SCOVILL'S PHOTO. SERIES. No. 17.

FIRST LESSONS IN AMATEUR PHOTOGRAPHY.

A SERIES OF LECTURES DELIVERED BEFORE THE SENIOR CLASS OF THE MONTCLAIR HIGH SCHOOL BY THE PRINCIPAL,

RANDALL SPAULDING.

Scovill Manufacturing Co., Publishers, New York.
W. IRVING ADAMS, Agent.

PRICE, 50 CENTS.

FIRST LESSONS

—IN—

Amateur Photography

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RANDALL SPAULDING.

1886.

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SCOVILL MANUFACTURING CO.,
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PREFACE.

The following familiar lectures were written for the members of my Senior Class, and with no thought that they would ever be cast in any form more permanent than the excellent periodical in which they first appeared. In presenting this subject, I have aimed at the greatest possible simplicity. Beginners should not be confused with a multiplicity of methods and formulas. At each step in the process of picture-making I have endeavored to describe a method that is known to be excellent both by the testimony of others and by my own experience. After one way of doing a thing has been mastered, experimenting in other ways may legitimately follow.

To professionals and experienced amateurs, who will find in these pages much that is superflous and will miss much that is to them more essential, I have no apology to make. This little work is not for them but for their sons and daughters.

Pardon me a word upon the relation of this "art-science" to public instruction. Science-teaching in the public school must necessarily stop short of those arts by which men gain a livelihood. Its task is quite different from that of the technical school. In photography, however, we have an applied science that, to a greater extent than almost any other, falls within the range of the time, knowledge, and resources that public school scholars have at their command. The study of photography, following that of physics and chemistry, will

clarify and fix the student's knowledge of many valuable points in these sciences. Practical work in the laboratory, without which the above-named sciences are not properly taught, will, I apprehend, enable advanced pupils in our High Schools to learn photography more readily and successfully than many amateurs who have not enjoyed such advantages.

Of the utility and pleasure to be derived from this art little needs to be said. Its utility is seen on all sides in almost numberless applications; while the art that enables us to catch and forever fix our liveliest impressions of beauty will always be held to be desirable as it is wonderful.

FIRST LESSONS IN AMATEUR PHOTOGRAPHY.

(Published in the PHOTOGRAPHIC TIMES, Vol. XIV., Nos. 162 to 171, inclusive.)

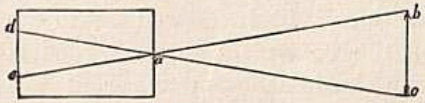
First Lecture.

MY first task shall be to describe a simple photographic outfit; and first, by way of introduction, the

CAMERA OBSCURA.

This may be a plain box, as seen in the figure, with a minute aperture at *a*.

Light travels in straight lines. Light reflected from the object at the point *b* can pass through the aperture *a* only to the point *e*. Light from *c* falls only upon the point *d*. We have, therefore, an inverted image situated between *d* and *e*.



Undoubtedly, then, a picture of the object could be taken by placing a sensitized plate at *d e*, and the question will be asked: "Why use more than this? Why introduce a lens with its necessity for nice adjustment?" The answer is this: Every convex lens, such as is used in photography, converges

to a point all rays that fall upon it from a single point outside. Suppose the aperture *a* in the above figure to be occupied by a lens. All rays from the point *c* that fall upon the area of the lens will meet at *d*, and form there an image. All rays from *b* falling within the diameter of the lens will meet and form their image at *e*. Were there no lens at *a*, strictly speaking, but a single ray of light would pass from *c* to *d* and from *b* to *e*.

By means of the lens, therefore, the brightness of the image is greatly intensified. The picture is made strong and sharp. You will understand that, with or without a lens, the aperture in the front of our box must be small in order to prevent the overlapping of light from different points in the object. Remove the front of the box, and rays not only from *c*, but from all other points in the object, fall upon *d*, creating thus a multitude of images in one place, so that practically the eye could discern no image at all.

By means of a lens, however, this aperture may be made quite large without danger of over-lapping; for, as I have shown, the lens converges a large number of rays to a single point.

Suppose now the lens to be set in its place, and we have all the essential parts of a *photographic camera.*

The camera box that I have to show you is one of the simplest and least expensive, and is therefore best adapted to our purpose. The front portion is made of strong, well-seasoned wood, and carries the lens. This part of the box is firmly fastened to the bed or track, which is itself screwed fast to the tripod. The hinder part of the box, made also of wood, is connected with the front by an elastic bellows that permits the former to slide freely back and forth upon the track. This movable part carries a ground-glass plate, on which is formed an image of objects that lie in front of the lens and are to be photographed.

Some cameras, however, have a "front focus." By sliding the front, bearing the lens, along a suitable track, the distance between the lens and the ground glass is adjusted at will.

A word now in regard to the structure and use of the

TRIPOD.

The legs are easily detached from the brass ring at the top on which rests the camera box. Each leg, by a joint in the middle, can be folded once upon itself, thus securing compactness of form in carrying. An improved form of tripod permits the upper portion of each leg to slide upon the lower, thus rendering it possible to lower the camera without spreading the legs of the tripod, which it is sometimes difficult, and even impossible, to do.

We will now set the camera in front of the window in position for taking a picture of our Primary building, some ten or twelve rods distant. The camera should first be so secured to the tripod that one leg of the tripod shall be directly under the lens. Grasp the other two legs and bring the camera at once to a level as to right and left. Then grasp the front leg of the tripod alone and bring front and rear of the camera to a common level. We are now ready for

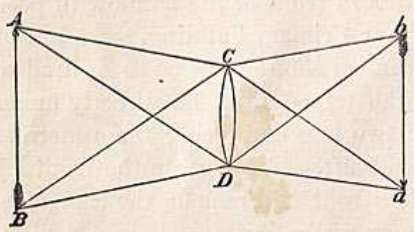
FOCUSING.

We take our station behind the ground-glass and, as the image upon the glass is too feeble to be distinctly seen in surrounding light, we cover our head and the ground-glass with the black focusing-cloth, drawing it tightly about the camera so as to exclude as much as possible of the light. A tightly fitting cap, which can be easily carried in the carrying-case, will be found convenient during the operation. The object upon which our lens is turned now stands clearly before us. By moving the ground-glass back and forth upon the track, we at length find a point at which the finest details of the picture are clear and sharp. The sliding frame is now screwed fast to the bed of the camera, and the building before us is said to be focused.

ACTION OF THE LENS.

Before proceeding further you will be curious to know more precisely what the lens is doing for us in this case, and why a particular distance between the lens and the glass plate is requisite to distinctness. I have said that a convex lens converges all rays of light that fall upon it from a given point to a point upon the opposite side.

In the figure, the ray of light *A C* is refracted or bent by the lens and takes the direction *C a*. The ray *A D* is bent in the direction *D a*. All the rays from the point *A*, falling upon the lens, will be bent to point *a*, thus forming the image of the arrowhead. In like manner, by converging the rays from each point in the object, the lens is able to sketch the image of each along the line *a b*. The arrowhead will be seen at *a* and the feather at *b*. We now understand why the image of the building at which our lens is pointed is inverted upon the ground-glass.



The ground-glass stands now in the position of the line *a b*. If we move it a little nearer the lens, the rays proceeding from *A* will strike the glass before they have come to a point, and can, therefore, form only a blurred image. The same is true of every other point in the object in its relation to the corresponding point in the image.

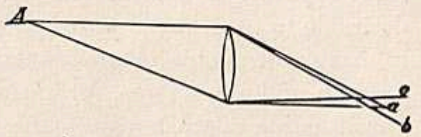
If, now, the ground-glass be moved to a position more remote from the lens than the line *a b*, we see that the rays from any point in the object cross somewhere in the line *a b*, and now meets the ground-glass while diverging. But these diverging rays can form only an indistinct image.

We now understand why it is that there is only one position of the ground-glass in which the picture of our building is most distinctly seen.

USE OF THE DIAPHRAGM.

You should next study the use of the diaphragm; and for this purpose I must introduce another figure.

I have stated that all rays from a single point in the object are converged by a convex lens to a single point in the image that is formed by these rays on the other side of the lens. We must now note an exception to this rule. Rays of light that pass through a spherical lens at points near the margin are not bent precisely to the same point with those passing through points near the center. Thus it is not strictly true that all rays from the point *A* will be converged to *a*. Some, passing through the lens near its upper margin, will be bent toward *b*; others, at the lower margin, will be bent toward *c*. This failure of certain rays to arrive at a common point with the others is due to the curvature of the lens and is a defect common to all spherical lenses. It is plain that the rays that pass a little to one side of *a* blur the image at this point. While it is true that all rays from objects in front of the lens suffer somewhat from this so-called "spherical aberration," it is also true that those rays that proceed from objects lying near the outer limits of the field of view and which, therefore, strike the lens most obliquely, suffer most from this cause. Expose the entire surface of our lens and you observe that the outer portions of the picture upon the ground-glass are hazy and indistinct. Cover the lens now with a diaphragm of blackened metal or card-board that has in its center a circular aperture of less diameter than that of the lens itself, and you are, of course, rid of all those rays that passed through the lens near its circumference and produced the blurring effect. You at once notice a greater sharpness of detail in the picture, and more especially in those portions near the margins.



Why, then, should we ever use anything but a "stop" of small diameter? We must here, as everywhere in this world,

face the great law of compensation. If we would take, we must give. In the case under consideration, we get multiplicity and sharpness of detail at the expense of longer time in exposing our sensitive plate. In some circumstances, the time of exposure is a matter of slight importance, but under other circumstances, as when living objects are in the field of view, a short exposure is absolutely essential. Again, it is sometimes desirable to neglect the outer portions of the picture in order to make central objects prominent by contrast. In looking at a group of human faces, for instance, we do not care to have our attention distracted from the main subject by a multitude of perfectly delineated trifles.

It is of great practical importance to understand the relation between the diameter of the aperture and the time of exposure. The amount of light that can pass in a given time from the building yonder to our ground-glass plate depends entirely on the area of the lens. Change the area and you change in exactly the same ratio the rate at which the light passes through the lens to the plate. Knowing the proper length of time to be given in exposure to one aperture, we can calculate the time for any other by the rule familiar to every schoolboy, viz., "Areas of circles are to each other as the squares of their diameters." Of course, the greater the aperture, the shorter the requisite time of exposure. We may, therefore, state the rule thus: "The time of exposure varies inversely as the square of the diameter of the aperture." For example, I have ascertained by previous experiment that in such light as we have to-day, and with the sensitive plates that I am now using, and with an aperture three-eighths of an inch in diameter, the exposure should last about five seconds. If, now, I use a stop whose diameter is three-sixteenths of an inch, the light must enter through an aperture whose area is only one-fourth as great as in the former case. If I have divided the diameter by two, I have divided the area by four, the square of two. I must, therefore, increase the length of exposure four times.

Most lenses sold to photographers are provided with a set of stops. If necessary, however, as in case of the well-known

Waterbury lens, they are easily made. In the center of a circular piece of card-board cut an aperture of the required diameter. The margin of the aperture should be smooth. Paint one side of the card-board with black ink. If this circular disk be a little loose in the tube, keep it in place by the tension of a bent twig.

THE PLATE-HOLDER.

The next instrument that we must take in hand is the plate-holder. The so-called "New Style" double holder (and I cannot see why any one should buy a single holder) has a central septum for separating the two plates, and is provided with brass springs for keeping them firm in position. The sensitive plates are pushed in at the same end into grooves on each side of the septum. Outside the plates, protecting slides are run in suitable grooves. Of course, the plates must be put into place in the dark-room by red or yellow light, and after the holder is once filled, the septum and slides should not be disturbed until the critical moment for exposure has come. Care should be taken in filling the holder to put the film-side outward, *i. e.*, toward the lens when the holder is in position. The film-side is easily distinguished even in weak light by its less glaring surface. The film should not be touched by the fingers.

THE POINT OF VIEW.

Although the selection of the point of view and of the particular objects to be included in the picture should be left largely to the individual taste, yet a few general directions may be given.

In the first place, the picture should be properly balanced. Buildings, trees, or hills massed heavily upon one side of the picture create upon the mind an uncomfortable impression. Such a view violates our sense of proportion and harmony. We look upon the real scene without any such feeling, since we are in the presence of an extended horizon.

Again, in landscape views the sky-line should not run right and left precisely through the center of the picture. The position of this line depends upon the particular scene to be represented. We shall see little sky amid the towering heights of mountain scenery while on the open prairie it fills a large proportion of our field of view.

