remedy for this trouble after the print is once stuck fast to the plate, but it can usually be prevented by washing the plate before use and rubbing it perfectly clean with a soft cloth. Prints are much less apt to stick to the plate if dried once before squeegeeing; simply lay them out singly after washing, and when perfectly dry throw them again into clean water and squeegee as usual as soon as they are thoroughly wet. Allowing the print to dry before squeegeeing hardens the film and lessens the danger of its sticking to the plate. If keeping the plates clean or drying the print before squeegeeing does not prevent the prints sticking, then you must resort to the following process, which will prevent sticking with absolute certainty:

Get a small piece of paraffin from your supply house or local druggist, scrape it into thin shavings with a knife, place it in a small bottle of benzine and, after it has stood a few hours, you have a solution of paraffin in benzine. Perhaps not all of the paraffin will dissolve, but enough will do so to answer our purpose. Clean the

ferrotype plate with water and rub it perfectly dry. Take a soft dry cloth, wet it with the solution of paraffin and benzine and rub it over the smooth side of the plate, then take another soft dry cloth, rub the plate until it is perfectly dry, and then you have an exceedingly thin coat of paraffin all over the plate. It is a very thin coating —you will not be able to see it—but it is there, and it will prevent all danger of the prints sticking to the plate.

If it is not desirable to finish the pictures as soon as you finish washing them, they may be laid out singly and allowed to dry. They will curl up into all sorts of shapes, but this does not injure them at all. Later, when you are ready to mount them, they are thrown into clean water to soak a few minutes and are soon soft and limp enough to mount or squeegee as usual.

CHAPTER XII.

PRINTS ON BLUE PAPER AND DEVELOPING PAPER.

In the preceding chapters we considered only that process of printing and toning which is in most general use, that is, the gelatine paper process. Probably three-fourths of the photographs made, both by professional and amateur photographers, are printed upon gelatine printing-out paper, by the methods described in Chapter IX, but there are several other methods of printing which well deserve attention.

Blue Prints

The process of making pictures with blue paper or ferro-prussiate paper, as it is also called, is the simplest method of printing known and, therefore, very popular with amateurs and beginners. The paper may be purchased all ready for use, and is printed in the regular way, just as described in Chapter IX, but it prints more slowly than gelatine paper and the picture does not show up as clearly and distinctly until after it is washed.

It should be allowed to print until the shadows, that is, the darkest parts of the pictures, assume a bronzed appearance. After printing to the proper depth, the print is washed for about ten minutes through two or three changes of clean water, which brings out the details of the picture, washes away the yellowish color and gives you a brilliant blue and white picture.

The prints may now be mounted in the ordinary manner or dried between blotters and kept unmounted. As blue prints will remain flat, they are usually left unmounted.

How to Make Blue Paper

Although blue paper can be purchased very cheaply, many people prefer to prepare it themselves, as it is an interesting operation and not very difficult.

Make up two solutions as follows:

Solution A—Citrate of iron and ammonia, 1⅞ ounces. Water, 8 ounces.

Solution B—Ferri-cyanide of potassium (red prussiate), 1¼ ounces. Water, 8 ounces.

To make the sensitizing bath, take equal parts of solution A and solution B in a tray or other flat dish, a little larger than the paper you are to sensitize. Float the paper on this bath for two or three minutes, being very careful to brush off any air bubbles that may form, then hang the paper up by one corner to dry. This work should be done by lamplight and there should be enough ventilation where the paper is hung up so that it will not dry too slowly.

The two solutions A and B will keep indefinitely, but should only be mixed immediately before use, as they soon spoil after mixing.

Any fine white close grained paper will do for making blue paper, but the best results are obtained with what is known as Rives' paper, which comes in sheets, 18x22 inches, and can be purchased for about 60 cents per dozen.

Developing Papers

Prints made upon developing papers are very popular nowadays, not only on account of the beautiful results obtained, but also because of the quickness with which the work can be done and the fact that the entire process of printing and developing may be done in the evening by lamp or gaslight. Many people are too busy to devote much time to photography during the day, and the advantage of being able to finish the pictures in the evening is very apparent.

Developing paper is so called because the picture does not show at all after it is printed, but must be brought out by a developer, just the same as the picture on the dry plate.

Darko Paper

One of the latest developing papers is known as Darko, and this paper is already a great favorite. Darko paper is very much more sensitive to light than any gelatine paper, and due allowance for this must be made in handling it. The package should be opened in subdued or weak lamplight at some little distance from the light, and care should be taken that the direct rays of the light do not strike the paper.

Put the paper into the printing frame quickly, being careful to place the sensitized side next to the negative. You can easily tell which is the sensitized side by noting which way it has a tendency to curl, as it always curls inward toward the sensitized side. Set it up to print about 10 or 12 inches from a bright lamp or gas jet. The time required for printing will depend altogether upon the density of the negative and the brightness of the light, but with an average negative and a bright kerosene lamp will be from three to ten minutes.

Printing may also be done by subdued daylight, say at a north window, and in this case from one to five seconds will be ample exposure. Printing by daylight, however, is so rapid that it is difficult to get the exposure exactly right, and better results are obtained by lamplight. You may spoil a few sheets of paper at first by not giving the correct exposure, but a little experience will soon enable you to tell just how much time any kind of a negative will require.

The picture does not show at all on this kind of paper until it is developed, being in this respect like a negative or dry plate. You can purchase developer for this work in dry form, requiring only to be dissolved in water, or you can prepare it yourself from the formulas given with the paper.

After printing, immerse the prints in the developer, taking care that the entire face of the print is wet as quickly as possible all over and any air bubbles brushed away. The picture will come up very quickly and as soon as it is fully developed, which will require only a few seconds, it should be quickly transferred to the fixing bath.

The fixing bath is prepared by dissolving 4 ounces of hypo in 16 ounces of water. The prints must be left in this bath fifteen minutes and kept in constant motion all the time in order to avoid spots or stains.

After fixing, the prints must be washed thoroughly through several changes of water, just the same as gelatine prints. After use the developer should not be saved for use again, but should be thrown away and a fresh developer used for each bath of prints. The hypo solution should also be made up fresh each time and thrown away after use.

Friction Marks

Prints made on developing papers, especially on glossy developing papers, are sometimes disfigured by dark streaks, lines, or irregular markings, these defects being known as friction marks. They are the result of pressure or friction with some hard object or substance on the surface of the paper, and as they do not show until after the print has been developed, there is no way of discarding such defective paper until after the print has been made.

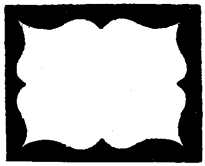
These friction marks may usually be removed by rubbing the finished print with a piece of cotton moistened with alcohol. As a means of avoiding friction marks, extreme care should be exercised in handling the paper. The friction of one piece of paper across the face of another when removing it from the box is sometimes sufficient, with glossy paper, to cause a friction mark, and rough handling of

the package itself, before it is opened, sometimes results in irregular markings which are due to the same cause, namely, friction or pressure on the surface of the paper. These marks occur much more frequently on glossy developing paper than on the mat surface styles, but are occasionally found with all styles of developing papers.

The manufacturers of some glossy developing papers put up a special developer containing an ingredient which seems to have the property of preventing these friction marks from showing, one such developer being known as "Anti-Friction." Photographers who use glossy developing papers extensively should exercise every possible care in the handling of the paper and should use an anti-friction developer. If, in spite of these precautions, an occasional friction mark is found, then recourse must be had to the cotton and alcohol remedy suggested above.

Printing With a Mask

A pleasing effect with any kind of paper can be obtained by using a printing frame and paper somewhat larger than the negative and printing under a mask. Cut an opening in a piece of postoffice paper, exact size and shape of the picture itself, thus making what is known as a mask, and place it between the negative and the paper while printing. In order to use a frame larger than your negative, it becomes necessary to fit the frame with a piece of plain clear glass, upon which the negative is placed, then the mask, and last the sensitized paper, after which the back of the frame is clamped into place and it is ready to print. This gives you a wide white border to the print, which greatly improves its appearance. Instead of making these masks you can purchase them, as they are made in a great variety of shapes and patterns, some of them very beautiful.



CHAPTER XIII.

MORE ABOUT DEVELOPING AND FIXING.

In Chapter VIII we did not take up the subject of developing as fully as it deserves, for it is, next to the actual operation of making the exposure, the most important part of photography. No matter how carefully and correctly the plate may have been exposed, it can be entirely ruined by some slight oversight or mistake in developing.

Kinds of Developers in Use

There are a great many different kinds of developers, and they are generally named after their principal ingredient. Pyro-gallic acid (called pyro, for short), hydrochinon, eikonogen, and metol are the ones in most general use and they are all good; in fact, although each of these developers has its own peculiar characteristics, it is largely a matter of personal preference as to which shall be used, and it cannot be said that any one developer is the best. We should advise you to try two or three different kinds, select the one you like best, and then stick to it.

Pyro is one of the oldest developers in use and gives excellent results, but is objected to by some because it stains the fingers and does not keep well after it is made up, soon turning brown, finally almost black.

Negatives developed with hydrochinon have great density, contrast and clearness, and development is rather slow.

Eikonogen yields a soft negative, particularly suitable for portrait work or groups, and also very popular for general all around work.

Metol gives a brilliant negative and develops very rapidly, but it is sometimes a little difficult to get as much density as is desirable.

A combination of hydrochinon and eikonogen is very popular and a good developer for all around purposes.

Hydrochinon and metol, in combination, is probably one of the best all around developers that can be made, the good points of both the hydrochinon and metol being apparent in the combination. Metol giving softness and speed to the developer, and hydrochinon giving the necessary density and contrast.

You can purchase your developer in solution form, requiring only to be diluted with water before using, or you can get it in the form of powders which are to be dissolved in water. If you send away for your supplies, you will probably find the powders the most satisfactory, as they are light, can be sent cheaply by mail, and there is no danger of breakage. The results obtained are just as good as with the ready prepared liquid developer.

Many photographers purchase the necessary chemicals and prepare their own developers, which is the cheapest way, and if you make many pictures, especially if you are engaged in photography as a business, we should by all means advise you to prepare your own developer.

Ingredients of Developer

A developer always has three principal ingredients: First, the developing agent itself, such as pyro, eikonogen, metol and hydrochinon; second, a chemical (usually sulphite of soda), which acts as a preservative of the developing agent and regulates the color or tone of the negative; and third, an alkali (called the accelerator), usually carbonate of soda or carbonate of potassium.

Developers are sometimes made up in one solution, that is, all the ingredients in one solution, and sometimes in two solutions, in which case the developing agent and the preservative form one solution, and the accelerator the other solution, the two being mixed in proper proportions at the time of using.

When to Stop Development

It always seems to be a little difficult for a beginner in photography to tell when to stop development. He is very apt to either take the plate from the developer before it is completely developed, or to leave it in so long that it is almost ruined. It is difficult, in fact, almost impossible, to give instructions upon this point which will enable the beginner to know positively just when to stop development, but a little practical experience, with the aid of the following suggestions, will soon enable anyone to master this point:

As stated before, the progress of development is judged not by looking at the negative, but by looking through it when held up in front of the ruby light. Looking through the negative in this way shows you its density, that is, how black or opaque it is getting and the proper density which must be obtained before development is stopped depends to a large extent upon the kind of developer used.

Let us take pyro as an example, and supposing our plate to have been properly exposed, we lay it in the tray and pour the developer over it. In about one minute the details of the picture commence to slowly appear; first the sky, then the most brightly lighted parts of the picture, a white dress, perhaps, if it is in a group, and finally, after about three or four minutes, the whole picture shows clearly and distinctly. If we lift the plate from the tray now and look through it toward the ruby light, we find that, although the picture showed so plainly when we looked at it lying in the tray, it really has very little density, and if we stop development at this point we shall have a very much under developed negative. Returning the negative again to the developer, we find in a few moments that the picture seems to be gradually fading away, but, examining it from time to time by holding it in front of the light, we see that it is becoming blacker and more opaque; in other words, it is gaining density. Finally, when it seems to be almost opaque, except in those portions that represent the shadows or darkest parts of the view (which are, of course, the lightest or most transparent parts in the negative), it is time to stop development.

After the negative has been fixed, examine it by holding it up toward a window, and if it appears very black, so dense that the detail is lost or obliterated in the darkest portions, we know that it is over developed, that is, left in the developer too long. On the other hand, if it is weak, possesses little density or blackness anywhere and no detail appears in the most transparent parts, that is, the shadows of the view, it is under developed. We should advise the beginner to carry out the following experiment, as we know from experience that more can be learned in this way regarding development than in any other:

Select a bright sunny landscape; set your camera up and make several, say half a dozen, instantaneous exposures, one right after the other, all exactly alike. This gives you six plates, all exactly alike in every respect, all having the correct exposure. If you will now develop these six plates, one after the other, all in the same kind of developer, carrying development to a different stage with each one, you will undoubtedly arrive at quite a definite idea as to how far development should be carried. After a little practical experience you will find development a very simple matter, and the making of good negatives will be easy.

Loss of Density in Fixing Bath

You will no doubt notice that the negative loses more or less of its density in the hypo bath, that is, the hypo seems to bleach it and it does not appear nearly so dense as it did when examining it before it was fixed. The amount of bleaching or loss of density which a negative undergoes in the fixing bath depends upon the kind of developer used, and this must be taken into consideration when judging development, when looking through the negative at the ruby light. The least amount of bleaching occurs when hydrochinon developer is used, and the greatest amount when metol developer is used. It will readily be seen that the more a negative bleaches in the hypo bath, the blacker it must be made in the developer, and vice versa. For example, when using metol, development must be carried so far that the negative appears perfectly black and opaque all over, but with the hydrochinon, if development is carried as far as is necessary with metol, the negative would be very much over developed.

Pyro Developer

Pyro-gallic acid developer, usually called pyro for short, is generally spoken of by photographers as the "old stand by," and has been in use longer than any other developer that is at present on the market. It certainly deserves its popularity, as it is a thoroughly reliable and satisfactory developer, giving the best of results, working equally well with any brand of plates or any class of work.

Pyro developer soon turns brown upon exposure to the air and should therefore be kept in a very tightly corked bottle and the bottle should be full, because, if only partly full, the air remaining in the bottle will soon cause the developer to spoil.

Pyro developer may be used for developing several plates, one after the other, but care must be taken not to use it after it has become so brown as to discolor or stain the plates. A slight yellowish stain, caused by pyro developer, however, will not injure the printing quality of a negative; in fact, many old photographers say that a little pyro stain actually improves the printing quality.

Proper Temperature of Developer

One of the most important points to consider when developing is the temperature. The best results are obtained when the temperature of the developing bath is about 65 to 75 degrees; that is, about the same as the temperature of an ordinary living room. If the developer is too warm, it develops the plate too rapidly and leads to a variety of other troubles.

If the developer is too cold, development proceeds very slowly, and a harsh negative, without much detail in the shadows, is the result. It is only in the winter that there is danger of having the developer too cold, and care should be taken to keep it up to about 75 degrees. Warm the trays before using by pouring hot water into them.

An all glass dairy or bath thermometer, which can be purchased for about 20 cents, is very convenient in many photographic operations, as it enables you to quickly ascertain the exact temperature of any solution.

Care must be taken to have the developer, fixing bath and washing water all at about the same temperature, as a sudden change of temperature when a plate is transferred from one bath to another, frequently causes a network of fine lines to appear all over the plate, this defect being known among photographers as reticulation.

Hot Weather Troubles

It will be remembered that the sensitive coating of a dry plate is composed principally of gelatine, and when gelatine is wet it absorbs a considerable amount of water, swells up and becomes soft. Now, if we raise the temperature a little, it melts or dissolves. In hot summer weather, therefore, it becomes especially important to keep the dark room, the developer, the fixing bath and the washing water as cool as possible. Without due precaution in hot weather, the film frequently becomes so soft as to run, thus completely ruining the negative, and sometimes it actually melts or dissolves, so that it comes entirely loose from the plate, leaving nothing but clear glass.

This softening or melting of the film only occurs in hot weather and can usually be avoided by keeping everything as cool as possible. A little ice in the developer is sometimes necessary to keep it cool enough, and the fixing bath should be freshly made, just before use, as a fresh solution of hypo is always cool and tends to prevent the film softening.

In cases where it is impossible to keep the temperature low enough to prevent the film melting, we can only advise you to keep the plates safely stored away in the dark room until cooler weather, before attempting to develop them.

Developing an Under Exposed Plate

If a plate develops slowly and no detail appears in the shadows, although the high lights have come up quickly, it is a pretty sure sign that the plate was under exposed. In this event we pour the developer back into the graduate and cover the plate with clean water. Then weaken or dilute the developer with an equal volume of water, stir it up to thoroughly mix it, pour the water off the plate and continue development with the weakened developer. Development will, of course, be rather slow, but when the high lights are quite opaque, sufficient detail will probably have appeared in the shadows.

Never attempt to weaken developer without pouring it off the plate, as it is impossible for thorough mixing to take place in this way, and unequal or patchy development will result.

Developing an Over Exposed Plate

If the picture appears very quickly after pouring the developer over a plate, and makes its full appearance in a very short space of time, instead of coming out regularly and gradually, you may safely conclude that the plate was over exposed. This requires prompt attention, and just as soon as there is any indication of over exposure, the developer should be poured off and the plate covered with clean water.

You should always have at hand in your dark room a 10 per cent solution of potassium bromide, made by dissolving 45 grains of potassium bromide in one ounce of water. Add a few drops (two or three, if the plate is not much over exposed, or as much as ten to twelve if it is much over exposed) of this solution to the developer, pour the water off the plate and proceed as usual with development.

Developer which has been used several times is also excellent for over exposed negatives, as it contains some silver bromide which it has taken from the plates previously developed, and silver bromide also acts as a restrainer, the same as potassium bromide.

Fixing

It is very important to keep the fixing bath cool, especially in warm weather, as a warm fixing bath will cause the film to become loose and wrinkled along the edge of the plate, this difficulty being known as frilling.

The plain hypo fixing bath, prepared by dissolving hypo in water in the proportion of 4 ounces of hypo to 16 ounces of water may be kept and used repeatedly as long as it remains clean and works perfectly, but a freshly prepared bath is better. As hypo is very cheap,

we therefore advise you to make up a fresh fixing bath each time and throw it away after use. Another advantage of a freshly prepared fixing bath lies in the fact that it is always cool, as the operation of dissolving hypo lowers the temperature of the water.

If plates are fixed in a grooved box in which they stand on edge, they are less likely to become spotted or scratched, and a larger number can be fixed at once than when a flat tray is used.

The Acid Fixing Bath

An acid fixing bath is of great advantage, especially in warm weather, as it hardens the film, thus preventing all danger of the film softening or melting, even in the hottest weather. It also remains clear a long time, may be used over and over again, and clears the negative better than a plain fixing bath.

The acid fixing bath is prepared as follows: Dissolve 8 ounces of hypo in 24 ounces of water, then dissolve 1 ounce of sodium sulphite in 3 ounces of water. After making these two solutions, mix ½ ounce of pure sulphuric acid with 1 ounce of water and pour it slowly into the sodium sulphite solution. Now pour the solution containing the sulphuric acid and sodium sulphite into the hypo solution. Next dissolve ½ ounce of chrome alum in 4 ounces of water and add it to the solution already prepared. The bath will now be of a beautiful green color and is ready for use.

How to Dry a Negative in Five Minutes

The time required to dry a negative in the regular way is sometimes a great disadvantage, and a method of hastening this process is at times very desirable. The only reason that we cannot dry a negative quickly by holding it up to the fire or standing it in the hot sun is because wet gelatine, which forms the film, melts when heated. It melts because it is soluble in hot water. If now we can discover some process of rendering the gelatine insoluble without injuring the picture, we can safely use heat to hasten the drying.

There is a new chemical known as formalin which possesses the peculiar property of rendering gelatine very hard and perfectly insoluble, so we will make use of this article in preparing the negative for quick drying. Make up the following solution:

Water - - - - - -	10 ounces
Bisulphite of Soda - - - -	¾ ounce
Formalin - - - - - -	2 ounces

For use, dilute this solution with water in the proportion of 3 ounces of water to 1 ounce of the solution.

Keep this solution tightly corked at all times, as the formalin itself is a gas, and if the bottle is not tightly corked, it will soon escape entirely, leaving nothing but water.

After the negative has been thoroughly washed, lay it in a perfectly clean tray and pour over it a sufficient quantity of the solution (diluted as above directed) to thoroughly cover it. Rock the tray gently, allowing the negative to remain in the solution about five minutes, after which it is rinsed in clear water. The film will then be thoroughly hardened and may be held over the fire or placed in the hot sun to dry. Remove the surplus water before drying by pressing a folded towel gently against the film.

Keep Everything Clean

Last, but not by any means least, keep everything that is used in your dark room absolutely clean, never use the developing tray for anything but developing. Keep one tray, or regular fixing box, for the hypo solution, and never use it for any other purpose. Wash your trays thoroughly with clean water as soon as you are through using them and stand them on edge to dry. Always wash your graduate glass thoroughly every time it is used. Keep the table you work on perfectly clean. If you happen to spill a little hypo solution on the floor or table, clean it up at once, for if left there to dry, the hypo will soon be floating around the room in the form of fine dust and you will wonder what causes the spots in your negatives. If you put your fingers in the hypo solution wash your hands thoroughly before you touch anything else.

CHAPTER XIV.

FAULTS IN NEGATIVES AND THEIR REMEDIES.

Technical Terms

In this chapter we are obliged to make use of several technical terms used by photographers in speaking of negatives. These terms, although a little hard to define without having a negative as an example, are to a certain extent self explanatory. For instance, a photographer speaks of a good negative as being "brilliant," or sometimes as "snappy" or "plucky," terms which seem to naturally express the idea that the negative has a bright appearance, possessing neither too much density nor too little, but at the same time showing considerable contrast between the high lights and the shadows.