In a perfect picture, too, the high lights and shadows are made strongly to contrast with each other, while at the same time a proper balance is secured by a judicious distribution of each.

In the introduction of human figures or other objects that gives special meaning to the picture, it is well to remember that the center is always the weakest point.

SWING-BACK AND SLIDING FRONT.

There are certain mechanical contrivances that must be regarded as essential to a good camera, and that we miss in the one before us. We are all familiar with the fact that parallel lines seem to converge in the distance. If we look up at a tall, narrow building, the parallel edges seem to converge.

So in like manner will these same lines converge upon our ground-glass if we point the camera upward at the building. Look in a horizontal direction at these lines and we shall see no such distortion. To prevent distortion upon the plate, therefore, we must keep it in a strictly vertical position. In order to accomplish this, and at the same time point our camera upward, so as to take in the top of the building, we must have a "swing-back," by which the plate may be kept constantly in a vertical position.

If, even then, the object does not assume the right position upon the plate, we resort to the "sliding front." This slide is set in front of the camera and carries the lens, which may thus be raised or lowered at will, thus raising or lowering the picture upon the plate.

LENSES.

I propose now to describe the peculiarities of certain lenses briefly, and with only sufficient fullness to enable you to select

a lens that shall be adapted to any particular purpose. Lenses differ in the width of angle included in the field of view. The Morrison wide-angle, for instance, covers an angle of about ninety degrees. It is an excellent lens for general landscape work, in which the most important objects are not in the immediate foreground. As the natural eye, with no turning of the head, covers an angle of about sixty degrees, it is impossible with this lens to avoid an appearance of distortion in the foreground. In general landscape work, however, this distortion is scarcely noticed, and is more than outweighed by the advantage of great width of angle.

The group lens includes an angle of about sixty degrees. Of course, at a given distance, the narrower the angle included by the lens, the larger objects will appear in the picture. This lens is therefore specially adapted to photographing groups of persons, buildings, and choice bits of natural scenery.

The portrait lens is adapted to use in the studio and at short range.

Lenses differ widely as to their focal length—that is, in the distance between the lens and the ground glass, when the scene to be photographed is sharply focused upon the latter. Some questions arise in connection with this subject that are too intricate for our present purpose.

It is true, in general, that the shorter the focus the deeper will the lens cut into a distant landscape with sharp definition. The fact should be noted also that the time during which the sensitive plate should be exposed depends upon the focal length—that is, upon the distance which the light must travel from the lens to the plate.

It may as well be said at this point that an outfit cannot be regarded as complete without at least two lenses—a wide-angle lens and a group lens. The former is indispensable when, by reason of intervening obstructions, such as trees or buildings, the photographer is compelled to set the camera quite near to the object to be photographed.

Second Lecture.

THE EXPOSURE.

While placing the camera in position, and focusing the object upon the ground glass, the holder containing the sensitive plate should lie in the carrying-case, or be in some way screened from the light. It is impossible to guard too carefully against the access of light into the plate-holder, although the holder is made, so far as possible, impervious to light.

The ground glass is now removed and the plate-holder is put in its place. Immediately throw the focusing-cloth over the camera and plate-holder. Decide upon the stop that you will use and set it in place. See that the lens is capped. Withdraw the slide that is between the lens and the front plate of the holder. At this point I must earnestly caution in one particular. While the slide is being withdrawn, and when at the proper time it is re-inserted, it should be held in a strictly horizontal position. If one corner of the slide be first pushed into the slit, it will open the spring along the whole width of the holder, and the light thus admitted will instantly spoil the plate. I have known many plates to be light-struck through carelessness in this matter.

We now uncap the lens, hoping that for a few seconds the wind will not blow, and that any living beings that may be in the scene will not stir. The proper time of exposure depends upon the focal distance and upon the diameter of the stop used, as already explained; also upon the strength of the light at the time of exposure and the degree of sensitiveness in the plate. Plates differ widely in this respect, some requiring

many seconds of exposure, others enduring but the small fraction of a second. The proper time, under given conditions, can be ascertained only by experiment.

It is important that the camera should be perfectly steady during exposure. An excellent device in windy weather is to hang a heavy stone or other weight to the head of the screw by which the camera is attached to the tripod.

After the time of exposure has elapsed, recap the lens, insert the slide, wrap the plate-holder in the focusing-cloth, and place it in the carrying-case.

We now pack up the camera, but before proceeding in quest of other game, we should attend to the

NOTE-BOOK.

An entry should be made of the number of the plate, each side of the holder having been previously numbered; the lens employed, the diameter of the stop used, time of exposure, subject of the view taken, and character of the light—as, strong, medium, or weak. These data will enable the photographer to ascertain with great accuracy the proper time of exposure, and also to treat the plate intelligently in the developing-bath. The note-book must not be neglected.

NATURE AND EFFECT OF LIGHT.

I must not fail to add, in this connection, that the time of exposure is modified to some extent by the character of the view to be taken. And this leads me to recall to your minds some facts, with which you are already familiar, concerning the subtle agency with which photography has to do. Light analyzed is found to consist of seven colors, though it is doubtful if more than six can be clearly distinguished. According to the most approved theory, the phenomena of light are due to waves or vibrations sent off from some vibrating body in straight lines and in all directions through the all-pervading ether. Its effects are best explained by supposing that the individual vibrations differ in length and power; that those

that produce upon the optic nerve the color sensation of red are peculiarly adapted to produce molecular motion of that special form known as heat; that somewhat shorter vibrations, that cause the sensation of yellow, produce the most intense effect upon the optic nerve; and that the shortest and weakest vibrations, that cause the sensation of blue and violet, have the peculiar power of inducing atomic motion, and of thus effecting a chemical change. It is the peculiar power of these short vibrations contained in white light that produces the change in the sensitive surface of our gelatine plate.

From what we have learned it is plain, therefore, that the blue sky will most quickly affect the plate, while green grass and foliage, or brick buildings, will require a much longer exposure. The atmosphere sometimes contains a notable excess of red and yellow rays. The photographer must be quick to discern this and lengthen accordingly the time of exposure. It is often impossible to so time the exposure as to produce the finest effect at the same time in all parts of the picture. If sufficient time be given to fix all the details of the landscape, the sky will appear in the finished print as a somewhat dreary expanse of white. This expanse is sometimes filled with cloud effects by artificial means. Cloud effects must be caught quickly by the camera, if they are caught at all.

If human faces are in the field of view, a longer exposure seems to me an advantage. It gives a more perfect delineation of the countenance, and does no harm if the plate be properly controlled in development.

The effect of light should be carefully studied in deciding at what time of day a view should be taken. Wait, if possible, until the conditions are perfect. If the sun be behind us when the exposure is made, surfaces will appear smooth; while, if the camera be pointed as nearly as may be in the face of the sun, objects and roughnesses of surface will be thrown into relief by the contrast of light and shade. The sun should never shine directly into the lens.

THE LANTERN.

As the plates must be handled and developed by non-actinic light, it may be well to speak at this point in regard to the lantern. Several excellent lanterns* are in the market, but I have found that a good instrument can be made as follows:

Construct a tight wooden box about seven or eight inches square and two feet tall. One side should slide up and down in grooves, or be in some way removable, so that a kerosene lamp may be set into the box. Two sides of the box should extend a little below the bottom, so that the latter may not rest upon the table. In order to maintain a draught several holes should be bored in the bottom and a large central hole cut in the top, which may be covered with an arch of stiff black paper in order to prevent the egress of light at the top. A tall pipe set in this opening will greatly improve the draught and prevent smoking. The top should be covered underneath with tin to prevent the wood from taking fire. A piece of stiff wire will serve for a handle. The front and two sides should be cut away and the space covered with ruby paper. Yellow post paper will answer the purpose very well, but yellow light is not altogether safe with highly sensitized plates.

Set a kerosene lamp into this box and we have an excellent non-actinic lantern.

* Scovill's Non-Actinic Lantern affords the most agreeable light.

Third Lecture.

DEVELOPING THE PLATE.

We come now to one of the most interesting and perhaps most difficult tasks that the photographer has to perform. The exposed plate shows upon inspection no change whatever. The invisible effects of the light are to be transformed into the visible picture.

Amateurs are generally advised to begin with the use of oxalate of iron as a developer. This developer is slow in its action, and is less liable to cloud or fog the plate. It may, therefore, be preferred by those who have had no experience in laboratory work.

Pyrogallic acid, however, is generally preferred by experienced photographers, since it allows a more complete control of the development in cases of under and over exposure, and produces a softer negative. I shall, therefore, describe to you briefly the pyro developer.

Discussion of the chemical changes involved will be deferred to a later stage. The alkali used with pyrogallic acid may be soda or ammonia. Each manufacturer of dry plates advises a certain formula, and if we use a different one, we do so, of course, at our own risk. I will now state the process that I have used with some success in connection with the plate that we are now to develop—a process that is recommended by the manufacturer of the plates:

No. 1.

Pyrogallic acid	1 ounce
Bromide of ammonia	¼ ounce
Oxalic acid	¼ ounce
Water	8 ounces

Dissolve the oxalic acid in the water, then add the pyro, bromide and water to make the solution ten fluid ounces.

No. 2.

Saturated solution of carbonate of soda	10 ounces
Saturated solution of sulphite of soda	2 ounces

To make a saturated solution of carbonate of soda: add one quart of boiling water to two pounds of soda, stir until dissolved, and leave it to cool.

To make a saturated solution of sulphite of soda: add three parts of boiling water to one part of the soda, dissolve, and allow to cool.

Suppose, now, that we have to develop a 5x8 plate. See that all necessary materials are in easy reach, and that no ray of light be found in the room except what comes from our ruby or yellow lantern. Slip the plate from the holder, handling it only by the corners and margins, and place it for a minute or two in a tray of water. This immersion in water is not absolutely necessary, but is desirable, as the water softens the film and thus renders it more sensitive to the action of the developer. The tray may be of japanned ware, or gutta percha, or glass.

Drain off the water, and pour upon the plate one dram of No. 1, mixed with three ounces of water. While this mixture is soaking into the film, measure out about one dram of No. 2, and pour this into the large graduate that was used for pyro and water.

Pour the mixture from the plate into the graduate and back again over the plate. If bubbles are seen adhering to the film, they should be immediately erased with a camel's-hair brush, or with a light touch of the finger. It is well to hold the tray in the hands and to keep the developer moving over the plate. In thirty to sixty seconds the image should appear, and if gradually and at the end of one or two minutes the image seems to stop developing, a little more of No. 2 should be added and the developing continued until the details are fully out and the shadows begin to gray over. I have found it convenient in

nearly all cases to begin with very little soda and bring up the development quite slowly until considerable contrast is secured between the high lights and shadows. As soon as I am sure of getting sufficient density, I add more soda and bring up the remaining detail rapidly. If, from an examination with transmitted light, there should appear a lack of density, add a few drops of a solution of potassic bromide (forty grains potassic bromide to one ounce water) and ten to fifteen minims of No. 1. After sufficient density has been gained, wash the plate under the tap and lay it in the

HARDENING AND BLEACHING BATH.

Pulverized alum	2 ounces
Oxalic acid	¼ ounce
Water	20 ounces

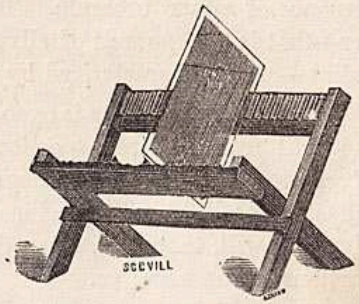
After the plate has been developed and washed, it may be put at once into the fixing bath. It is generally safer, however, to let it lie a few minutes in the bleaching solution. If the film has contracted a yellowish stain from the pyro during development, this stain will be to a great extent dissolved out in the alum, which should then, of course, be thrown away. The alum serves also to harden the film, and thus prevent that frilling and puckering that sometimes happens to the film, especially in summer. The same solution may be used many times, provided it has not become badly stained.

FIXING THE PLATE.

After the plate has been rinsed it must be laid in a clearing or fixing solution. Sodic hyposulphite or "hypo" is universally used, although certain other known compounds will answer the purpose. In making the solution, the ratio of hypo to water by weight may be one to four, or five, or six. Which ratio is adopted matters little with plates that I have used. In a few minutes the plates will begin to clear. The progress of the clearing can be best watched by turning the plate over and looking at the back. The fixing is not complete until the creamy appearance has entirely vanished. Several plates may be fixed in the same hypo.