If, however, there is very little density even in the high lights, the negative is said to be "weak" or "thin." If it is so black all over that it prints very slowly, it is said to be "dense," and if it shows no clear or transparent places, even in the shadows, it is said to be "fogged."

When a negative shows little contrast between the high lights and the shadows, it is referred to as a "flat" negative. The term "thin" as used in connection with a negative does not refer to the thickness of the glass, but simply to the transparency of the negative, or its ability to transmit light. It is used as meaning the opposite of dense.

The "high lights" of a negative are the blackest parts—usually the sky, water, or any white or light colored object. The "shadows" are the most transparent parts of the negative, representing the shaded or dark colored portions of the picture.

Negatives which have been exposed longer than was necessary or proper are said to be "over exposed," and on the other hand, negatives which have not been exposed long enough are said to be "under exposed."

If a negative is not left in the developer long enough, it is said to be "under developed," and if left in too long, it is "over developed."

Great Contrast and no Detail in Shadows

When the high lights of a negative are very black and the shadows quite transparent, the trouble is caused by under exposure. Such a negative usually develops slowly and shows little or no detail in the shadows. Instantaneous exposures made in the shade, or on dull days, are nearly always under exposed. Under exposure is also frequently caused by using too small a diaphragm when making instantaneous exposures.

Very Little Contrast and Plenty of Detail in Shadows

If the high lights of the negative possess but little density and there is plenty of detail in the shadows, over exposure is indicated. The image on an over exposed negative usually comes up very quickly when placed in the developer. Such a negative is flat and cannot be made to yield a good print. Even an instantaneous picture may be over exposed if the subject happens to be very brilliantly lighted or very light colored, and in such cases (as we cannot make a shorter exposure) we lessen the exposure by using a smaller diaphragm. Views taken on the water will usually be over exposed, even though the fastest speed of the shutter is employed, unless a small diaphragm is used.

Too Much Density

If the negative is very black, so that it prints very slowly, the probability is that it is over developed—that is, left in the developer too long. Negatives are frequently left in the developer so long that the detail in the high lights is entirely obliterated, the negative in these parts becoming so black that it is almost entirely opaque. Dense negatives can be reduced, that is, made thinner, as explained in the chapter on Intensification and Reduction.

Thin or Almost Transparent Negatives

Negatives which are very thin, showing almost no black, and no details in the shadows, are usually the result of under development. Beginners in photography are very apt to stop development too soon, thinking that when the picture shows plainly all over the plate it must be fully developed, thus making no allowance for the fading which takes place in the fixing bath.

Small Transparent Spots

The defects usually spoken of as "pin holes," consisting of small transparent spots, are almost invariably caused by particles of dust which were on the plate at the time it was exposed. This

may be easily avoided by carefully dusting the face of the plate with a soft camel's hair brush before putting it into the holder.

Round Transparent Spots

Round or nearly round semi-transparent spots varying from the size of a pin head to that of a pea, are caused by air bubbles forming on the plate during development. Such bubbles protect the surface of the film from the action of the developer and thus leave the spot not fully developed. Bubbles should be instantly brushed away by a light touch of the finger as soon as they appear.

Fine Transparent Lines

Fine transparent lines in the negative are the result of dusting the plate with too stiff a camel's hair brush or using too much force. The brush for dusting plates should be very soft and used very lightly and carefully. It should also be kept exclusively for the purpose of dusting plates and never put to any other use.

Opaque Spots and Lines

Black or opaque spots in the negative may be due to a great variety of causes, most of which, however, come under the heading of dirt or impurities of some kind, either in the developer, fixing bath or the washing water. Dirt, from the photographer's standpoint, is simply matter of any kind in the wrong place, and cleanliness and special attention to the water used in making the developer or the fixing bath, and for washing the plates is the only preventive. Particles of iron or iron rust frequently cause black spots, and spots caused in this way can be removed by soaking the plate a few moments in the following bath:

Water - - - - - -	5 ounces
Concentrated Sulphuric Acid - -	¼ ounce

Opaque spots and lines are also caused by hypo, pyro, carbonate of soda or other chemicals getting on the camel's hair brush used for dusting the plates.

Yellow or Brown Stains

The most frequent cause of yellow or brown stains on a negative is the use of a pyro developer which has been allowed to spoil from age or exposure to the air. Other developers, under the same circumstances also produce stains, although not so frequently as pyro. Stains may also be caused by a fixing bath which has been used repeatedly until it has become discolored. Stains are invariably the result of carelessness in working, or a failure to keep the dishes or chemicals absolutely clean at all times.

A White or Frosty Appearance

Sometimes a white deposit, somewhat resembling frost, appears on the film of the negative after it has been dry a few days. This is caused by insufficient washing, the white deposit being hypo which was not entirely washed out of the film. Great care should always be exercised in washing negatives, as failure to entirely remove the hypo will invariably result in the ruin of the negatives sooner or later.

Spreading of the High Lights

In subjects in which there is great contrast of light and shade, the high lights in the negative frequently extend beyond their proper boundaries and thus blot out the detail in the surrounding portions. This is known technically as "halation," and is most frequently met with when photographing interiors. If there is a window in the view, the light from the window spreads out on every side and very seriously impairs the beauty of the picture. In photographing interiors the view should, if possible, be taken from a point where no window will be included, and if this is impracticable a non-halation plate should be employed. This is a specially prepared plate so made that it overcomes halation, and is very useful, especially when making interiors.

Finger Marks

If the fingers are allowed to come in contact with the film of the plate at any time before development, a finger mark on the negative is almost invariably the result and it is almost impossible to remove such marks. Finger marks are also frequently caused by placing exposed plates in a box with the film side of one plate in contact with the glass side of another. Although the greatest care may have been exercised not to touch the film when handling the plates, the backs of the plates were undoubtedly touched, and as the film lies in contact with the back of the plate next to it, the finger marks there are transferred to the film. If plates are to be kept in a box before development they should be placed film to film.

Uneven Density or Mottled Appearance

Carelessness in pouring the developer over the plate, thus failing to entirely cover it at the start, or failure to keep the tray rocking during the development, results in making the negative more dense in one part than in another, or giving it, especially in the sky, a mottled appearance.

Black Streaks or Blotches

If the negative has black streaks or a large patch of black, thus partially obliterating the details of the picture, it has been light struck, that is, it has been subjected to the action of light either before or after exposure. This may be due to a leaky plate holder, to white light coming from the ruby lamp, to light entering through cracks in the dark room, to the slide of the plate holder being partly drawn by accident, or to a number of other causes which will no doubt readily suggest themselves to the reader. Bear in mind that a light struck plate is always black where the light has touched it, this being the only effect light ever produces on a plate. There is no remedy for a light struck plate.

Fogged Negatives

If there is a general darkening or blackening of a negative all over, even in the parts which should be almost transparent, the negative is said to be fogged. If the fog extends evenly all over the entire plate, including the narrow margin of clear glass along the edge, the probability is that the trouble was caused by an unsafe dark room lamp. The lamp may actually leak white light, or it may simply give such a bright ruby light that it affects the plate while it is being developed. If your light is bright enough to affect the plate it should be covered over with one or more thicknesses of either postoffice paper or ruby fabric. The safest light is one in which both an orange or yellow and a ruby glass is used.

If the margin of the plate is perfectly clear and the fog therefore entirely confined to that portion of the plate which was exposed, the cause is either over exposure or a dirty, dusty lens.

Too strong a developer is another cause of fog and may be avoided by weakening the developer with water.

During warm weather fog is frequently caused by the developer being too warm, as explained in the chapter on Developing.

Negatives are sometimes fogged by accidentally getting a little hypo into the developer.

Blurring or Lack of Sharpness

If the picture is not sharply defined anywhere on the plate, appearing blurred to about the same extent everywhere, the probability is that the camera was jarred or moved during the exposure. This is, of course, more apt to occur when a time exposure is made. The wind may shake the tripod or the camera may be placed on a support that is not perfectly steady. The negative is always blurred when the camera is held in the hand during a time exposure, as it is

absolutely impossible to hold it steady enough to make a sharp picture. Sometimes when pressing the button for an instantaneous exposure the camera is jarred sufficiently to blur the negative.

If the picture is sharp in one part and blurred in another, the fault is due to lack of proper focusing. In such cases the picture may be sharp in the foreground but blurred in the distant parts, or it may be blurred in the foreground and perfectly sharp in the distance. Blurring from this cause can, of course, be avoided by focusing more carefully or by using a smaller diaphragm. Another cause of blurred negatives is movement on the part of the object photographed. This occurs more frequently in time exposures, especially when there are people in the view, as in a group. It is quite difficult to make a photograph of a large group without having someone in the group move if the exposure is very long. In photographing moving objects, in which case an instantaneous exposure is, of course, made, the object may move so rapidly as to cause a blur. Blurring from this cause can frequently be avoided by selecting a point of view where the moving object does not move directly across the field of view but rather moves diagonally. This is an especially important point to consider when photographing running horses. They should not be taken broadside on, but should be taken at an angle.

Defects in General

If a negative never possessed more than one defect at a time, it would be an easy matter to locate the difficulty in every case, but it frequently happens that several defects exist in the same negative at the same time, and a correct diagnosis of the trouble then becomes a more difficult problem. We have seen a negative which was out of focus, under exposed, light struck, fogged, stained by developer and insufficiently washed. Such a negative presents a puzzle, even to the expert, who finds it hard to say, fully, just what caused the trouble, and under such circumstances we can only advise the unfortunate photographer to look carefully to all possible causes for the failure; examine the camera and plate holders for leaks, see that the ruby lamp is not too bright, make up fresh developer and fresh fixing bath, make sure that your plates have not been previously exposed to white light, and be absolutely certain that everything, including your chemicals, trays, etc., are absolutely clean; then try two or three more exposures of the same subject, giving them different lengths of time. The chances are that you will succeed in making a better negative, if not a perfect one, after taking these precautions. Perseverance, care and careful

attention to details will invariably win in the end, and you will soon wonder why you ever had any trouble in photography.

Do not blame your plates or the chemicals when you make a bad negative. The writer, who has been engaged in photography for fifteen years, during which time he has made thousands of negatives, has seen but one box of defective dry plates, and that was more than ten years ago, when the dry plate makers didn't know nearly as much as they do at present. The defect in these plates, by the way, was so trifling that they were used in making some negatives for the publisher of one of our leading magazines, who wished to use them for halftone illustrations, and he was perfectly satisfied with the pictures; in fact, he did not notice that anything was wrong.

The following incident, which recently came under the writer's notice, will serve to illustrate how easily some slight error in working may be overlooked, and consequent defects attributed to the plates or the materials, when the fault in reality lies entirely with the operator: One of the leading photographers in Chicago noticed that for some time every negative that he made was almost ruined by black streaks and spots. He at once set about to find the cause of the trouble, and made perfectly sure there was no leak in the camera, that his developer and fixing bath were all perfectly good in every respect, and he decided that the trouble must be due to faults or defects in the plates which he was using. He therefore sent to his supply house for a box of plates of a different brand; made a trial exposure with one of them, developed it, rinsed it off under the tap, fixed it and took it out to the light for examination; he found he had a perfect negative and then had no further doubt in his mind as to the cause of his troubles. He concluded, very naturally, that the brand of plates he was using was defective. He had, however, overlooked one little point, which, although apparently of no consequence whatever, happened in this case to make all the difference in the world. He was accustomed to develop a large number of plates every day, and in order to save time each plate as it came from the developer was placed in a wooden tank of water on the dark room floor. When the entire batch was developed they were removed from this tank of water and put through the fixing bath. When he tried the plate out of the new box, he was naturally anxious to see at once whether he had a good negative or not, and so did not place this plate in the tank of water before putting it into the fixing bath, but simply rinsed it under the tap and transferred it at once to the fixing bath. The writer, after looking over his method of working, suggested that possibly

the trouble with his regular brand of plates had been due to placing them in the tank of water, to which he replied that there was nothing in the tank but water, which could not possibly account for his difficulty. We examined the water in this tank, however, and found that it had not been changed for several weeks and was consequently full of impurities, especially organic matter, and was, in fact, the sole cause of the spots and streaks. After emptying out this tank, thoroughly cleaning it and refilling it with clean water, no further spots or streaks were found in any brand of plates which he used.

We mention this incident merely to show how easily overlooked the real cause of the trouble may be, and how important it is to look carefully into the details in every particular.

CHAPTER XV.

INTENSIFICATION AND REDUCTION.

Even the expert photographer, with his years of experience, does not produce a perfect negative every time, so the amateur or beginner must expect to make many negatives which will require doctoring in some way before they will yield good prints.

A weak, thin negative, lacking in contrast, may be improved by intensification, and a negative which has been over developed, thus making it so dense that the detail in the high lights is lost, may be corrected by reduction.

Intensification

Negatives may be intensified at once as soon as they are fixed and thoroughly washed, or at any subsequent time, at the discretion or convenience of the operator. It is, however, extremely important that the washing of the negative before intensification be very thorough, as the least trace of hypo left in the film will cause stains when the intensifier is used.

Prepare the following solutions:

SOLUTION No. 1.

Bichloride of Mercury - - -	60 grains
Water - - - - - - -	8 ounces

SOLUTION No. 2.

Sulphite of Sodium, crystals -	400 grains
Water - - - - - -	8 ounces

If these solutions are not perfectly clear and clean they should be filtered before use.

The operation of intensifying may be done in daylight, as light has no effect on the plate during this process. If the negative has been allowed to dry, put it to soak in clean water for ten or fifteen minutes or until the film is thoroughly softened. Place the plate in a clean tray and pour over it enough of solution No. 1 to thoroughly cover it, then rock the tray as in developing. The plate will commence to turn white, and as soon as it is well bleached or whitened, remove it from the tray and wash it through three or four changes of water.

Now place the negative in another perfectly clean tray, pour a sufficient amount of solution No. 2 over it to thoroughly cover it and rock as before. In solution No. 2 the negative will quickly turn black again and soon gain the desired density, after which it is washed for about one-half hour, changing the water several times.

Good results depend principally upon leaving the negative in solution No. 1 the correct length of time, and this can only be learned by practical experience. If the negative comes out too black it was in solution No. 1 too long, and, on the other hand, if it is not dense enough it was not left in solution No. 1 long enough.

If the trays used for intensifying have been previously used for other purposes, they must first be very thoroughly washed. Failure to observe this rule carefully will almost invariably result in stains. If there is a yellow stain formed on the plate during intensification, it is due to the fact that the hypo was not entirely washed out of the film before commencing the operation.

CAUTION.—Solution No. 1 is a deadly poison and must be handled with great care. All intensifiers are deadly poison, as there are no non-poisonous chemicals which can be used for intensifying.

Reduction

The operation of reducing an over dense plate is usually attended with more satisfactory results than the process of intensifying a weak negative.

Make up the following solution:

HYPO SOLUTION.

Water	8 ounces
Hypo	2 ounces

RED PRUSSIATE SOLUTION.

Red Prussiate of Potash	½ ounce
Water	8 ounces

It will be noted that the hypo solution is just the same as an ordinary fixing bath, but it should be freshly prepared at the time of using and should not have been previously used for any other purpose. Red prussiate of potash is also known as ferri-cyanide of potash and must be handled carefully as it is a deadly poison. Keep the red prussiate solution in the dark room when not in use, or wrap the bottle with opaque paper, as the solution is sensitive to light.

Negatives may be reduced as soon as they are fixed, even before they are washed, or they may be reduced at any subsequent time after they have dried. In the latter case, however, they should be put to soak for ten or fifteen minutes to thoroughly soften the film.

When the negative is ready to be reduced, add about ¼ ounce of the red prussiate solution to 8 ounces of the hypo solution, stir or shake it well and pour over the negative in a perfectly clean tray. Reduction will take place more or less rapidly according to the amount of prussiate solution added to the hypo solution. We advise rather a small amount, so that the process can be more easily controlled. Examine the plate frequently by holding it up to the light, and just as soon as it is sufficiently reduced, stop the action by placing it in clean water.

The negative should now be thoroughly washed for one hour, changing the water about one dozen times in order to thoroughly remove all traces of hypo.

CHAPTER XVI.

OUTDOOR PHOTOGRAPHY.

Landscapes The success of a landscape photograph depends very largely on the judgment with which the subject is chosen. It is not always the view which at first sight appears the most beautiful to the eye that makes the best photograph. The moving clouds, in their background of bright blue, contrasted with the brilliant green grass, and the darker colors of the foliage may lose their charm, when rendered in the indiscriminating black and white of the photographic negative. The beginner in photography requires a little education by practical experience before he can see just what will make a good picture.

Let it be remembered, first, that a photograph is merely light and shade. Brilliant and contrasting colors, however beautiful to the eye, may make a poor showing when depicted in plain black and white. It must not be imagined, however, that grand and impressive scenery is necessary to get pictorial results; frequently the best pictures are the simple subjects right at hand; a clump of trees, with cattle grazing peacefully by, a rustic bridge, or a glimpse of the river with a fisherman watching his line.

Get into the habit of studying the effect of light and shade. Notice the different aspects which the same view presents under the changing light of morning, noon and evening.

If there are any straight lines in the picture, such as a hedge, a road, a row of trees or the horizon line, select a point of view from which this line will not run parallel with the edge of your picture.

The foreground is always the most important part of the picture, and a flat, monotonous foreground, such as a broad, unbroken expanse of water or a level meadow, must be avoided. A clump of bushes or a boat may relieve a monotonous foreground and make a view picturesque that would otherwise be far from artistic.

Choose that point of view which brings into prominence the most interesting features, and endeavor to relieve any monotony or flatness of foreground by the introduction of human figures or anything else that will break up and lend variety to the picture.

There is a mistaken idea prevalent among many photographers that the sun must always be at one's back when making an exposure. Nothing could be further from correct, as, with the sun shining directly behind the camera, the lighted side only of the subject is shown, thus giving no shadows, and consequently no contrasts of light and shade. A picture with no shadows is flat, entirely lacking in vigor and life. The best results are obtained when the sun is at one's side, so that the subjects in the view present both a brightly lighted and a shaded side. If the sun is so far in front of the camera that it shines directly into the lens, shade the lens with the slide from your plate holder or your hat. If this is not done, the direct rays of light shining into the lens will fog the plate.

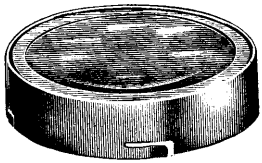
Moonlight Views

Photographs may actually be taken at night by moonlight, the necessary exposure varying from one to three hours, but such pictures look very little different from photographs made by daylight, and are of interest only as showing that it is possible to make a negative by moonlight. The so called moonlight views, however, which look like actual night scenes are always taken, strange as it may seem, in the day time. Views on lakes or rivers with the light coming from behind the clouds and a glimmering reflection on the water, are the most popular subjects.

Such views are usually made either early in the morning or late in the afternoon, and the camera is pointed directly toward the sun, the exposure being made while the sun is hidden by the clouds. A very short exposure is made, if necessary with a small diaphragm, in order to obtain a slightly undertimed negative. The result is a picture which has every appearance of having been made in the evening by moonlight, and some very artistic views may be made in this manner.

Photographing Clouds

Clouds improve the artistic quality of a landscape very greatly, and yet the sky in most photographs is perfectly blank. This is due to the fact that the light from the blue sky produces quite as much effect on the plate as the light from the white or light colored clouds, resulting in a complete loss of the clouds themselves. Therefore, if we wish to have the clouds show in the negative, we must find some way of cutting out the power of the light from the sky, and this is accomplished by slipping over the hood of the lens during exposure a little device known as a ray filter, which is simply a piece of very



A RAY FILTER.

perfect optical glass of a light yellow color. It has the effect of holding back the blue rays of light, but admits the white rays from the clouds, and the result is a negative in which the clouds are shown as distinctly as the rest of the picture.

Photographing a Lightning Flash

At first thought the photographing of a flash of lightning may appear to be a very difficult operation, but in reality nothing is easier. Select a window from which you can command a view of that portion of the sky in which the lightning is appearing, focus the camera for objects 100 feet or farther away, put the plate holder in, draw the slide, open the shutter, and wait for a flash. As soon as it comes, close the shutter, for a second flash on the same plate would probably spoil the effect. Use the largest diaphragm, and if possible avoid having any street lamps or other lights within the field of view.

If you are using a simple hand camera it will, of course, require no focusing, and if you have a regular view camera without a focus scale, it would be a good idea to focus the camera beforehand on some distant object, say 200 or 300 feet away, marking on the camera bed the place to which the bellows is extended, then, when the storm comes, you can easily run the bellows out to this point and the lightning will be sharply focused.

Groups

The most satisfactory results in photographing groups are obtained out of doors. The picture should be made in the shade, as direct sunlight gives a very harsh light to the face and an unnatural expression to the eyes. In the shade a softer and more pleasing effect is obtained. The north side of a house frequently makes a very satisfactory place for photographing a group, and if possible a spot should be selected where a clump of small trees, a hedge, a wall covered with vines, or some similar natural background can be utilized.

Do not place the camera so close to the subject that the group will occupy the entire plate, as a much better effect is obtained if there is some margin left. Careful attention should be given to the general arrangement of the group, placing them neither too close together nor too far apart. Give the foremost place to the smaller members of the group, placing the larger members in the rear. If the group is a large one, so that some of the members are likely to be hidden by others it is a good idea to have a bench or some chairs so that those in the rear can be raised above those in the front, thus bringing them all into view. A more artistic appearance is obtained

if each member of the group is allowed to select the point toward which he will direct his eyes during the exposure, as in this way the members of the group are not all looking in exactly the same direction and the general effect is much better.

Use the largest diaphragm in your lens and make the exposure as short as possible without undertiming the plate. As a general rule about one-half or one second exposure is correct when making a group on a bright day in the shade of the north side of a house. It is well, of course, to caution the members of the group to remain quiet during the exposure, although there is not much danger of blurring the negative in exposures of one second or less.