The hypo pan should never be used for any other purpose than "fixing." The fingers also should be kept free from the hypo while conducting other processes.

After fixing, the plate must be thoroughly washed. If considerable hypo be left in the film, it will certainly crystallize and spoil in a short time.



After washing, the negative should be set away upon a negative-rack to dry. This rack consists of a light wooden frame that supports two strips of thin board set at an angle of ninety degrees from each other, and covered with fluted tin. The negatives rest in these flutings. (See illustration above.)

CHEMICAL ACTION IN DEVELOPING AND FIXING.

I am sure that at this point you will be interested in some remarks on the nature of the gelatine plate and the chemical action involved in developing and fixing. It is sometimes said that a photographer makes better pictures the less he knows about these mysterious molecular and atomic changes involved in the process. It is true that the ancient Greeks, who knew nothing of the interior structure of the human body, cut from the marble forms that have never been excelled for naturalness and beauty; while Michael Angelo and Leonardo da Vinci, expert anatomists for their time, have not been able to avoid in their work a certain mannerism. So it may be that, by strict attention to mechanical details alone, better pictures can be made. There can be no progress in any art, however, without a study of the science that underlies that art;

and it is a well-known fact that much of the recent progress in photography has been due to the scientific investigations of amateurs. In our studies here we ought surely to be limited by no mere bread-and-butter considerations. I shall attempt to give you, however, only a few elementary principles.

The sensitiveness to light of the gelatine film is due to the presence of silver bromide. The halogen compounds of silver—that is, compounds of silver with chlorine, bromine and iodine—are all characterized by this sensitiveness.

When a gelatine plate is exposed to a landscape, for instance, the light from different portions of the scene acts upon the silver bromide with various degrees of intensity. Objects that reflect most light will produce the strongest effect upon the film, and will, therefore, after development, form the darkest portions of the negative.

If only a part of a plate be exposed to light, we cannot, even with the help of the microscope, detect the slightest difference between the exposed and unexposed parts. The action of light upon silver chloride is to reduce it to silver subchloride with the elimination of free chlorine, as seen in the equation with which you are already familiar: $4\ Ag\ Cl = Ag_2\ Cl + Cl_2$.

Is a chemical change wrought by the light in silver bromide also? Eminent authority might be quoted on both sides of this question, yet the weight of opinion seems to me to incline to the view that the change in exposure is merely molecular, and does not involve any actual separation of atoms. It is not easy to picture to the mind just how this molecular change takes place. The atoms that compose the molecule are in some way made to stand to each other in altered relations within the same molecule; and by this change they become more sensitive to, and are more easily separated by, any disturbing cause. Now, this disturbing cause is found in the developing mixture which produces in the silver bromide an actual separation of atoms, a tendency to which was caused by the light during exposure.

One reason, then, for supposing the change during exposure to be only molecular is that no visible image is formed, as is

the case with silver chloride, in which there is a well-known chemical reaction.

Another reason for thus believing may be stated as follows: If the light during exposure initiates a chemical change which the developer carries on to completion, then in cases of under-exposure we have only to employ a sufficiently powerful developer, and continue its application long enough to secure results equally good with those obtained from a correctly timed exposure. But this cannot be done if the plate be much under-exposed. The fact seems to be that if this molecular change be too slight, no strength of developer can effect the reduction of the silver bromide.

Lest you regard this molecular change as something strange and impossible, I will mention a single experiment. A glass long used to cover an engraving, no matter how much it may be rubbed and polished, will show the image of the engraving when breathed upon. In consequence of a peculiar molecular condition the breath will adhere to some parts and not to others. Set the glass aside and it gradually returns to its original condition.

Another instance of probable molecular change is seen in the film sensitized with silver iodide. Expose a part of this film to light, then plunge it into vapor of mercury, and the mercury will adhere to the part exposed and not to the other. In this way the image is developed in what is known as the daguerreotype process.

We may now understand how objects are imaged upon the plate by the contrast of light and shade. The developer effects a chemical change that results in a deposit of metallic silver, as seen in the following equations:

$$C_6\ H_6\ O_3 + H_2\ O = C_6\ H_6\ O_4 + {}_2H.$$

$${}_2Ag\ Br_2 + H = {}_2H\ Br_2 + Ag.$$

We see here that pyrogallic acid in water becomes oxidized, liberating the hydrogen, that acts in turn with silver bromide to produce hydrobromic acid and metallic silver. It should be noted here that the affinity of pyrogallic acid for oxygen is much increased by the presence of an alkali; hence the use of soda, potash, or ammonia in the developing bath.

The silver that is deposited is of a darker hue, and the darkness at any one point is more or less intense, according to the intensity of the light that fell upon that particular point. Hence objects in the field of view, with their infinite variety of light and shade, are reproduced upon the film.

Consider, now, that after development some parts of the plate that have been exposed to the weakest light still contain silver bromide and but very little metallic silver; that other parts contain more of the latter; and that still other parts that have been exposed to the strongest light contain the latter almost exclusively. The remaining silver bromide will, of course, not bear exposure to the light. What we now require, therefore, is something that will react with the silver bromide and form with it a compound that is soluble in water. Sodic hyposulphite will do this. This new and soluble compound is dissolved away in the subsequent washing. The shadows, therefore, that determine the image consist of metallic silver in the form of a fine, impalpable powder. The negative may now be exposed to light with impunity.

Fourth Lecture.

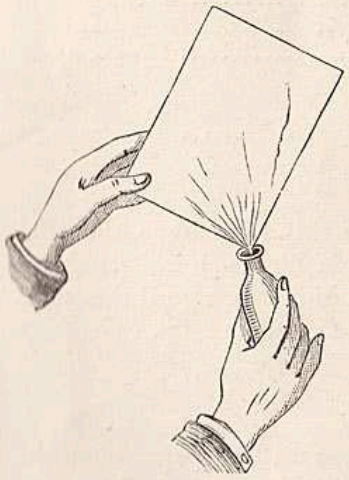
VARNISHING.

With amateurs, as a rule, there is little need of varnishing. If a negative is very valuable, or is to produce a large number of prints, it should be varnished. The danger is that the silver nitrate in the sensitive paper will at length affect the film, especially if moisture be present.

Several varnishes are in the market. A good formula that I have used with success is as follows:

Sandarac	1 ounce
Castor oil	80 grains
Alcohol	6 ounces

Grasp the plate at one corner, having the film up, with the left-hand thumb and fingers. With the right hand pour varnish upon the middle and nearer to the farther end. Let it run first to the farther right-hand corner, then to the left, then to the nearer left hand, and, at last, to the nearer right-hand corner, whence the excess may be returned to the bottle. While the varnish is being drained into the bottle, a rocking motion should be maintained to prevent the varnish from drying in ridges. (See illustration.)



Before varnishing, the negative may be warmed over a lamp chimney until it feels decidedly warm to the back of the hand. If the negative be too warm the varnish will dry in

ridges before the plate can be evenly flowed. The plate may be dried by very gentle heat, and may then be packed away in dry-plate boxes, or, better yet, in negative boxes with grooved sides, into which grooves the negatives are run.

INTENSIFYING NEGATIVES.

This must be done, if at all, before varnishing. The thinness arising from over-exposure may be remedied to some extent by intensifying, although intensified negatives are rarely as good as those made from properly exposed plates.

You observe that when I dip this polished silver coin in mercury, the latter adheres and forms an amalgam with the silver. A compound of mercury, therefore, is used to intensify the silver image. Recently it has been found advantageous to use nitrate of silver solution in connection with the mercury. I cannot do better than give you the following formula:

No. 1.

Mercuric bichloride	60 grains
Potassic bromide	60 grains
Water	6 ounces

No. 2.

Pure potassic cyanide	60 grains
Water	6 ounces

Add 50 grains nitrate of silver dissolved in 1 ounce of water.

First cleanse the negative thoroughly from hypo, then immerse in solution No. 1 until it is bleached white. After thorough washing immerse in solution No. 2 until the negative turns brown throughout. Wash well and dry.

THE SILVER SOLUTION.

Most amateurs use at first ready-sensitized paper obtained at the stock dealers. This is well, as we cannot have too many irons in the fire at once; but we soon find that such paper cannot be toned so as to equal the best work in the market. We must therefore silver our own paper.

In your laboratory work you have already learned that ordinary paper may be sensitized with silver nitrate. We shall find, however, that paper that has received a coating of albumen will give much more brilliant results. Two compounds are formed by floating upon the silver nitrate solution—the organic albuminate of silver and silver chloride, the latter arising from the solution of an alkaline salt in which the paper has been previously soaked.

The sensitizing solution may be made up in various ways. In this, and most of the following cases, I shall give you formulas that were recommended to me by a photographer of much experience and skill. I can now recommend them from my own experience.

To make a sixty-grain solution—that is, a solution that shall contain sixty grains of silver nitrate to the ounce—take

Water	64 ounces
Silver nitrate	8 ounces
Ammonic nitrate	2 ounces
Magnesic nitrate	1 ounce

To each ounce of the solution add one drop of strong ammonia.

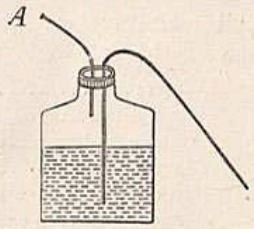
By adding silver nitrate from time to time the solution should be kept up to the standard strength of sixty grains per ounce. The strength may at any time be ascertained by the hydrometer. This instrument, when so modified as to serve this special purpose, is called an argentometer. The ordinary form, however, may be used by observing the reading when the solution is first made up, and by adding sufficient silver nitrate from time to time to cause the hydrometer to stand at the same level. Indeed, we may accomplish our purpose equally well with a glass tube open at one end and closed at the other, which is made to stand upright in the liquid by dropping into the open end some shot. The surface of the solution may be marked by a ring of thread and then made permanent with a three-cornered file. Of course, the tube must always contain shot of the same number and size.

It must not be forgotten that, on account of the presence of ammonic and magnesic salts in the above solution, the argen-

tometer should not read sixty, but about eighty. Only silver nitrate needs to be added from time to time, as the solution is not depleted of the alkaline salts, except in proportion as the quantity of the liquid is diminished. The best way is to add a quantity of solution compounded as above, and then add silver nitrate to bring the whole to the required reading on the hydrometer.

The silver-bath should be kept in a decidedly alkaline condition by the occasional addition of a few drops of ammonia. The tendency to become acid is due to the liberation of nitric acid from the silver nitrate.

The salts in the above solution coagulate the surface of the albumen upon the paper, yet not so quickly and completely as to prevent some organic particles from passing from the paper into the liquid, where they soon decompose and discolor the solution. An excellent method of purifying the solution is to shake it up with a handful of china clay or kaolin, which adheres to the organic particles and carries them to the bottom. The solution may then be filtered, or, after settling, it may be drawn from the bottle for use by means of a syphon reaching nearly to the bottom.



To start the flow, blow into the glass tube at *A*. By this device the sediment is left behind.

SILVERING THE PAPER.

This must be done in a glass, porcelain or wooden tray. A convenient size for washing 5x8 prints will serve for silvering at one time a quarter-sheet of albumenized paper—that is, a sheet that will yield two prints of cabinet size.

I have found it convenient, however, to have made a wooden tray large enough to contain an entire sheet 18x22 inches. A large sheet of glass is made to serve as a bottom, and the wood is well shellacked. The sides of the tray near one corner

should be left considerably higher than elsewhere, and a hole may be bored for convenience in pouring out the silver bath.

The object now is to float the sheet upon the silver solution, with the film down, in such a way that the back of the sheet shall not be wetted. The art of doing this neatly and successfully will doubtless require a little practice. There is in this no royal road to the desired skill. Grasp the opposite corners of the sheet by the thumb and finger of each hand, and bend the sheet down in the middle so that it will first touch the liquid along a line at right angles with that joining the two hands. Lower it quickly and smoothly by lowering and spreading the hands until the whole sheet is floated. Unless the paper has been kept in damp atmosphere, or has been steamed, it will curl and roll at the edges in a most exasperating manner. An excellent preventive is to breathe upon the margins as soon as the sheet is floated. If this is not sufficient, lay across each end of the sheet a light strip of wood before the curling begins. As soon as it has yielded to the situation, the corners must be lifted to see that no air-bubbles are adhering to the under surface of the paper. These may be broken with the smooth end of a glass rod, or by a quick blast of the breath. If allowed to remain a considerable time they spoil the sheet. The sheet should float about two minutes—perhaps a little less in warm weather.