Length of Exposure

A good negative cannot be made unless the plate is exposed the correct length of time, and the beginner in photography usually finds this a rather difficult problem. With the subject brightly lighted by sunlight, the largest diaphragm in your lens, and a fast plate, a quick, instantaneous exposure will always produce a properly timed plate. Just as soon, however, as any of the above conditions are lacking, it becomes necessary to use judgment in determining the correct exposure, which, for out of door views, may vary from a fraction of a second to possibly, under very unusual circumstances, several minutes.

We will take it for granted that a rapid plate is used, as slow plates are very seldom used nowadays; in fact, very few dealers even carry them in stock, and the time of exposure will then depend upon two factors, the brightness of the light and the size of diaphragm. Of course, the duller the light or the smaller the diaphragm, the longer the exposure must be. It is impossible to give definite instructions upon this point, and each one of us must find by practical experience how to judge the light accurately enough to determine the correct exposure.

There is a little book published, called The Photo Beacon Exposure Tables, which is of great assistance in determining this important point. These tables give the exact exposure at any time of day, for any day in the year, with any size of diaphragm or any brand of plates.

It will, of course, be readily understood that the time of day or the time of the year has a great deal to do with the length of exposure. It is, for example, much brighter at twelve o'clock than at five, and much brighter in June than in November.

CHAPTER XVII.

INDOOR PHOTOGRAPHY.

Interior Views

The photographing of interiors presents a harder problem to the beginner than outdoor views, owing to the strong contrasts of light and shade, the confined situation and the difficulty of judging the correct length of exposure.

Any kind of a camera may be used, although better results are obtained with a folding camera, as the picture can be so much more accurately focused and carefully arranged on the ground glass. If you have a wide angle lens, so much the better, as a much larger field of view is included in the picture than can possibly be included with a single achromatic or rapid rectilinear lens.

Set the camera up at the point from which the most interesting view of the room is obtained, and if possible, select a position from which no window is included in the picture. The light from a window has a tendency to spread out on every side, thus obliterating the details all around it, giving the picture a fogged appearance and frequently entirely ruining it.

Focus very carefully upon some object about midway between the immediate foreground and the farthest point away. Focus with the largest diaphragm, but when the exposure is made use one of the smaller diaphragms. We advise the use of a small diaphragm in all cases for interior work, as it is practically impossible to get everything sharply defined with a large diaphragm.

Length of Exposure

The length of exposure for an interior view is very long as compared with an outdoor exposure, owing to the great difference in the amount of light. It is difficult at first to appreciate the immense difference between the intensity of light, indoors and out. Our eyes accommodate themselves to the brilliant light outside or the dim light inside, but the camera has no such power of accommodation, and the length of exposure must be regulated according to the actual amount of light.

The brilliancy of the light in a room depends upon the brightness of the light outside, the number and size of the windows and the color of the walls, all of which must be taken into consideration in determining how long an exposure to give.

The following table will aid the beginner in deciding the correct length of exposure, although it cannot be relied on in all cases, as experience is the best teacher:

White walls and more than one window.	
Bright sun outside	2 seconds
Cloudy but bright	8 seconds
Cloudy and dull	20 seconds
White walls and only one window.	
Bright sun outside	3 seconds
Cloudy but bright	12 seconds
Cloudy and dull	24 seconds
Medium colored walls and more than one window.	
Bright sun outside	4 seconds
Cloudy but bright	16 seconds
Cloudy and dull	32 seconds
Medium colored walls and only one window.	
Bright sun outside	10 seconds
Cloudy but bright	40 seconds
Cloudy and dull	1 minute 20 seconds
Dark colored walls and more than one window.	
Bright sun outside	10 seconds
Cloudy but bright	40 seconds
Cloudy and dull	1 minute 20 seconds
Dark colored walls and only one window.	
Bright sun outside	20 seconds
Cloudy but bright	1 minute 20 seconds
Cloudy and dull	2 minutes 40 seconds

The exposures given in this table are for stop No. 4 (F.8). As a smaller stop is almost always used, the actual exposure must be increased according to the size of the stop; for instance, with stop No. 8, multiply the above figures by two; with stop No. 16, multiply by four; with stop No. 32, multiply by eight; with stop No. 64, multiply by sixteen.

If you are using a box camera without stops, the exposure given in the table should be multiplied by two.

In making an interior view which you will not have an opportunity to make over again, we should advise two or three exposures, giving different lengths of time to each, in order to make sure of getting one correct. After a little experience you will be able to judge the correct exposure very accurately by noting the brilliancy of the image on the ground glass.

There will be, of course, many interior views in which no point of view can be selected from which no window will be included, and in such cases a special plate, known as a non-halation plate, must be used. These plates are especially prepared with reference to overcoming the spreading of high lights, and if properly exposed the window will appear sharp and distinct, while the detail all around it will come out with perfect clearness.

Copying

It is frequently desirable to make a photographic copy of a painting, an engraving or another photograph. When any large amount of such work is to be done, a camera made especially for the purpose is more satisfactory, but the occasional copying that the ordinary photographer does may be accomplished with any view camera, or a folding hand camera of the long focus style. The long bellows is necessary if the copy is to be as large or nearly as large as the original, as it is impossible to focus a short bellows camera when close enough to the subject to make it large. A recent invention, however, known as a copying and enlarging lens, which is used in connection with the regular lens of a folding camera, makes it possible to do copying even with a short bellows camera.

The picture to be copied should be attached to a vertical board placed as near as possible to a north window through which a strong diffused light shines upon it. The camera is placed directly opposite the picture and at the same height. It will probably be found necessary to do considerable maneuvering in order to get the picture into the desired position on the ground glass, and of the right size and in sharp focus. When the camera is arranged in a satisfactory manner, give a rather long exposure with the smallest stop.

CHAPTER XVIII.

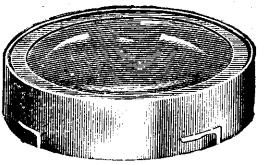
HOW TO MAKE PORTRAITS.

The making of portraits is one of the most fascinating branches of photography, and at the same time the one in which the beginner meets with the greatest disappointments. The difficulties met with in portraiture, however, are almost invariably due simply to a lack of the necessary knowledge of proper lighting and the use of backgrounds, reflectors and other accessories. We hope to make these points so clear in this chapter that portrait making at home will become one of the easiest instead of the hardest parts of photography, and the pictures that you will make of your family or friends will really be better likenesses than those in the family album. Their features, unawed by the solemn preparations incidental to having a picture taken in a professional's studio, will retain that natural and unrestrained expression so essential to a good likeness.

Cameras for Portrait Making

Any kind of a camera may be used for portrait work, but a folding camera or view camera with long bellows is the best adapted for this purpose, as it is necessary to place the camera rather close to the subject in order to make the face as large as desirable and without a long bellows it is impossible to focus when close to the subject. If a simple hand camera is used it must be placed at least six to eight feet from the sitter in order to make sure that the picture will be sharp, that is, in focus. This has the effect of making the face rather small, but with this kind of a camera there is no way of avoiding this. If a short bellows camera, such as the Conley A Folding or the Conley Senior Folding, is used, the faces will be a little larger than when a box camera is used, but still not as large as is desirable. In this case, however, there is a remedy in the shape of an auxiliary lens, which can be used in connection with the regular lens of the camera and by the aid of which, the faces can be made as large as wanted. These portrait lenses are fully described in our catalogue and constitute a very valuable addition to an outfit.

Portraits can, of course, be made out of doors, and the suggestions regarding the making of groups, as outlined in the preceding chapter, will apply just as well to portraits. Out of door portraits, however, are not nearly so satisfactory as those made in the house, owing to the fact that the operator has practically no control whatever of the light, and it is therefore impossible to get the natural and lifelike expressions which can be obtained indoors where the light is under perfect control.



AUXILIARY PORTRAIT LENS.

Lighting in Portraiture

Good results in the making of portraits are entirely dependent upon the lighting; that is, the way in which the light falls upon the subject or sitter. There should be but one source of light and, if possible, this should be a north window not shaded by trees or buildings. If there are other windows in the room, they should be darkened by opaque curtains, and the lower half of the window admitting the light to the room should be darkened by covering it over with a dark cloth. With this arrangement the light comes from one source only, and that from above the head, thus striking the sitter at an angle of about 45 degrees.

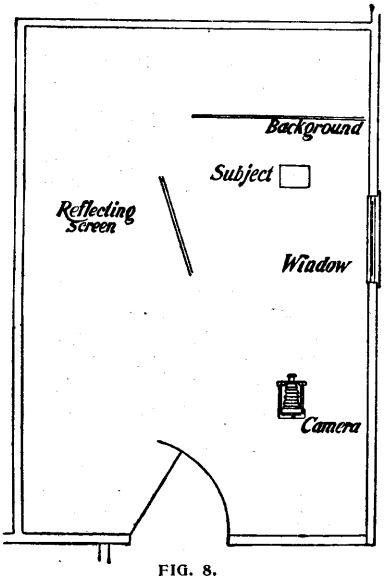
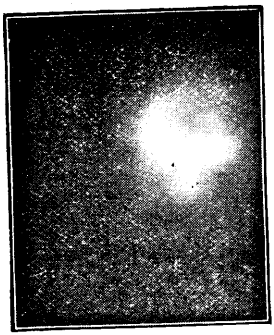


FIG. 8.

We can best explain the proper lighting and the proper use of the background and reflecting screen by the aid of a diagram. (See Fig. 8.) In this diagram we have illustrated in a general way the relative position of the camera, the sitter, the background, the reflecting screen and the window, from which the light is admitted to the sitter.

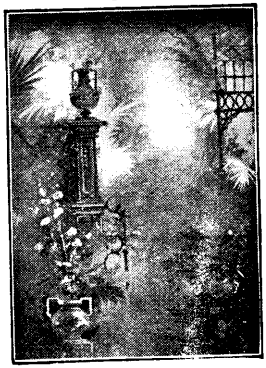


CLOUDED BACKGROUND.

While it is, of course, not necessary that the exact relative position of the camera, the sitter, reflector, etc., be maintained exactly as shown in the diagram, still this arrangement gives the best results as a general rule. As you gain experience in the work, you can modify this arrangement as may be required, to suit special occasions. In this diagram the sitter is 2½ feet from the window, and the front of the chair is just even with the farther side of the window. The background is 3 feet behind the sitter, and the reflector is 3½ feet from the sitter.

Backgrounds and Reflectors

A good background in portrait work is quite essential, as it gives a more elegant or finished appearance and eliminates all unsightly objects, which would otherwise detract from the portrait. Backgrounds should be painted in oil, on heavy canvas, and a shadowy or clouded design is usually the most suitable. For bust pictures a headground 4x4 feet is large enough, but for full figure portraits we recommend a ground measuring 5x7 feet



SCENIC BACKGROUND.

The object of the reflecting screen is to illuminate the side of the face away from the window, which would otherwise be very much too dark. By careful manipulation the reflecting screen may be made to produce the soft reflected lighting which gives light and beauty to the portrait. A turn of the screen toward or from the light and you have the difference between a flat, untruthful portrait and one that is natural and consequently artistic.

Posing

A great deal depends upon the care taken in posing a subject, and any position which is stiff, unnatural or difficult for the subject to maintain should be avoided. In many instances the sitter will naturally take some position which will be satisfactory, and in such cases the photographer will do well to make the exposure without further delay. Spend as little time as possible in posing, especially when photographing children or very old people,

as the fuss and worry soon make them nervous and ill at ease, and a successful portrait is almost impossible. Always have the camera ready, the plate holders loaded, the background, etc., all arranged before you attempt to pose a sitter, as a delay after the subject is once ready is sure to undo all your efforts.

Try to pose your subjects in a manner that is in some way characteristic; for instance, grandmother may be seated in her favorite rocking chair, busy with her knitting; or grandfather will undoubtedly appear thoroughly himself if photographed with his spectacles and evening paper. The baby in his high chair, with a bowl of bread and milk in front of him, will please his proud parents, and the small boy of the family will look as natural as life if pictured with his big straw hat and bare feet.

Length of Exposure

The proper length of exposure depends entirely upon the brightness of the light, which, of course, varies according to the time of day, the size of the window, the color of the walls in the room, etc. It is naturally desirable that the exposures be as short as possible, and for this reason the largest diaphragm in the lens should always be used. If the window is a large one, the exposure on a bright day with a rapid lens may be as short as one or two seconds. With a smaller window, dark colored walls in the room or a cloudy day, it may be necessary to expose much longer, but long exposures should be avoided if possible, as the sitter is almost certain to move and it is impossible to maintain a natural expression so long.

We suggest that a number of exposures be made in each case, as you cannot always be certain that you have secured just the results desired, but from three or four or one-half dozen exposures you will undoubtedly be able to select one which will be entirely satisfactory.

Do not become discouraged if your first attempts in portraiture are not successful, but keep at it. Practice makes perfect and experience is the best teacher. Good portrait making is really difficult work and for this reason you will take all the more satisfaction in your portraits when you have become proficient.

CHAPTER XIX.

FLASHLIGHT PHOTOGRAPHY.

For indoor work, especially at night, flashlight offers many opportunities for picture making, and it is a branch of photography which is frequently neglected by those who do not realize its possibilities. For many purposes flashlight is even better than natural light, as it can always be depended upon and can be so placed as to get just the effect desired; in other words, the operator has perfect control of the illumination, which is not always the case with daylight. Interior views, groups and portraits around the family fireside or at evening gatherings and parties, are all easy with the aid of the flashlight.

Many interior views which are so dimly lighted, or in which certain parts are in such deep shadow that an exposure in the ordinary way is a failure, may be successfully photographed by using flashlight.

Apparatus for Flashlight Work

Any camera may be used for making pictures by flashlight, no special apparatus being required excepting the flash powder itself, and a lamp in which to burn it. Even the lamp may be dispensed with if desired.

Flashlight powder is simply an explosive compound containing a large proportion of powdered magnesium, and when ignited it burns with explosive violence, the same as so much gunpowder. The light produced by the burning magnesium is exceedingly brilliant, in fact, almost equal to sunlight in its effect upon the photographic plate. Owing to its explosive nature, it should, of course, be handled with great care, although with due caution there is little or no danger of an accident. Flashlight powder may be purchased in bulk, usually in 1-ounce packages, or it may be purchased in the form of cartridges, which are simply little boxes full of powder with a fuse attached.

Flashlight lamps are simply devices for igniting flash powder. There are a great many different styles made and it would be hard

to say which is the best; in fact, it is largely a matter of personal opinion, as almost any of the lamps on the market will give good results.

In using the cartridges no lamp is necessary, the cartridge being simply placed on something which will not be injured by the heat, and the fuse lighted with a match.

Arrangement of Light and Camera

When making a flashlight exposure, the flashlight should be placed on some support a little above the level of the camera and about 2 feet to one side. The light should never be placed far enough in front of the camera so that it can shine into the lens, and should always be a little to one side and above.

Focusing

When it is necessary to employ flashlight, it is usually too dark to focus in the ordinary manner, owing to the dimness of the image seen on the ground glass, and the most convenient method of focusing in such cases is to place a lighted lamp at that point in the picture upon which you desire to focus sharply. The image of the lamp is easily seen on the ground glass and, therefore, readily focused. In order to make sure of getting all parts of the picture sharp, the lamp may be carried from one point to another. When focusing upon a group it is a good plan to have a light of some kind (a candle or a burning match will answer) held by those members of the group at each side, in order to make sure that every member of the group is included within the field of view. The members of the group should also be cautioned not to look at the flashlight when it is ignited, as the intensely white, blinding flash is sure to give an unnatural staring expression to the eyes. It is sometimes recommended that the lamps or gas jets in a room be turned down or extinguished during the exposure, but this is entirely wrong; the more light you can have in the room the better, and, therefore, all lamps and gas jets should be burning brightly. This not only makes it easier for the photographer to see what he is about, but gives a more natural and easy expression to the subject photographed.

Making the Exposure

Care should be taken not to ignite the flash powder close to any inflammable material, such as lace curtains. Cotton offers a very convenient method of igniting flash powder without a lamp, a small wisp of it being spread out loosely and the powder sprinkled upon it. A small piece of cotton is drawn out to act as a fuse and when ready for the exposure, this piece is lighted, the operator thus having abundant time to withdraw to a safe distance before the flame reaches and explodes the powder.

The exact method of making a flashlight exposure of any kind, whether it be an interior, group or portrait, is as follows: The camera is first sharply focused, the plate holder inserted, the slide drawn and then, when everything is ready, the shutter is opened, after which the flash is lighted. As soon as the flash has been made, the shutter is closed. This, it will be noticed, allows the shutter to remain open a few seconds, both before and after the flash is made; but owing to the dim light in the room, no impression whatever is made on the plate except during the actual time occupied by the flash powder in burning, and this is practically instantaneous.

Amount of Powder to Use

The amount of powder necessary for a flashlight exposure depends upon the size of the room to be lighted and the colors of the walls. In a small room with white or light colored walls, a small size cartridge is sufficient; or, if the powder is used in bulk and burned on cotton or with a lamp, from 15 to 25 grains will be required. If the walls are dark colored, a large cartridge, or as much as 30 or 40 grains, will be required; and in a very large room, such as a hall or church with dark colored walls, it may be necessary to burn as much as a half ounce, or even more. The exact amount depends, of course, upon the circumstances, and a little experience in this work, just as in judging the correct length of exposure, is necessary. Negatives made by flashlight may be over exposed or under exposed, just the same as those made in the ordinary way, although in this case over or under exposure is due to the use of too much or too little powder, instead of too long an exposure or too short an exposure.

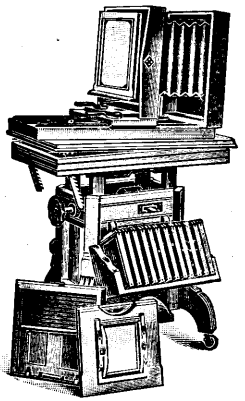
Portraits by Flashlight

Portraits by flashlight are easily made and in some respects are even superior to those made by daylight, owing to the fact that the operator has more perfect control of his light and the exposures are practically instantaneous. The same instructions regarding portraiture by daylight, as given in Chapter XVII, will apply to portraiture by flashlight, the flash taking the place of the window referred to in that chapter. The same relative positions of the camera, background, sitter and source of illumination are maintained. Flashlight is especially suitable in making portraits of children and babies, as it is often difficult to keep them quiet long enough for the time exposure which is necessary when working by daylight.

CHAPTER XX.

HOW TO MAKE MONEY IN PHOTOGRAPHY.

Photography as a profession offers a better opportunity to engage in a pleasant and lucrative business, upon a small investment, than anything else at present open to consideration. To those who anticipate making a profession of photography, we would advise the purchase of a regular viewing outfit, such as the Conley No. 1 View Camera. The outfit should be equipped with a first class time and instantaneous shutter and a rapid rectilinear lens, or, better still, an anastigmat lens. Such a camera can be used for any kind of outdoor work which the operator might be called upon to do, such as landscape work, residences, groups, street scenes, interiors, flashlights, etc. If a regular photographic studio making a specialty of portrait work is contemplated, it would probably be well to purchase a regular studio camera, such as is shown in our illustration, equipped with regular portrait lens, although such a camera can only be used in the studio, owing to its weight and bulk, and a great many people prefer, therefore, to start with a viewing outfit which can also be used in the studio in place of the studio camera, thus making one outfit answer for all the work which might be encountered.



STUDIO PORTRAIT OUTFIT.

The following method of conducting a photographer's business has been operated very successfully by many: The operator selects some business street or a residence district and starts out in the morning with plenty of plate holders loaded and makes an exposure on each store or residence on the street. He tells the owner that he merely wishes to make a photograph of his establishment for which he will charge him nothing, and that he would like to have

the members of the family or employes come out in front, where they will be included in the picture, in order to lend interest to it. No one ever objects to this, in fact, they are usually glad of the opportunity to have a picture made, and as they are not asked to pay out any money, they can make no objection on account of expense. In this way forty or fifty, or even a hundred exposures may be made in the course of a day. The plates are then developed, one picture finished up from each, and these pictures taken around to the owners of the places photographed and offered for sale; nine men out of ten will be pleased with the photograph, and even though they would not have ordered any in the first place, they will, when they see the finished picture, usually decide to take at least the one shown, and generally decide to order a dozen. In the case of a store, factory or other business establishment, every one of the employes who appears in the picture is a possible customer for one or more of the views, and sometimes a single negative may be made to yield a profit of from $10.00 to $30.00 or $40.00. The profit in view work of this kind is, of course, large. The actual cost of a finished picture in the 5x7 size, including the plate, paper, card mount and chemicals used, need not exceed 10 cents, and in case the customer desires only one copy, he can easily be induced to pay a half dollar for same. If he is willing to order one dozen, the price can be made much lower and still allow a large profit, as in the cost of making the additional copies only the expense of paper, card mounts and toning solution is included, and they may therefore be sold at a good margin of profit, for $2.00 or $3.00 per dozen.

If you encounter some who are not willing to pay 50 cents for the one picture which you have made, you can offer it for less money, say, 25 cents, or if necessary 15 cents, thus getting back your original expenditure. We have actually seen photographers working in this manner, making an average profit of $50.00 per day.

We should advise the photographer operating in this way to have, in addition to his rapid rectilinear or anastigmat lens, a wide angle lens, as store fronts, etc., are frequently located in confined situations where the operator cannot get far enough away to include the whole of the store with the regular lens.

This scheme for a permanent business is practical only when the operator expects to travel about from one town to another, and if it is desired to remain permanently in one place, the best way of getting business is by means of attractively written circulars, which can be mailed to all possible customers, and advertisements in the

local newspapers. These advertisements should draw particular attention to the excellence of the work which will be furnished, to the low prices and to the prompt and careful attention which will be given to all work intrusted to you. It is well to make suggestions to your customers regarding subjects which they might desire photographed, such as their residences, family groups, pictures of private grounds, fancy live stock, such as blooded horses, cattle, etc. Large groups made at picnics or flashlight groups made at evening parties are often very profitable, owing to the large number of pictures which will be sold. The writer recently photographed a group at a picnic containing over one hundred members, and practically every member of the group took at least one picture, and many of them took more to give away to their friends. The total sales were over two hundred pictures, upon which a net profit of over $60.00 was made, certainly a very fair return for a few hours' work.