A knife-blade and the thumb and finger are convenient instruments for lifting the corners of the sheet. The amateur should not object to a little stain of silver nitrate. If he does object, it can be removed by first softening with a mixture of alcohol, iodine, and nitric and hydrochloric acids, then by applying hypo or potassic cyanide.

The sheet is now to be lifted from the bath. A most convenient instrument for this purpose is the American clip, which is provided with a hook by which the sheet may be hung upon a line. The sheet may be caught with clips at two corners and, after being drained over the tray, it may be hung up to dry. A better method is to catch the sheet at two corners with the clips and draw it over a glass rod laid across

the tray at one end. The ends of the rod are kept in place by rolling against any objects set for the purpose. If the end of your porcelain tray be smooth, a still better way is as follows: Draw up the end of the sheet a little and press it with the fingers against the porcelain. Push it up until it can be grasped with the clips. As it is drawn out the pressure of the air will cause it to adhere closely to the tray, and it will thus be wiped clean of the silver nitrate. By reason of this it will dry more quickly, and, being rid of all superfluous silver nitrate, it will keep a longer time without turning yellow.

The sheet should now be hung up to dry in the dark-room or in very dim light.

It is necessary that I should give you at this point an earnest caution. Do not handle the albumenized side of the paper, either before or after sensitizing, any more than it is absolutely necessary in cutting to the proper size. The hands should, at any rate, be clean and dry.

Sensitized paper soon becomes discolored, and it is better to use it within twenty-four hours after it is silvered.

Fifth Lecture.

FUMING.

Fuming the paper is next in order, a process too often neglected by amateurs, though essential to the best results. Any large and tight box with a tight-fitting lid will answer your purpose. In this the paper may be hung over a plate containing a shallow depth of strong ammonia. I have found an old trunk convenient. I lift the lid and spread over the top of the body of the trunk a loose netting. Upon this the paper is spread, with the face downward, and the lid is closed. Two plates containing ammonia have been previously placed upon the bottom of the trunk. Thirty minutes' fuming will be sufficient in cold, and twenty minutes in warm weather. The chemical necessity of fuming will be explained at a later stage.

THE PRINTING FRAME.

We may print with merely a smooth piece of board cut to the size of the negative. Lay the sensitized paper upon the board with the face-side up, and upon this lay the negative with the film side to the paper. The whole may be clamped firmly together at the margins.

It is much better, however, to buy or make a printing-frame. This is a simple wooden frame with a shoulder cut upon the inside, upon which the negative rests. The negative should be dropped into its place gently, with the film side up. Upon this the paper is placed, and held to the glass by the cover, which is kept firmly in position by springs, and which is provided with hinges in the middle, so that one-half of the cover can be raised without disturbing the other half. Thus the progress of the printing may be watched from time to time.

When the negative and paper are once in place, expose the frame to direct sunlight. If, however, you have a weak negative, it is better to turn the frame away from the sun and print by diffused light.

The print should be carried to a degree of density considerably beyond what you desire to see in the finished picture. This superfluous density will disappear in the subsequent washing and fixing.

Do not forget to handle the sensitized paper in very weak light. In watching the progress of the printing, one should step back into the dim lighted part of the room. The print, until you are ready to wash, should be put into a light-proof box.

EFFECT OF SUNLIGHT.

Let us now examine the chemical change involved in printing. The paper was first coated with albumen and some salt of chlorine, as ammonic or sodic chloride. When this albumenized paper is floated upon silver nitrate solution, there is a double reaction resulting in the organic compound, silver albuminate and the inorganic ammonic or sodic chloride. In order to simplify the explanation, I will consider the latter compound alone. If the albumenized paper has been salted with common salt or sodic chloride, the reaction with silver nitrate will be as follows:

$$Na\ Cl + Ag\ NO_3 = Ag\ Cl + Na\ NO_3.$$

The paper, therefore, owes its sensitiveness to light to the presence of silver chloride (Ag Cl).

On examining the print, we find that the light has passed through the negative more or less freely and with more or less darkening effect according to the density of the negative at any given point; and that in the print the relation of light and shade has been reversed, producing what is known as a positive. As this relation of light and shade among objects in

nature is reversed in the negative, so the print by a second reversal corresponds to nature.

The darkening effect upon the sensitized paper is due to a change of silver chloride (Ag Cl) into silver subchloride (Ag_2 Cl), as shown in the following equation:

$$4\ Ag\ Cl = 2\ Ag_2 + Cl_2.$$

We now find in the surface of the paper, silver chloride and silver subchloride, the former having been changed into the latter more or less according to the amount of light received at any particular point.

NEED OF FUMING.

We now see at a glance the necessity of fuming the sensitized paper before printing. We learn from the above equation that the actinic rays from the sun not only reduce silver chloride to the subchloride, but also cause the evolution of free chlorine. Now chlorine is an exceedingly energetic element, and, unless in some way counteracted at the instant of its evolution, it is very likely to attack the silver albuminate of the paper, blacken it, and at the same time produce fresh silver chloride, which immediately discolors in the light, giving rise to that spotted, mealy appearance known as "measles." The ammonia with which the paper becomes saturated in fuming combines ultimately with the chlorine to produce ammonic chloride—an inert and harmless salt. The free chlorine is first absorbed by the moisture present, and this solution, as seen in an experiment successfully performed not long ago by yourselves, is changed in the presence of light into hydrochloric acid and free oxygen as follows:

$$Cl_2 + 2\ H_2\ O = 2\ H\ Cl + O_2.$$

The hydrochloric acid then combines with the ammonia present:

$$H_3\ N + H\ Cl = (H_4\ N)\ Cl.$$

Other well-known compounds will secure the same result by combining with the free chlorine, but in practice ammonia is found to be the most convenient.

ALKALINE SALTS IN THE SILVER BATH.

I am prepared to explain to you now the presence of ammonic and magnesic nitrates in the solution of silver nitrate. These salts are deliquescent and absorb a certain amount of moisture from the air, which, as we have seen, absorbs the free chlorine evolved during the action of light upon the silver chloride. Without the presence of moisture, the chlorine would not readily combine with the ammonia to produce ammonic chloride.

WASHING THE PRINTS.

The prints must now be put, face downward, into clean water. After a little rocking and shaking of the tray to give the water access to the prints it is poured out and fresh water added. The milky appearance is due to presence of silver nitrate, some of which still remained in the paper, and no attempt should be made to wash this entirely away.

Wash in three changes of water, and into the fourth change put about half an ounce of saturated solution of common salt and a quarter ounce saturated solution of sodic carbonate. Leave the prints in this about five minutes, and then wash. I am supposing in this case that you are washing about twenty prints, 5x8 inches in size, and that you add water enough to cover them well.

The prints, that are now of a reddish hue and not agreeable to the eye, are ready for toning.

Sixth Lecture.

TONING THE PRINTS.

After developing the plate, toning occasions the amateur more difficulty, perhaps, than any other process. All that is necessary to success, however, is strict attention to well-known conditions and a little training of the eye to discern the critical moment at which the process should be stopped.

In all the variations of the toning bath, and there are many, gold chloride lies at the foundation. The object in toning is to effect in the silver compounds a partial substitution of some metal that will tarnish less easily when exposed to the air, and will, at the same time, present a more pleasing color to the eye. Precisely how this substitution is effected is not certainly known. Gold in a fine state of division has a powerful coloring effect, and a little of it along with the compounds of silver, present gives an agreeable tone. After toning, a picture is supposed to consist of silver subchloride, metallic gold, and an organic compound of silver.

A prime requisite of any toning-bath is that it be alkaline, though not strongly so. It should have the power of turning red litmus paper to a faint blue.

I will now give you formulas that I have used with excellent results. Others have been recommended to me as equally good.

STOCK SOLUTION.

Water	15 ounces.
Gold chloride	15 grains.

To make up a toning bath for twenty prints of cabinet size, take:

Water	10 ounces.
Sodic bicarbonate	3 grains.
Sodic chloride (common salt)	6 grains
Stock solution of gold	3 ounces.

First drop three drops of saturated solution of sodic bicarbonate into the glass; then pour in the gold solution. This mixture may now be added to the bath. After toning, this bath should be poured into a large bottle, and may be used many times without further change except the addition each time of the proper amount of gold. It is well to try the bath now and then with red litmus paper to see if it be still alkaline. If necessary, add a little sodic bicarbonate.

As the prints during toning should be carefully watched, they should not be immersed in the bath all at once. Begin with ten or a dozen, and add others from time to time. If the bath is in good condition, the reddish color will begin to disappear within ten minutes or even less time. The time required in toning varies greatly.

From fifteen to thirty minutes, or even a much longer time, may elapse before the critical moment arrives. The bath that I have described to you will yield rich, black tones, although the photographer may, if he chooses, withdraw the prints while in the purple stage. There is always danger that the amateur will become impatient and take the prints from the bath before they are thoroughly toned. On the other hand, the prints should never lie so long as to acquire a bluish or slaty color. The eye must be trained before the operator can proceed with absolute certainty.

It is sometimes necessary in winter to warm the toning-bath, for the well-known reason that heat assists chemical action. I have found it convenient to set the tray upon a hot soap-stone, or into a larger tray containing hot water, care being taken that the bath does not become overheated.

The prints are, of course, placed in the bath face downward, and should be constantly moved during the toning, both in

order to watch the progress of the toning and to prevent the prints from adhering together. This motion may be conveniently secured by constantly slipping out the bottom one and placing it upon the top.

While very strong light is to be avoided during this process, it must be, nevertheless, strong enough to enable the operator to judge of the tone with certainty.

The prints should, after toning, be rinsed in water, when they are ready for the

FIXING SOLUTION.

A good fixing solution for prints consists of

Water	1 gallon,
Sodic hyposulphite	1 pound,
Sodic bicarbonate	1 tablespoonful,
Common salt	1 tablespoonful.

Enough solution should be poured upon the prints to cover them well. One ounce of hyposulphite crystal is sufficient to fix about two dozen prints of cabinet size. One can well afford, however, not to stint the amount of so inexpensive a material.

During fixing, the tray should be rocked gently in order to bring fresh solution continually in contact with the silver compounds in the paper. The prints should remain in the bath from fifteen to twenty minutes, or they may be watched and withdrawn after fixation is complete.

In the imperfectly fixed print small dark spots may be seen by transmitted light. The print should remain in the bath several minutes after these spots have disappeared.

The fixing solution, after being once used, should be thrown away. The tray used should never, under any circumstances, be used for any other than a hypo solution.

The prints may now be exposed to a strong light without risk.

CHEMISTRY OF FIXING.

I propose again, for the sake of simplicity, to pass over the more obscure action with silver albuminate, and illustrate to you the use of the hyposulphite by its reaction with the silver chlorides alone. We have seen that the sensitized paper contains after printing the chloride and subchloride of silver. The reaction of these with sodic hyposulphite is as follows:

$$2\ Ag\ Cl + Na_2\ S_2\ O_3 \quad 2\ Na\ Cl + Ag_2\ S_2\ O_3 \text{ and}$$
$$2\ Ag_2\ Cl + Na_2\ S_2\ O_3 = 2\ Na\ Cl + Ag_2\ S_2\ O_3 + Ag_2.$$

From both reactions we get silver hyposulphite. This, if there be present an insufficient quantity of sodic hyposulphite, combines with it to produce a double salt of silver and sodium that is almost insoluble. If, however, there be present an excess of the fixing solution, the silver hyposulphite combines with it to produce a double salt of silver and sodium that is freely soluble in water, thus:

$$Ag_2\ S_2\ O_3 + 2\ Na_2\ S_2\ O_3 = Ag_2\ Na_4\ S_6\ O_9.$$

We see, therefore, that all the resulting compounds, as shown upon the second members of our equations, are soluble in water. If these be dissolved away in the subsequent washing, the metallic silver that appears in our second equation will alone remain, and of this the picture will consist. Since metallic silver is in a high degree unfading and durable, the picture is said to be "fixed."

BLISTERING.

If the paper inclines to blister, on being transferred from the fixing bath to cold water, the prints may be soaked three or four minutes in a strong solution of common salt. Generally this will not be necessary.

THE FINAL WASHING.

The task now is to cleanse the paper thoroughly from sodic hyposulphite and other compounds that contain it; and this is no easy task.

I have been accustomed to wash in three or four changes of water, agitating and rinsing thoroughly at each change and allowing the tray to stand a considerable time between the changes.

ACETATE OF LEAD.

Some photographers believe that acetate of lead greatly facilitates the expulsion of sodic hyposulphite. It may be applied as follows:—Into two quarts of water pour one ounce of the solution of lead, composed of two parts lead acetate to sixteen parts water. While stirring, drop in acetic acid until the milky appearance has disappeared.

Into this bath place the prints and allow them to remain from five to ten minutes. Wash again in three or four changes of water. It is quite safe to establish the rule, "The more washing, the better." The fact that nearly all photographs fade after a time on exposure to light shows us the necessity of thorough and patient washing.

When convenient, it is well to let the water run over the prints all night.

It is important to remember that long standing in water is of little avail without frequent change. The inflowing water should be carried to the bottom, while the overflow may be from the top of the tray.

After washing, the prints may be hung upon stretched twine to dry, after which they are ready for

TRIMMING.

The amateur may, of course, trim his pictures with a flat rule and penknife, or with long-bladed shears, and he may trim

them to any size that suits his fancy. But these crude methods are unsatisfactory.

The wisest course will be to purchase a glass form with straight and polished sides and of the proper size. The print is laid upon a pane of thick glass, and upon the print the glass form is laid so as to cover the best portions of the picture. Care should be taken to trim away all of the imperfectly printed edges, and all margins shaded by the printing-frame. This must be done, even if it necessitates a recutting of one or two edges. The picture will otherwise present a slovenly appearance.

The cutting may be performed with a sharp blade, but a Robinson trimmer will be found to be by far the more convenient instrument.

After considerable use upon a glass plate the trimmer will become dulled; but if the amateur have not suitable instruments, he may take it to a jeweler, who will sharpen it for a few cents. The edge should be kept smooth and somewhat rounded. In pushing the trimmer along the print, care should be taken not to incline it so far to the right as to grind and break the lower edge of the glass form.

MOUNTING THE PRINTS.

Card-board mounts may be had of the stock-dealer in great variety of style and tint. Almost any tint is, in my judgment, better than pure white, as the latter tends in many cases by its extreme brightness to distract attention from the picture. Amber and rose have been favorite tints with myself. Black is in excellent taste, but it has been hinted that the pigment used is liable to affect the print injuriously.

After trimming, the prints are laid in a tray of water. They are then taken out and pressed gently between sheets of

blotting-paper, after which they are laid one upon another, face downward, upon a pane of glass. They may be transferred at once from the tray to the glass, and then by pressure be relieved of superfluous water. The prints are now ready for the brush. I believe that a wider brush should be used than those that are often sold for this purpose. For mounting 5x8 views, a brush two inches in width, instead of one inch, will effect an important saving of time.

While the amateur is making his first attempts, and has but few prints to mount, he may be content with the parlor paste sold for this purpose. It is the general verdict, however, among photographers, that pure starch is the best mountant. Some substance must be used that will not absorb moisture, and that contains no acid. Glue and various gums are therefore excluded. The presence of acid will in time cause discoloration of the picture.

The starch should be first dissolved in cold water, and then thoroughly scalded, not boiled, in hot water. If properly made, it will be translucent and adhesive.

Dip the brush, previously wetted, into the starch, and apply it to the back of the uppermost print. The starch should be brushed smoothly over the whole surface, special attention being paid to the edges and corners. No grains or lump of any sort should be left upon the surface. The aim should be to use as little starch as possible, as the less used the greater the probability of future permanence in the print. If the print fails to adhere to the mount it is an indication that the former contained too much water when it received the starch.

The print may now be lifted at one corner with a thin blade, and taken from the pile. It is held between the two hands over the mount and carefully lowered, so that the middle part shall first touch; then the two ends are laid smoothly down. Cover the print with a clean paper, and with the palm of the hand smooth out all wrinkles and air-bubbles by rubbing from the center in all directions toward the margins.

In practice, however, I never do this, as I find it much more convenient to roll the mounted prints between sheets of blot-

ting-paper. By mounting a rubber roller, taken from a worn-out clothes-wringer, in a wooden frame, I have made a very effective instrument.

If starch be pressed out at the margins, it should be wiped off with a clean wet sponge.

As soon as the print has begun to dry, and the mount to curl, it is well to continue the drying under pressure. An herbarium press serves an excellent purpose. The prints should be separated by blotters, or at least by clean paper.

BURNISHING.

After drying, the pictures are ready for burnishing, which is the last act of the drama. The act consists essentially in smoothing the face of the print with a hot iron. The "tool" over which the print is dragged is a solid piece of iron, firmly fixed, and very smoothly polished. Over this, at a variable distance, so as to admit a card of greater or less thickness, a cylinder is made to revolve, whose surface is roughened by draw-filing.

The mounted picture, by means of the friction of this roughened surface upon the back of the mount, is forced through between the cylinder and the tool, which has been previously heated quite hot. The card may be passed through several times, as the polishing is due to friction of the tool, and not merely to heat and pressure.

The action of the burnisher is greatly facilitated by first rubbing upon the surface of the print some pure castile soap dissolved in alcohol. If one prefer, however, it is just as well to apply the soap in a dry state with a piece of soft flannel.

It is better to heat the tool quite hot before beginning to burnish—not so hot, however, as to raise blisters upon the surface of the print. The picture is sometimes marred by fine lines that are drawn by the burnisher. These indicate that the instrument has not been heated to the right temperature, or that it is in some way out of order. If the tool becomes

rough, it may be repolished, but only with some fine material, such as is used for polishing silver-ware. The starch that sometimes accumulates upon the tool may be cleaned away by rubbing with alcohol.

I should not forget to mention that the fine lines that sometimes appear on the surface of the picture may be made to entirely disappear by a little judicious rubbing with alcohol and reburnishing.

This polishing not only improves the general appearance of the picture, but it also strengthens the fine detail in the shadows. An extreme polish, however, should be regarded as in rather vulgar taste.

Seventh Lecture.

STEREOSCOPIC PICTURES.

Fashion, which rules supreme in all earthly affairs, commands us just at present to produce only pictures of ample size—pictures that may be viewed without the aid of instruments. Do not fear, however, that the beautiful and realistic effects of the stereoscope will ever become wholly obsolete.

A stereoscopic picture reproduces the conditions and effects of binocular vision—a principle with which you are already somewhat familiar. Any object seen at a distance of not more than two hundred feet gives us the perception of the third dimension in extension. We perceive depth as well as length and breadth. Each eye sees a different picture from that seen by the other eye. The right eye sees more of the right side of an object than does the left, and the left eye sees more of the left side than does the right eye. When the axes of the eyes are converged to a single object, these two pictures are, by a mental act, combined into the one picture of which the mind is conscious; and this axial adjustment and combination give to the mind the impression of solidity. If then we can, by means of a photograph, evoke the same act of adjustment of the ocular axes, we shall produce in the mind the same impression of solidity.

To accomplish this two pictures are taken with two different lenses, the distance between whose centers is the same as that between the eyes of a man. When these two pictures are so placed that light from each of them is reflected into the eyes from the same distance and direction, as in the instrument of Wheatstone; or when, as in Brewster's stereoscope, the common form, the light from each picture is made by reflecting

lenses to enter the eyes from the same apparent position, the ocular axes receive precisely the same adjustment as when viewing the natural object.

This act of adjustment involves the same muscular sensation, and, of course, gives to the mind the same impression as that received in the presence of the natural object.

The mechanical execution of this work is by no means difficult. Care should be taken at the outset to make the exposure through each lens at the same time and of the same length. If the exposure is extremely short, the drop shutter is preferable. Do not forget to insert the septum that limits the light from each lens to its own side of the plate.

The developing and printing are conducted as in ordinary work. Directions might be given for marking the negative so as to facilitate trimming, but this practice is hardly to be recommended to amateurs, for it spoils the negative for printing from either side small pictures not designed for the stereoscope. In mounting the pictures it is absolutely essential that the picture taken by the right hand lens of the camera, as we stand behind it, should appear on the right hand of the card as we hold it before us in an upright position. I have found it convenient, before cutting the pictures apart, to write upon the back of each R or L to indicate the end of the card upon which each is to be mounted. After trimming, the pictures cannot be distinguished except by actual experiment.

In trimming, draw a base line through both pictures, running it through the same objects in each.

Bring the glass form to which you trim exactly to this base line, and see to it that the right and left sides of the form run through the same objects in the foreground of each picture.

This may be easily done by noting particular points in the detail through which the trimmer may be made to cut.

In mounting, the unpracticed eye may be assisted by drawing a light line that shall divide the mount in halves and indicate the line of contact of the two pictures.

When now the mounted pictures are placed before the lenses of the stereoscope, the mind is actually conscious of the same retinal image that would be produced if we were standing before the objects that have been photographed, and has therefore the same vivid impression of these dimensions. For producing realistic impressions the stereoscopic picture must always remain unsurpassed.

TRANSPARENCIES.

The transparency is so far superior to the print in brilliancy and in perfection of detail that it is surprising that so few are produced by amateur photographers. Fortunately we do not need for this work a copying camera, but may produce excellent results by the method of contact. The negative and transparency plate are pressed close together, film to film, either by the hands or, more conveniently, in a printing frame, and are exposed to an ordinary gas flame. The time of exposure varies, of course, with the density of the negative and the sensitiveness of the plate.

With a Keystone B Plate I should try ten to fifteen seconds. With an A Plate I should increase the time about fifty per cent.

The oxalate of iron should be used in developing, as that produces a cleaner plate and a better tone. My advice would be to follow the directions that accompany the plates. I have found it to be an excellent practice to keep on hand a supply of old developers, and to first immerse the exposed plate in this. An over-exposed plate will be thus restrained from a too rapid development, and a judiciously exposed plate will be in no wise injured, but rather strengthened by receiving its first motion in this weak developer. If the image does not appear after a minute or two, the plate may be transferred to the fresh developer.

The development should be carried considerably beyond the degree of density required in the finished transparency, as much density will be lost in fixing.

In order to distribute the light evenly and softly a ground glass should be placed behind the transparency, and both together be bound or mounted in a nickel frame. If the film is to be protected it must be turned in next to the ground glass; but this reverses the natural order of the picture as to right and left. In many cases this is a matter of no consequence. To avoid this reversal, however, we may flow the back of the transparency with ground glass substitute, and then cover the film with a plate of thin clear glass.

LANTERN SLIDES.

Magic lanterns and solar projectors of various kinds have become so common and so cheap that great inducement is offered for the production of lantern slides. These may, of course, be made by contact, if the negatives are sufficiently small. But as this is rarely the case, the majority of slides must be made by reduction with a copying camera, or with something that answers the same purpose.

My own reductions have been from 5x8 negatives, though it must be admitted that 6½x8½ negatives are, for this purpose, superior in form. The necessary apparatus any amateur can make for himself. I use a wooden box whose inside dimensions are about 7 inches in height, 10 inches in width, and 20 inches in length. One end is left open, while in the other an aperture is cut, over which the negative may be buttoned.

The camera, carrying a Morrison wide-Angle lens of about six inches focus, is brought up to the open end of the box. The two are placed together upon a table and are pointed to a white paper screen standing at an angle of about 45 degrees with the sun. The sunlight should fall directly upon this screen. With the largest diaphragm of this lens, and with the Keystone A Plate of 3¼x4 size, the exposure of negative of average density should be about 20 or 25 seconds.

If the image is to be reduced to a still smaller size, a book or piece of board may be inserted between the box and the camera, and the open space covered with the focusing cloth.

Of course, the plate must be provided with a kit that will carry a plate of the required size. I have found no difficulty in making one for the "new style" holder; and it would certainly be easier to make one for the so-called "Daisy" holder, or others constructed in like fashion.

Clearness and fullness of detail are prime requisites in a good lantern slide. It should be slightly thinner than the ordinary transparency. To secure these qualities a slow development is to be recommended.

After the plate is dry, and the back has been carefully cleaned, a mat should be cut to include whatever part of the picture is to be shown upon the screen. This mat is laid upon the film and covered with a clean thin glass. The margins are then bound with needle paper, or with some other paper equally strong. Parlor paste is sufficiently adhesive for this purpose. The lantern slide is now ready for use.

CONCLUSION.

It has been my aim, in these familiar talks, while making with you sundry excursions into the science of photography, to induct you so far into the art of executing these processes as to enable you to produce for yourselves excellent pictures. These photographic impressions of the best scenes that we have looked upon will have a growing interest as the years pass by, and will always bring to us a joy in reminiscence.

My purpose has been attained if I have excited in you a desire to know more of this useful and beautiful art.

Old Style Equipment.