In making pictures of groups for sale, special attention should be paid to the importance of finishing the pictures and having them ready for delivery at the earliest possible moment, as the customers will lose interest in the pictures after a time, and a great many more can always be sold immediately after the picture is made than several days or weeks later. Make one finished picture at once from which to take orders, then deliver them as soon afterward as possible.

The writer recently made a flashlight picture of a large group at a dance, making the exposure early in the evening. The negative was developed at once, quickly dried by the method described in Chapter XIII, and several prints made at once by gaslight on Darko paper. Within an hour and a half after making the exposure, several finished prints were ready, and while the interest was thus at its height, a large number of orders were taken. Had the pictures been shown several days later, not half so many could have been sold.

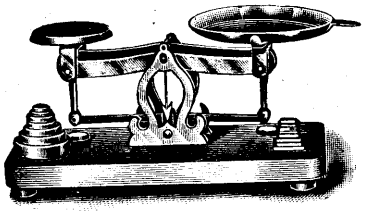
Students in college can sometimes make a large proportion of their expenses with a good camera, as views of the college buildings and grounds, groups of students, etc., will always meet with a ready sale.

Amateur photographers, without attempting to make a business of photography, frequently make, without difficulty, enough profit from pictures sold to more than reimburse them for the original outlay for the outfit and all running expenses for supplies, etc.

CHAPTER XXI.

MAKING SOLUTIONS.

We believe that almost everyone engaged in photography will find it to their advantage to prepare all of the various solutions used, such as developers, toning baths, intensifiers, reducers, etc., instead of purchasing them ready made. It not only adds interest to the work, but when any quantity of work is to be done, it greatly lessens the expense.



PRESCRIPTION SCALE.

Apparatus Required

The first requisite for this work is a scale of some kind for weighing the chemicals; a regular prescription scale is the best and it should be sensitive to as small a quantity as 1 grain. If, however, you do not wish to invest as much as the regular prescription scales cost, there is a new style of scale now on the market designed especially for photographic work, which is sold for about 35 cents and which will meet the requirements in most cases. This scale we illustrate in Figure 14. It has a glass pan which is easily cleaned and will weigh any quantity from 15 grains to 1½ ounces. For measuring water or other liquids, a glass graduate is used, and the 8-ounce size will usually be found the most convenient. Besides the scale and graduate you should provide yourself with a glass funnel and some filter paper for filtering the solutions, a mortar and pestle for grinding up chemicals, so they will dissolve more readily, and a number of clean empty bottles with capacities of from 4 to 16 ounces or larger.

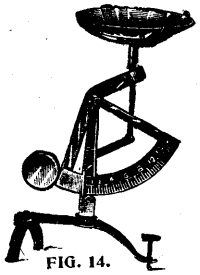


FIG. 14.

Chemicals

Only the best grade of chemicals should be used, as many of the failures and disappointments in photography are due entirely to impure or unsuitable chemicals. Buy all chemicals from a reliable dealer who makes a specialty of chemicals for photographic use. Then you are sure of getting the right kind.

Do not attempt to use chemicals bought from druggists or grocers, as such chemicals are not designed especially for photographic work and are almost certain to result in failure.

Do not ask your dealer to send you chemicals in the exact quantities called for by the formula, as he carries his stock in original packages, containing 1 ounce or 1 pound, as the case may be, and usually has no facilities for carefully weighing out small quantities; and even if he does, he is compelled to break a package, the balance of which immediately becomes dead stock on his hands. The smallest size package of developer, such as eikonogen, hydrochinon, metol or pyro, is 1 ounce, and other chemicals, such as sulphite of soda, carbonate of potassium, etc., are usually sold in 1-pound packages. Always order the size as given in the price list from which you make up your order.

Names of Chemicals

The fact that many chemicals have several different names or variations of the same name is sometimes confusing to the beginner in photography. For example, carbonate of soda is also called carbonate of sodium, or sodium carbonate, or sal soda, or simply soda. The writer has known customers to claim errors in the filling of their orders because the label on the package did not read exactly the same as specified in the catalogue or in the order. For example, it is not unusual for customers to order sodium sulphite and think that an error has been made in filling the order if the label on the bottle happens to read suphite of soda. Sulphite of soda and sodium sulphite mean exactly the same thing, and this same article may also be referred to as sulphite of sodium.

As another example, we may take potassium carbonate, which is also called carbonate of potassium, carbonate of potash, or salts of tartar, and the druggist will probably have this same chemical in his prescription case labeled "Carb. Potassii." Sulphate of soda is exactly the same as sodium sulphate, sulphate of sodium, or Glauber's salt, but is a very different article from sulphite of soda.

It is equally correct to speak of potassium bromide as bromide of potassium or bromide of potash. Nitrate of silver may be called

silver nitrate. Acetate of lead is the same as lead acetate, and so on, nearly all chemicals having these variations in their names.

Hypo, the most commonly used chemical in photographic work, is also called hyposulphite of sodium, hyposulphite of soda, or sodium hyposulphite, all of these names, differing slightly in their spelling or in the arrangement of the words, standing for exactly the same chemical.

Briefly, the point which we wish to make clear in this matter is that a difference in the name or in the arrangement of the words composing the name, does not necessarily indicate a difference in the chemical itself. Sodium sulphite, for example, is exactly the same article as sulphite of sodium or sulphite of soda.

There are great differences in the quality or purity of chemicals, however, and when buying chemicals for photographic purposes, care should be exercised to obtain those of the proper grade of purity for this purpose. For example, carbonate of soda is sold in grocery stores, usually under the name of sal soda or washing soda, and while this substance as sold in the grocery stores is actually carbonate of soda or sodium carbonate, it is a very impure form, which is entirely unsuitable for photographic work. Dealers in photographic chemicals nearly always offer for sale two forms of many chemicals, the most notable examples being carbonate of soda or sulphite of soda, one form being designated as crystals, the other as dry or anhydrous. Now, the chemical properties of either the crystals or the dry form are exactly the same, but, weight for weight, the dry form is the stronger or more powerful. This is due to the fact that a portion of the weight of the crystal form is made up of water, known as the water of crystallization. The crystals appear to be perfectly dry, as the water is combined with the chemical itself, but in the dry form this water of crystallization has been entirely driven out. Taking sodium sulphite as an example, an ounce of the dry form will go as far in making up a developing solution as 2 ounces of the crystals, as about one-half of the weight of the crystallized sodium sulphite is water.

Weights and Measures

Chemicals in dry form are always sold by avoirdupois weight, in which there are 16 ounces to the pound and 437½ grains to the ounce.

Formulas for solutions, however, are always given in apothecaries' weight, in which there are 12 ounces to the pound and 480 grains to the ounce. As apothecaries' weight is

the one you will use, we give the following table for convenience in figuring out formulas:

60 grains equal 1 dram
8 drams equal 1 ounce
12 ounces equal 1 pound

Water or other liquids are always measured by fluid measure and graduates are therefore marked with fluid ounces or drams and sometimes minims. A table of fluid measure is as follows:

60 minims	equal 1 dram
8 drams	equal 1 ounce
16 ounces	equal 1 pint
2 pints	equal 1 quart
4 quarts	equal 1 gallon

GRADUATE.

How to Make a Solution

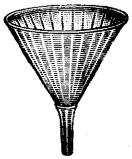
Absolute cleanliness and accuracy are essential to success in the making of solutions. Keep everything clean, wash graduates and all other dishes or bottles as soon as you are through using them, keep all chemicals in tightly corked glass bottles; have a place for everything and keep everything in its place. Always have every bottle or package of chemicals properly labeled.

As an example of the proper method of making up a solution, let us take the following formula, which is a very good hydrochinon developer:

Hydrochinon - - - - -	80 grains
Sodium Sulphite, crystals - -	640 grains
Potassium Carbonate - -	320 grains
Water - - - - - -	10 ounces

With the graduate, we first measure out 10 ounces of pure, clean water, which, for convenience, may be placed in a large bottle. Next weigh out, with the scales, 80 grains of hydrochinon, put it into the water and shake the bottle energetically until it is entirely dissolved. Then weigh out 640 grains of sodium sulphite, add it to the solution and again shake the bottle until it is entirely dissolved. Lastly, add the 320 grains of potassium carbonate, shake the bottle as before until it is all dissolved, then allow it to stand for an hour or so, after which the solution should be filtered to remove any particles of dirt, sediment or impurities which may be present.

Filtering is merely the chemist's name for straining, and its object is simply to remove dirt or other impurities which may be suspended in the solution.



FLUTED GLASS FUNNEL.

Fold a piece of filter paper straight down the middle, then fold it again at right angles to the first fold and you will find you can open it out to a cone shape which just fits into the funnel. Place the funnel, with the filter paper in it, in the neck of a bottle and pour the solution in. It will slowly soak through the paper and come out perfectly clear. Filtering is accomplished more rapidly in a ribbed or fluted funnel, such as is shown in the illustration, than in a plain one, as the ribs form air spaces between the sides of the funnel and the paper.

After filtering, the solution is complete; in other words, you have made up a hydrochinon developer, which is now ready for use except that it must first be diluted with water, as it is a concentrated solution. Developer prepared as just described should be diluted with water before using, in the proportion of three ounces of water to one ounce of above solution. It will thus readily be seen that each ounce of this solution makes four ounces of developer ready for use.

Some chemicals dissolve more easily or rapidly than others, and various means are resorted to for hastening the process of solution. When a chemical comes in the form of large crystals, sulphite of sodium or hypo for examples, it should first be ground up or pulverized with a mortar and pestle, or failing to have these articles, it may be enclosed in a piece of clean stout cotton cloth and pounded with a hammer.

Heat always hastens solution, and in cases where chemicals dissolve slowly, it is generally advisable to use hot water. When it is necessary to employ hot water, it is an excellent idea to make up the solution in a dipper, stew pan or small kettle of enameled steel ware. If an ordinary tin or iron dish is used, the chemicals will act upon it, and in many cases ruin the solution, but the enameled ware is free from this objection. Hot water will generally break a graduate glass, so it should be measured before heating, and the height to which it fills the vessel in which it is heated should be marked so that the correct amount of water may be added later to make up for the evaporation which occurs while heating.

A glass stirring rod is a great convenience when making up solutions, and we advise you to add two or three to your outfit.

Saturated Solutions

There is a certain limit to the amount of any chemical which can be dissolved in a given quantity of water. When the water has taken up, that is, dissolved, all that it can, the solution is said to be saturated. As the solubility of different chemicals varies greatly, the proportions of water and chemical necessary to form a saturated solution vary accordingly. As illustrating the great differences in the relative proportions of water and solid chemicals necessary to form saturated solutions, we may take, for example, potassium carbonate, which entirely dissolves in less than its own weight of cold water, while, on the other hand, eikonogen is so sparingly soluble that it requires forty times its weight of cold water to completely dissolve it.