THE

SCOVILL

Portable

DRY PLATE OUTFITS

FOR AMATEURS.

New Style Equipment.

THE introduction of Dry Plates and the impetus given by them to the cause of Amateur Photography, created a demand for light and compact apparatus that could be easily carried about. That demand the Scovill Manufacturing Company of New York *anticipated and first met* by the introduction of apparatus especially designed for the use of amateurs.

When they announced an Outfit comprising a Camera, Holder, Tripod, Carrying Case, and a good Lens, for $10, a new era in Amateur Photography began, and it was destined to be henceforth a popular and cultivating recreation.

The Cameras they make for amateurs are not mere toys—they have been used and approved by eminent photographers. Certainly no apparatus can compare with that made by our American Optical Co.'s Factory, in durability, accuracy and elegance of finish. It is in use in all parts of the globe, and has by merit won this wide-spread reputation. Be not deceived by what is copied after it. See that your apparatus bears the brand of their actory.

Every article enumerated in this Catalogue has the guarantee of the Scovill Manufacturing Co., established in 1802, and well known throughout the world for fair and honorable dealing as well as for the marked superiority of their photographic apparatus and specialties.

New Catalogues, circulars, etc., will be mailed to any one whose address is sent with the request for copies.

CATALOGUE

—OF—

SCOVILL'S

AMATEUR PHOTOGRAPHIC REQUISITES.

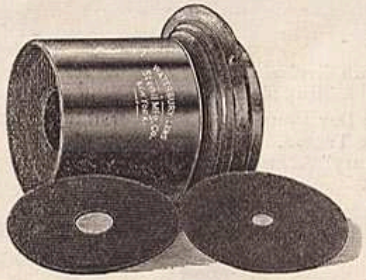
SCOVILL'S

NE PLUS ULTRA

APPARATUS OUTFITS.

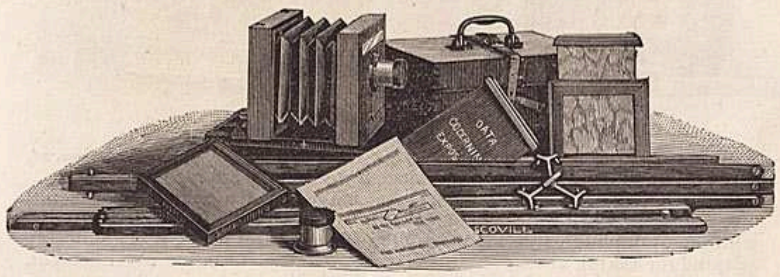
All Articles of which are Warranted Accurate in Every Respect.

These Outfits are lighter, more compact, far handsomer and more accurate than any which are offered at the same price. Many professional photographers have bought them and use them constantly.



In each outfit the Lens, *to which stops have recently been added,* is worth the price of the whole outfit.

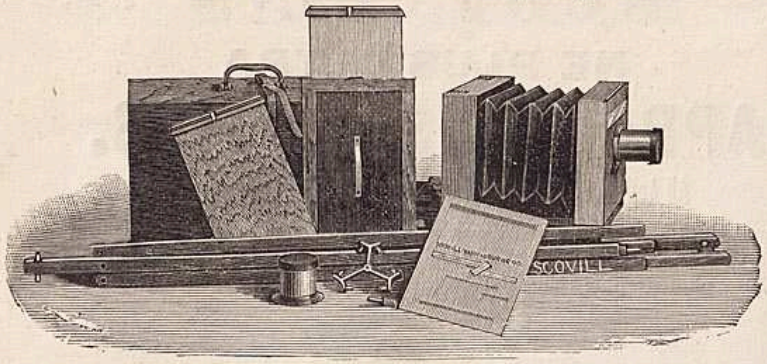
OUTFIT A, price $10.00, comprises



A VIEW CAMERA with *vertical shifting front or the single swing movement,* rubber bellows and folding platform, for making 4 x 5 inch pictures, with

1 Patent Double Dry Plate Holder (Reversible), also
1 Taylor Folding Tripod.
1 No. 1 "Waterbury" Achromatic Nickel-Plated Lens *with a set of Stops.*
1 Carrying Case.

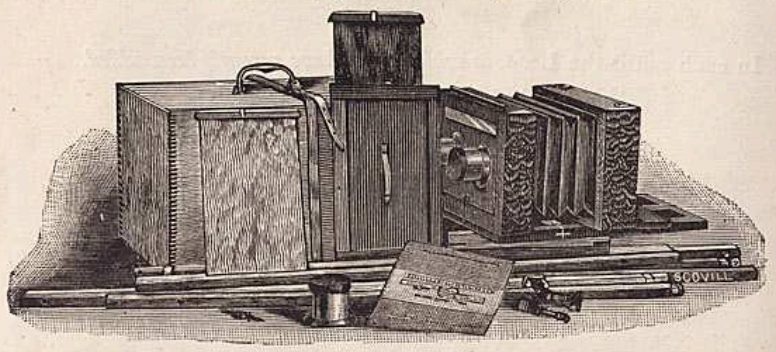
OUTFIT B, price $12.00, comprises



A VIEW CAMERA with *vertical shifting front or the single swing movement*, rubber bellows and folding platform, for making pictures 5x8 inches, also

1 Patent Double Dry Plate Holder (Reversible), *with Kits.*
1 Taylor Folding Tripod.
1 No. 2 "Waterbury" Achromatic Nickel-Plated Lens *with a set of Stops.*
1 Carrying Case.

OUTFIT C, price $18.50, comprises



A VIEW CAMERA with *vertical shifting front or the single swing movement*, rubber bellows and folding platform, for making 5 x 8 inch pictures.

This Camera is constructed so as to make either a *Picture* on the full size of the plate (5 x 8 inches), or by substituting the extra front (supplied with the outfit) and using the pair of lenses of shorter focus, it is admirably adapted for taking *stereoscopic* negatives; also, by the same arrangement, two small pictures, 4 x 5 inches each, of dissimilar objects can be made on the one plate. Included in this outfit are also

1 Patent Double Dry Plate Holder, *with Kits.*
1 Large "Waterbury" Achromatic Nickel-Plated Lens, *with Stops.*
1 Pair "Waterbury" Achromatic Matched Stereoscopic Lenses, *each with Stops.*
1 Taylor Folding Tripod.
1 Carrying Case.

OUTFIT D, price $14.00, comprises

A VIEW CAMERA with *vertical shifting front or the single swing movement*, rubber bellows and folding platform for making pictures 6½x8½ inches, also

1 Patent Double Dry Plate Holder (Reversible), *with Kits.*
1 Taylor Folding Tripod.
1 No. 2 "Waterbury" Achromatic Nickel-Plated Lens *with a set of Stops.*
1 Carrying Case.

OUTFIT E, price $26.00, comprises

A VIEW CAMERA with *vertical shifting front or the single swing movement*, rubber bellows and folding platform, for making pictures 8x10 inches, also

1 Patent Double Dry Plate Holder (Reversible), *with Kits.*
1 Taylor Folding Tripod.
1 No. 3 "Waterbury" Achromatic Lens *with a set of Stops.*
1 Carrying Case.

EQUIPMENT A-A.

Consists of APPARATUS OUTFIT A, with

1 Scovill Focusing Cloth.
1 Dozen 4 x 5 Dry Plates.
1 W. I. A. Improved Ruby Lantern.

Complete for field service, Price, $12.25.

EQUIPMENT B-B.

Consisting of APPARATUS OUTFIT B, with the additional articles enumerated in A-A. (Dry Plates 5 x 8 size.)

Complete for field service, Price, $15.00.

EQUIPMENT C-C.

Consisting of APPARATUS OUTFIT C, with the additional articles mentioned in Equipment A-A. (Dry Plates 5 x 8 size.)

Complete for field service, Price, $21.50.

EQUIPMENT D-D.

Consisting of APPARATUS OUTFIT D, with the additional articles enumerated in A-A. (Dry Plates 6½ x 8½ inches.) Price, $18.00.

Where sensitive Plates are taken to a photographer's and there developed, printed from, and mounted on card-board, any of the above Equipments lack nothing that is essential. We recommend the amateur to finish his own pictures, and hence to procure one of the equipments on page 6.

SCOVILL'S

Pure Chemicals & Accessories

FOR MAKING NEGATIVES.

We offer for use with any Outfits to make pictures 4 x 5 inches, the following goods packed securely in a wooden case:

1 pkg. S.P.C. Carbonate Soda Developer,
2 4 x 5 Glossy Rubber Pans,
1 4 oz. Graduate.
1 Minum Graduate,
1 oz. Bromide Ammonium,
1 lb. Hyposulphite Soda,
1 lb. Alum,
1 bot. S.P.C. Negative Varnish,
1 doz. 4 x 5 Dry Plates,
1 Scovill Focusing Cloth,
1 W. I. A. Ruby Lantern,
1 Scovill Plate Lifter.

PRICE, COMPLETE, $5.25.

For use with any 5 x 8 Outfit we supply the same goods, with the exception of the substitution of 5 x 8 Pans and Plates for the 4 x 5 size.

PRICE, 4¼x5½ DEVELOPING OUTFIT, 5.50.

"	5 x 8	"	"	6.50.
"	6¼x8¼	"	"	7.00.
"	8x10	"	"	8.50.

BLUE PRINTS.

S. P. C.

Ferro-Prussiate Paper Outfit for Printing and Mounting 4 x 5 Blue Print Pictures.

1 4 x 5 Printing Frame.
1 4½ x 5½ S.P.C. Vulcanite Pan.
3 dozen 4 x 5 S.P.C. Ferro-Prussiate Paper.
2 dozen sheets 6½ x 8½ Card-board.
1 Glass Form (for trimming prints).
1 Robinson's Straight Trimmer.
½ Pint Jar Parlor Paste.
1 1 inch Paste Brush.

Price complete, $2.80. Securely packed in a Wooden Box.

S. P. C.

Ferro-Prussiate Paper Outfit for Printing and Mounting 5 x 8 Blue Print Pictures.

This Outfit is like the one above, but with Printing Frame, Vulcanite Tray, Ferro-Prussiate Paper and Card-board adapted to 5 x 8 Pictures.

Price complete, $3.50. Securely packed in a Wooden Box.

6½ x 8½ Ferro-Prussiate Paper Outfit. Price, $4.25.

S. P. C.

Outfit for Printing, Toning, Fixing and Mounting 4 x 5 Pictures.

1 4 x 5 Printing Frame.
1 5 x 7 Porcelain Pan Deep.
1 4½ x 5½ S. P. C. Vulcanite Tray.
2 dozen 4 x 5 S. P. C. Sensitized Albumen Paper.
1 bottle French Azotate. } For
1 " Chlor. Gold, 7½ gr. } toning.
1 2 ounce graduate.
1 lb. Hyposulphite of Soda.
2 dozen sheets 6½ x 8½ Card-board with Gilt Form.
1 ½ Pint Jar Parlor Paste.
1 1½ inch Bristle Brush.
1 Glass Form (for trimming prints).
1 Robinson's Straight Trimmer.
Securely packed in a Wooden Box.

Price complete, $4.87.

S. P. C.

Outfit for Printing, Toning, Fixing and Mounting 5 x 8 Pictures.

This outfit is like the one on preceding page, but with Printing Frame, Vulcanite Tray, Sensitized Paper, and Card-board adapted for 5 x 8 Pictures.

Price complete, $6.38. Securely packed in a Paper Box.

4½ x 5½ Printing and Toning Outfit. Price, $5.00.
6½ x 8½ " " " " 7.00.
8 x 10 " " " " 8.50.

EQUIPMENT A-A-A.

Complete in every Requisite for making the Highest Class Pictures!

LACKING NOTHING FOR VIEW TAKING, DEVELOPMENT AND THE PRINTING AND MOUNTING OF PHOTOGRAPHS.

Consisting of *Apparatus* Outfit A.....$10 00
Also 1 *Chemical* Outfit 4 x 5 (see page 6.).... .. .. 5 25
" 1 *Sensitized Paper* Outfit, 4 x 5 (see page 7.)..... ..... 4 87

Price, $20.00.

EQUIPMENT B-B-B.

Complete in every Requisite for making the Highest Class Pictures.

Consisting of *Apparatus* Outfit B..... .....$12 00
Also 1 *Chemical* Outfit 5 x 8 (see page 6.)..... 6 50
" 1 *Sensitized Paper* Outfit (see above) 6 38

Price, $24.50.

EQUIPMENT C-C-C.

Complete in every Requisite for making the Highest Class Pictures.

Consisting of *Apparatus* Outfit C..... ....$18 50
Also 1 *Chemical* Outfit 5 x 8 (see page 6.)..... 6 50
" 1 *Sensitized Paper* Outfit (see above.)..... 6 38

Price, $31.00.

EQUIPMENT D-D-D.

Consisting of *Apparatus* Outfit D.....$14 00
Also 1 *Chemical* Outfit (see page 6.)..... 7 00
" 1 *Sensitized Paper* Outfit (see above)..... 7 00

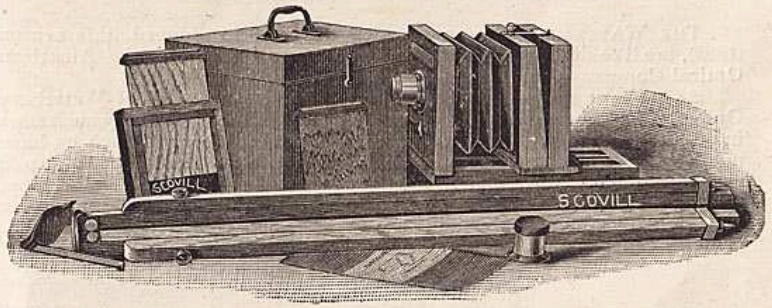
Price, $28.00.

NEW YORK

DRY PLATE OUTFITS

INTRODUCED IN 1884.

* *



These outfits are unsurpassed in neatness, lightness, and compactness, yet there is no question about their durability or serviceable qualities. On this account they have found favor everywhere. Each one is supplied with a patent reversing attachment, which has been styled "the lightning reverser." The whole outfit is so tasteful that many ladies have selected them for their own use.

New York Outfit 601, size 4¼x5½, consisting of
1 Finely Finished Single Swing Camera, with Folding Bed and Improved Dry Plate Holder, *with Kits.*
1 No. 1 Extension Tripod, with Patent Reversing Attachment.
1 No. 1 Waterbury Lens, *with a set of Stops,* and
1 Compact Carrying Case, with Handle. Price, $14.00.

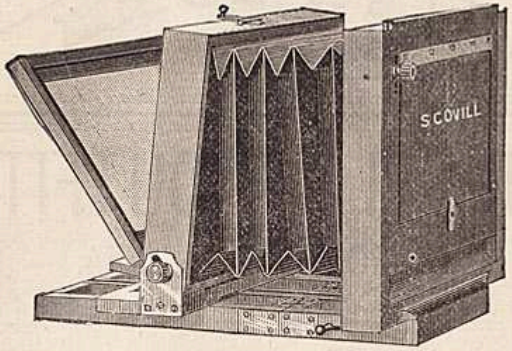
New York Outfit 601A, size 4¼x6½, same as described above, except in respect to size. Price, $15.00.

New York Outfit 602, size 5x8, same as described above, except in respect to size. Price, $16.00.

New York Outfit 603, size 6½x8½, same as described above, except in respect to size. Price, $20.00.

New York Outfits not made larger than 6½ x 8½ size

WATERBURY OUTFITS.



THE WATERBURY CAMERAS which we have introduced this season (1885), are like other cameras and apparatus now made by the American Optical Company—unapproachable!

As we have had urgent requests for 4x5 and 6½x8½ sizes of Waterbury Outfits, we are now prepared to announce our readiness to supply such sizes in addition to the 5x8 stereoscopic size. For the benefit of such as have not seen a Waterbury Camera, we present the above illustration, and add that these cameras are made of mahogany. They have rubber bellows, folding platform, single swing, vertical shifting front, side latch for making bed rigid instantaneously, and are as light and compact as substantial cameras can be constructed.

		Fitted with Eastman-Walker Roll-Holder. New Model.
4x5 Waterbuy Outfits, Complete	**$12 00**	**27 00**

CONSISTING OF

1 Single Swing Camera, described above.
1 New Style Double Dry Holder.
1 Wooden Carrying Case.
1 Taylor Tripod.
1 No. 1 Waterbury Lens *with a set of Stops.*

5x8 Watebury Outfits, Complete	**$16 50**	**36 50**

CONSISTING OF

1 Single Swing Camera, described above.
1 New Style Double Dry Holder.
1 Wooden Carrying Case.
1 Taylor Tripod.
1 No. 2 Waterbury Lens *with a set of Stops.*

6½x8½ Watebury Outfits, Complete	**$20 00**	**44 00**

CONSISTING OF

1 Single Swing Camera, described above.
1 New Style Double Dry Holder.
1 Wooden Carrying Case.
1 Taylor Tripod.
1 No. 2 Waterbury Lens *with a set of Stops.*

Latest! 4¼x5½ Waterbury Outfit, complete $14 00
4¼x6½ " " " 15 00
5x7 " " " 16 00

AMERICAN OPTICAL CO.'S APPARATUS OUTFITS.

This apparatus is manufactured in New York City under our immediate personal supervision; and, as we employ only highly skilled workmen, and use nothing but the choicest selected materials, we do not hesitate to assert that the products of our factory are unequalled in durability, excellence of workmanship, and style of finish. This fact is now freely conceded not only in this country but throughout Great Britain, Germany, Australia, South America, and the West Indies.

OUTFIT No. 202, price $22.00, Consists of

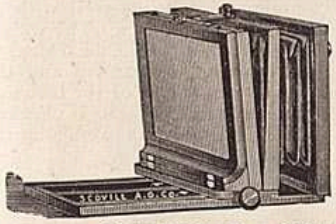
A MAHOGANY POLISHED CAMERA for taking pictures 4x5 inches, with *Folding Bellows Body*, single swing, hinged bed, and brass guides. It has a shifting front for adjusting the sky and foreground, with
1 Daisy Double Dry Plate Holder; also 1 Canvas Carrying Case.
1 Scovill Adjustable Tripod.

OUTFIT No. 202 A, price $24.00,

The same as No. 202, but with Camera for taking pictures 4¼ x 5½ inches.

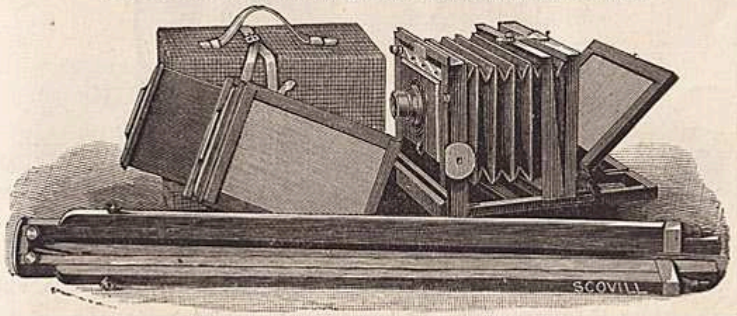
OUTFIT No. 202 B, price $26.00, for pictures 4¼x6½ inches.

OUTFIT No. 203, price $30.00, Consists of



A FOLDING MAHOGANY CAMERA, well known as the '76 Camera (see illustration). It is adapted for taking 5x8 inch pictures, and also for stereoscopic views—together with
1 Daisy Double Dry Plate Holder; also
1 Canvas Carrying Case.
1 Scovill Adjustable Tripod.

OUTFIT No. 204, price $42.00, Consists of



A FOLDING MAHOGANY CAMERA of finest style and finish for taking 6½ x 8½ inch pictures, with
1 Daisy Dry Plate Holder; also
1 Canvas Carrying Case.
1 Scovill Extension Tripod, No. 3.

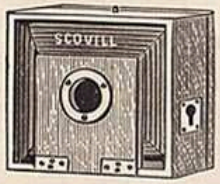
For larger or special View Cameras, consult the American Optical Company's Catalogue.

We recommend the purchase and use with the above Outfits of a Lens or Lenses selected from the list on page 24.

For Chemical and Sensitized Paper Outfits to be used with the above refer to pages 6 and 7.

NOTE REDUCTION IN PRICE.

TOURISTS' POCKET OUTFITS.

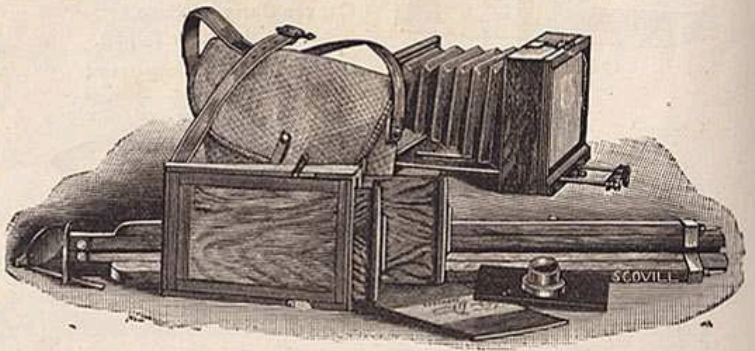


TOURISTS' POCKET CAMERA FOLDED.

(*Extract from* PHOTOGRAPHIC TIMES, *March*, 1883.)

AMERICAN OPTICAL COMPANY'S TOURISTS' POCKET CAMERA.

"This camera, of which a cut is appended, may be called new, as it is now advertised for the first time; but several of these cameras, both of 4 x 5 and 5 x 8 sizes, have been in use for months, and have given perfect satisfaction. When folded up, a 4 x 5 Tourists' Camera measures but 5¼ x 6½ x 2 inches, and it is without any projecting parts, pins or screws, so that it may be slipped into and not tear a gentleman's pocket. The rods which are used to move forward the front of the camera are easily detached from it and drawn out of the bed. The connector at the other end of the rods is just as readily unset. To replace these three parts when the camera is brought out for service, requires no more time or skill than to take them off. They are nicely adjusted, and are polished and nickel plated, so that they add to the handsome appearance of the camera, and contrast well with its polished mahogany surface and the purple hue of its bellows. The weight of this camera and its dry plate holder (but 1½ pounds for the 4 x 5 size) is on the center of the tripod. In focusing, the front of the camera and the lens are pushed forward, thus avoiding any disarrangement of the focusing cloth. When the focus is obtained, further movement of the lens is checked or stopped by means of a screw acting on a spring, which is pressed at the ends against the focusing rods."



Tourist's Pocket Outfit No. 0206.—4x5 Tourist's Pocket Camera, with
1 Daisy Double Dry Plate Holder.
1 Scovill Extension Tripod No. 1, with patent reversing attachment.
1 Canvas Carrying Case with Shoulder Strap.

Price, complete, $22.00.

Tourist's Pocket Outfit No. 0207.—5x8 Tourist's Pocket Camera, with
1 Daisy Double Dry Plate Holder.
1 Scovill Extension Tripod No. 2, with patent reversing attachment.
1 Canvas Carrying Case with Shoulder Strap.

Price, complete, $30.00.

We recommend the purchase and use with the above Outfits of a Lens or Lenses selected from the list on page 24.

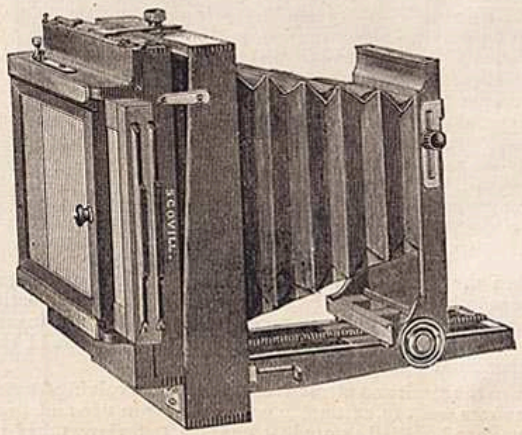
For Chemical and Sensitized Paper Outfits to be used with the above, refer to pages 6 and 7.

SAINT LOUIS

Reversible-Back Cameras.

IN addition to the desirable features which the Back Focus Reversible Camera possesses (see description below) the St. Louis Reversible-Back Cameras have the rack and pinion movement, side latch for making the bed rigid instantaneously, and the ground-glass so arranged that the holder may be slid in front of it, as shown in the illustration.

Each Camera is supplied with one Daisy Holder and canvas case.