It will thus be readily understood that in a saturated solution of potassium carbonate the amount of the chemical in proportion to the water is much greater than in the case of a saturated solution of eikonogen.

In making a saturated solution, enough of the dry chemical is added to the water so that no more will dissolve, enough, in fact, so that a small amount will remain undissolved.

Solutions by Hydrometer Test

Formulas for making solutions are sometimes given by hydrometer test instead of weight, and many photographers prefer this method. A photographer's hydrometer is a small glass instrument which shows the specific gravity of liquids. It will readily be understood that the specific gravity of water increases in exact proportion to the quantity of any chemical which may be dissolved in it, and the hydrometer enables us to obtain the correct proportions without the use of scales. The stem of the hydrometer has a graduated scale reading from 0 to 80. When placed in pure water the hydrometer sinks until the 0 point is exactly at the surface of the water. If any chemical be dissolved in the water the specific gravity is increased, causing the hydrometer to stand higher in the solution, and the height to which it stands indicates in degrees the strength of the solution.

HYDROMETER

The easiest way to prepare a solution of any given chemical by hydrometer test is to first make a saturated solution, which can then be gradually weakened by adding more water until it tests to the desired strength.

CHAPTER XXII.

USEFUL FORMULAS AND RECIPES.

The following formulas for photographic solutions will be found of great value to those who make up their own preparations. Every formula herein given has been carefully tested and proven to be good, and many of them have never before been published.

HYDROCHINON DEVELOPER.

Water	12 ounces
Sulphite of Soda, Crystals	750 grains
Hydrochinon	75 grains
Yellow Prussiate of Potash	50 grains
Borax	10 grains
Carbonate of Soda	375 grains
Carbonate of Potassium	125 grains

For use, dilute in the proportion of one ounce of this solution to one-half ounce of water.

PYRO DEVELOPER.

SOLUTION No. 1.

Water	16 ounces
Sulphite of Soda, Crystals	4 ounces
Pyro	1 ounce
Sulphuric Acid	10 drops

SOLUTION No. 2.

Water	16 ounces
Carbonate of Soda, Crystals	4 ounces

For use, take —

Solution No. 1	1 ounce
Solution No. 2	1 ounce
Water	8 ounces

EIKONOGEN DEVELOPER.

Water (boiling hot)	10 ounces
Eikonogen	114 grains
Sulphite of Soda, Crystals	456 grains
Carbonate of Potassium	456 grains

In hot weather, dilute with an equal volume of water; in cold weather, use full strength.

METOL DEVELOPER.

Water	10 ounces
Metol	75 grains
Sulphite of Soda, Crystals	1 ounce
Carbonate of Potassium	½ ounce
Bromide of Potassium	10 grains

Dissolve the metol thoroughly before adding the sulphite of soda.

For use, dilute in the proportion of one ounce of this solution to two or three ounces of water.

GLYCIN DEVELOPER.

Water (hot)	10 ounces
Glycin	75 grains
Sulphite of Soda, Crystals	386 grains
Carbonate of Potassium	386 grains

For use, dilute in the proportion of one ounce of this solution to two ounces of water.

This developer is especially suitable for developing plates which may have been somewhat over or under exposed.

HYDROCHINON AND METOL DEVELOPER.

Water	10 ounces
Sulphite of Soda, Crystals	180 grains
Carbonate of Soda, Crystals	150 grains
Metol	30 grains
Hydrochinon	4 grains

For use, dilute the desired quantity of this solution with an equal amount of water.

PYRO AND METOL DEVELOPER.

SOLUTION A.

Water	10 ounces
Metol	23 grains
Sulphite of Soda, Crystals	1 ounce
Pyro	28 grains

SOLUTION B.

Water	10 ounces
Carbonate of Potassium	1 ounce

For use, take—

Solution A	1 ounce
Solution B	1 ounce
Water	1 ounce

This developer gives a very brilliant negative of splendid printing quality.

EIKONOGEN AND HYDROCHINON DEVELOPER.

Water (hot)	10 ounces
Eikonogen	120 grains
Hydrochinon	15 grains
Sulphite of Sodium, Crystals	360 grains
Carbonate of Potassium	120 grains
Glycerin	½ ounce

For use, dilute the required quantity of this solution with an equal volume of water.

ACID FIXING BATH FOR PLATES.

Make up two solutions, A and B, as follows:

SOLUTION A.

Water	24 ounces
Hypo	8 ounces
Sulphite of Soda, Dry	½ ounce

SOLUTION B.

Water	8 ounces
Chrome Alum	½ ounce
Sulphuric Acid	½ dram

Pour solution B into solution A and the bath is ready for use. Never pour A into B.

INTENSIFIER.

SOLUTION A.

Mercuric Chloride (Corrosive Sublimate)	60 grains
Bromide of Potassium	60 grains
Water	6½ ounces

SOLUTION B.

Sodium Sulphite	1 ounce
Water	8 ounces

Bleach the negative in solution A and blacken it in solution B, just as described in Chapter XV.

INTENSIFIER.

SOLUTION A.

Saturated Solution Mercuric Chloride	8 ounces
Bromide of Potassium	60 grains

SOLUTION B.

Water	10 ounces
Hydrochinon	40 grains
Sulphite of Soda, Crystals	160 grains

This formula is also used in the same manner as described in the chapter on Intensification—gives a fine bluish black color.

REDUCING SOLUTION.

Water	14 ounces
Muriate of Iron Solution	4 drams
Potassium Oxalate	360 grains
Sulphite of Soda, Crystals	240 grains
Oxalic Acid, about	70 grains
Hypo	3½ ounces

The chemicals should be powdered and added one after another in the same order given in the formula, allowing each one to thoroughly dissolve before adding the next.

It may not be necessary to use the whole 70 grains of oxalic acid, as this chemical is added a little at a time until the green color appears.

The preparation of this reducing solution is a most interesting operation on account of the wonderful changes in color which take place as one chemical after another is added.

The negative to be reduced is placed on a clean tray, the reducing solution poured over it, and rocked, just as in developing. The negative should be examined from time to time by holding it up to the light, and when it is sufficiently reduced, wash it thoroughly for about one hour, changing the water several times. This solution should be kept in the dark when not in use.

CLEARING SOLUTION.

Negatives which are slightly fogged or lacking in clearness may be improved by soaking a few minutes in the following solution:

Water	20 ounces
Chrome Alum	1 ounce
Muriatic Acid (Pure)	2 drams

Wash the negative thoroughly after treating it with this solution.

DEVELOPER FOR DARKO PAPER.

Water	20 ounces
Metol	14 grains
Sodium Sulphite, Crystals	1 ounce
Hydrochinon	60 grains
Sodium Carbonate, Crystals	1⅔ ounces

When the above chemicals are fully dissolved, add about 15 to 25 drops of the following solution:

Bromide of Potassium	1 ounce
Water	10 ounces

The prints should be transferred directly from the developer to the fixing bath.

ACID FIXING BATH FOR DARKO PAPER.

Water	64 ounces
Hypo	16 ounces

After the Hypo is dissolved add the following solution:

Water	5 ounces
Sulphite of Soda, crystals	1 ounce
Acetic Acid, No. 8	3 ounces
Powdered Alum	1 ounce

This bath is ready for use as soon as mixed.

COMBINED TONING AND FIXING BATH FOR DU VOLL'S PAPER.

STOCK SOLUTION No. 1.

Hot Water	64 ounces
Hypo	8 ounces
Powdered Alum	4 ounces
Powdered Borax	2 ounces
Common Salt	1 ounce

Place all of the above chemicals in a stone jar and pour the water on them, stirring until everything is thoroughly dissolved. Then allow it to cool and settle, after which the clear portion is poured off and the settlings left in the jar may be thrown away.

Now dissolve ½ ounce lead acetate in 8 ounces of water and add 1½ ounces of this solution to the Stock Solution No. 1.

STOCK SOLUTION No. 2.

Water	15 ounces
Chloride of Gold	15 grains

For use take

Stock Solution No. 1	8 ounces
Stock Solution No. 2	2 ounces

This amount of bath will tone about fifty 4x5 prints or a proportionate number of other sizes. After this number of prints have been toned the bath should be thrown away.

HOW TO HANDLE CHLORIDE OF GOLD.

Chloride of gold comes in small bottles containing 15 grains, and even though the bottle is very small, 15 grains is not enough to fill it, so **the bottle is never full.** Do not jump at the conclusion that you are getting short weight because the bottle is not full.

Never attempt to weigh chloride of gold; you cannot do it accurately, and there is danger of wasting it. Simply dissolve the entire contents of the bottle (15 grains) in 15 ounces of water, and you can then measure out the required quantity in a graduate glass, each ounce of the solution containing one grain of gold.

SEPARATE TONING BATH FOR DU VOLL'S PAPER.

Dissolve the contents of a bottle of chloride of gold (15 grains) in 15 ounces of water and label this solution "Gold Stock Solution."

Make a saturated solution of borax in water and label it "Borax Stock Solution." (See page 106 regarding Saturated Solutions.)

To make the toning bath, add ½ ounce of Gold Stock Solution to 20 ounces of water, and then add just enough of the Borax Stock Solution so that the bath will turn red litmus paper blue. Only a small amount of the Borax Solution should be used, and no more added than is necessary to make the bath turn red litmus paper blue.

SEPARATE FIXING BATH FOR DU VOLL'S PAPER.

Dissolve 2 ounces of Hypo in 24 ounces of water.

Use the above separate toning and fixing baths in accordance with instructions given in Chapter X of this book.

JAMES B. FORGAN,
President.
CHARLES N GILLETT.
Cashier.
WM H MONROE,
Assistant Cashier

CAPITAL $8,000,000
SURPLUS $6,000,000

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Chicago, September 15, 1908.

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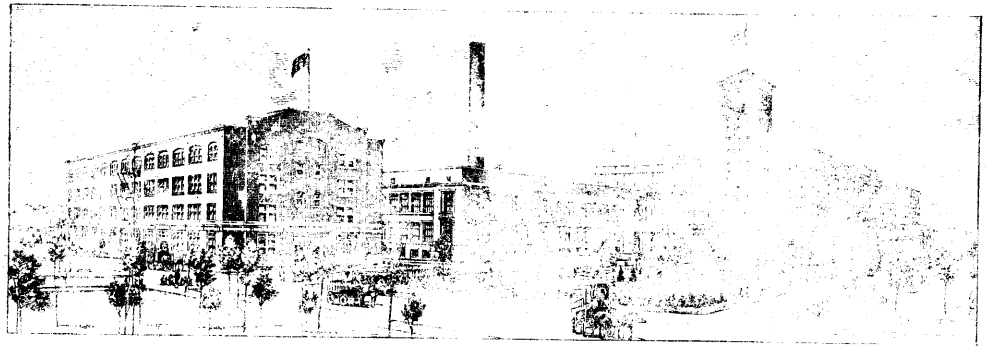

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