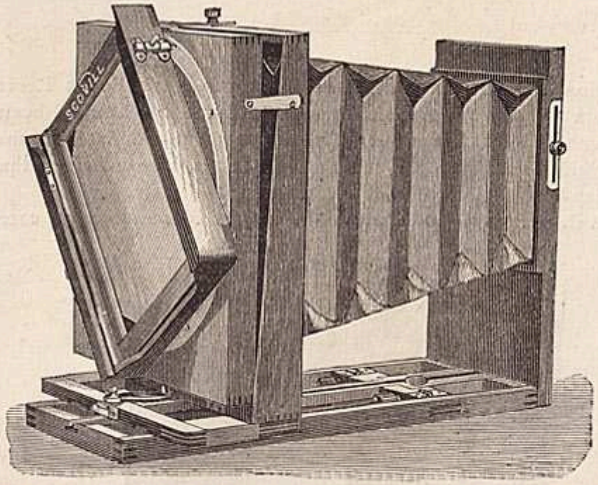
THE growing use of dry plates, and the desire for rapid exposures, led to their introduction, and because they add to the grace and celerity of view-taking they have become vastly popular. A novel arrangement of a detachable carriage at the back combines such a multiplicity of adjustments in itself that a dry-plate holder *may be reversed or be set for either an* 8x10 *upright or horizontal picture*—all of these movements, without once changing the dry-plate holder in the carriage, which may be made to take an S. G. C., but not a Bonanza Holder.

	For View.	Single Swing-back.	Double Swing-back.
Saint Louis Reversible-Back Camera,	4¼x5½,	$26 00	$30 00
" " "	5x7,	32 00	35 00
" " "	6½x8½,	36 00	40 00
" " "	8x10,	40 00	44 00
" " "	11x14,	60 00	66 00

Not made front focus above 11x14 size.

Flammang's Patent Revolving-Back Cameras.

Each Incased in a Canvas Bag, with Handle.



"These are the finest View Cameras ever constructed," so says every photographer who has examined any of them, and this exclamation is not merely a tribute to the beauty and grace of their design, for invariably the desire has at the same time been expressed to possess one of these truly novel and substantial Cameras.

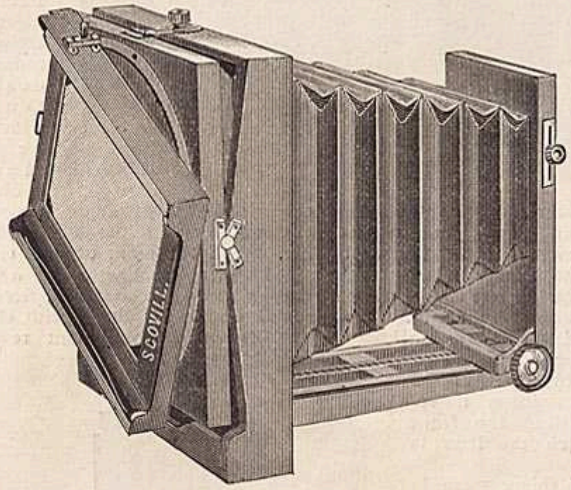
Wherein lies the merit and attractiveness of the Revolving-Back Camera, that photographers want to cast aside cameras now in use and procure one of this new pattern? Briefly stated, it enables the view taker to secure either an upright or a horizontal picture without changing the plate holder after it has been slid into the carriage. No other camera can with such wondrous ease and celerity be changed from the vertical to the upright or *vice versa*. The carriage is simply turned about in the circle and automatically fastened. By this latter provision the carriage may be secured at either quarter of the circle. Ordinarily, the slide will be drawn out of the holder to the right; but in certain confined situations, the ability to withdraw the slide to the left enables the photographer to obtain a view which he could not get with the usual provision in a camera. The photographer of experience is well aware of the difficulty, when taking an upright picture with a large camera, of reaching up to draw out the slide at the top, and, what is more essential, of getting out the slide without fogging the plate in the holder.

Grace and strength are combined in the Revolving-Back Camera, and its highly-desirable features are gained without the sacrifice of steadiness or any other essential principle in a good camera. Indeed, its merit is such that out-door photography has been advanced and made more attractive by its introduction.

For a more detailed description consult Scovill's general catalogue.

Revolving-Back Camera, Front Focus.

(Not made larger than 8x10 Size.)



PRICE LIST.

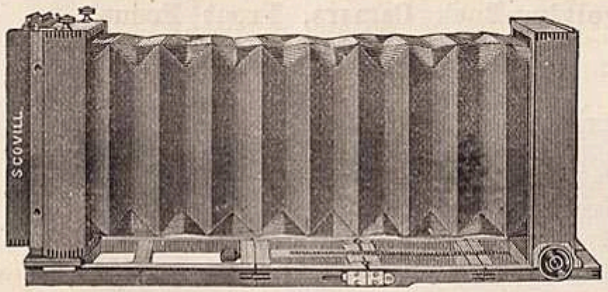
Revolving Back Cameras, each Incased in a Canvas Bag, with Handle, above 11 x 14 size, with two handles.

No.				Plain.	Single Swing.	Double Swing.
550A.	For View 4 x 5 in.,	reversible	.....	$26 00	$31 00	$36 00
551.	" 4¼ x 5½ "	"	.....	28 00	33 00	38 00
551A.	" 5 x 7 "	"	.....	30 00	35 00	40 00
551B.	" 5 x 8 "	"	.....	30 00	35 00	40 00
552.	" 6½ x 8½ "	"	.....	40 00	45 00	50 00
553.	" 8 x 10 "	"	.....	45 00	50 00	55 00
554.	" 10 x 12 "	"	.....	60 00	65 00	70 00
555.	" 11 x 14 "	"	.....	70 00	77 50	82 50
556.	" 14 x 17 "	"	.....	80 00	90 00	95 00
557.	" 17 x 20 "	"	.....	95 00	105 00	110 00
558.	" 20 x 24 "	"	.....	110 00	120 00	130 00
559.	" 25 x 30 "	"	.....	150 00	165 00	175 00

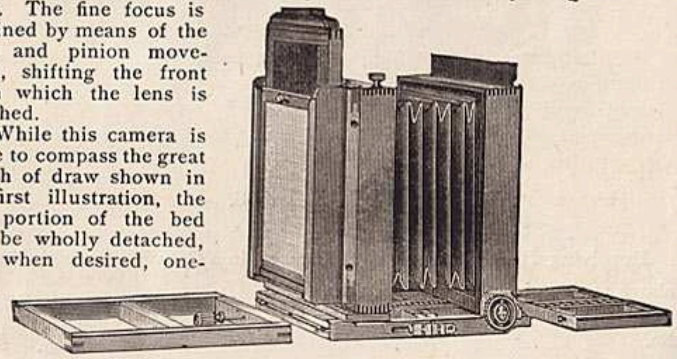
These Cameras are fitted with Daisy Dry Plate Holders.

☞ Please state, when ordering, whether front or back focus is desired.

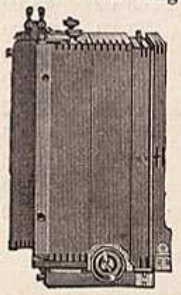
THE SCOVILL MANIFOLD CAMERA.



The Manifold Camera has special advantages peculiar to itself and possesses the greatest number of desirable features which can be combined in a camera without sacrificing lightness and compactness, or having complicated adjustments. The unique device which controls the horizontal and vertical swings was patented by Mr. W. J. Stillman, of the editorial staff of the PHOTOGRAPHIC TIMES. *To this has been added a central latch for the purpose of bringing the swing movements within perfect control of the operator.* An approximate focus is obtained quickly with the rear portion of the camera, which is provided with the patent reversible back. The fine focus is obtained by means of the rack and pinion movement, shifting the front upon which the lens is attached.



While this camera is made to compass the great length of draw shown in the first illustration, the rear portion of the bed may be wholly detached, and when desired, one-third of the remaining portion of the platform; a great advantage when photographing interiors, when an obtrusive tail board renders focusing almost an impossibility. With one-half of the bed taken off, this camera is still of the usual length of draw. The ground glass, when not in use, is displaced, *not detached*, by having the plate holder slid in front of it. This arrangement of ground glass and plate holder is shown in the second view. Still another noticeable feature is the absence of clamping screws from the front boards, to move which one needs but to press firmly against the lens. The bed folds in front of and behind the camera, and has the side latch recently devised at the American Optical Co.'s factory. While this camera serves manifold purposes, as its name indicates, nothing could be more simple or more easily manipulated. PRICE LIST, including Canvas Case for Camera and one Holder.



3¼x4¼ size... $34 00	4¾x6½ size.....$41 00	6½x8½ size.....$52 50
4x5 size..... 38 00	5x7 size..... 42 00	8x10 size. 58 00
4¼x5½ size.... 40 00	Other sizes made to order.	

Photographic Outfits for Bicyclists,

WITH WHICH TO SECURE MEMENTOES OF PLEASANT EXCURSIONS.

So popular has amateur photography become among wheelmen that the two amusements are now almost identical. The "Wheel" allows unbounded opportunities to the amateur photographer to gather choice landscape views, which he could not get otherwise.

"NE PLUS ULTRA" BICYCLISTS' PHOTO-OUTFIT

(COMPLETE).

PRICE, - - - $10.00.

Consisting of a 3¼x4¼ Imitation Mahogany Camera with Vertical Shifting Front, Folding Bed and Hinged Ground Glass,

A UNIVERSAL JOINT BICYCLE ATTACHMENT,

A No. 1 WATERBURY LENS (NICKEL-PLATED), *with Stops,*

A CANVAS BAG TO CARRY THE ABOVE, *with Shoulder Strap.*

The advantages of this outfit are its Lightness and Compactness, and the ease with which it can be brought into use—a new device on bed of the Camera permitting it to be made rigid, or to fold instantaneously. There are no loose pieces. The outfit complete weighs 2 pounds 3 ounces.

NICKEL-PLATED BICYCLE ADJUSTABLE SUPPORT.....$1.50

This has no loose pieces and is so accurately made as to have no side play.

THE "MIGNON" BICYCLISTS' PHOTO-OUTFIT

(COMPLETE).

Consisting of a 3¼x4¼ Finely Polished Mahogany Camera, with Swing Back, Vertical Shifting Front, Hinged Ground Glass, Folding Bed, Rack and Pinion Movement (Front Focus). In short, it has every improvement, and has no loose pieces. Nothing finer, more attractive and yet simple was ever made.

A Universal Joint Bicycle Attachment.

A 5½ inch Morrison Wide-Angle Instantaneous Lens, pronounced by authorities on optics to be without a peer. The Rotary Shutter with this Lens is the Most Compact and the Lightest known.

A Canvas Saddle Bag lined with flannel to prevent marring of the fine finish of the camera.

THIS OUTFIT COMPLETE WEIGHS LESS THAN TWO POUNDS.

Price of "Mignon" Bicyclists' Photo-Outfit Complete, $70.00.
Without Lens, $25.00.

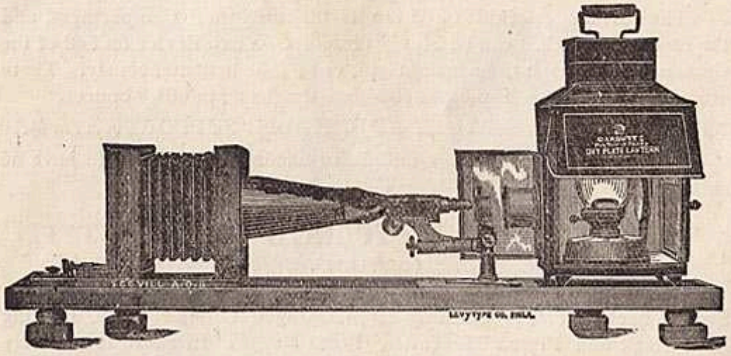
With the lenses just described, clear, sharp pictures can be obtained which will make fine transparencies and lantern slides, or which can be enlarged up to 8x10 size.

SCOVILL'S OUTFIT

For PHOTOGRAPHING with the MICROSCOPE.

Photographing with the microscope has hitherto been accomplished by the aid of elaborate and costly apparatus, and been applied chiefly to making illustrations for scientific magazines. The process used, that of wet collodion in connection with sunlight, involved the procurement of an expensive heliostat to produce a steady illumination, for with any less powerful light the exposure would necessarily be so prolonged that the coating of the plate would dry and become useless. Now all this is changed, for with the modern improvements in photography which are the result of the introduction of gelatine dry plates, the photographing of microscopic objects becomes as easy of accomplishment as the photographing of the beautiful and visible in nature is with the popular amateur outfits.

The scientist and microscopist, instead of spending hours in making imperfect drawings, aided by the camera lucida, may in a few minutes, with the assistance of photography, produce a more perfect representation of a minute object than it is possible for the hand of man to do, working conjointly with the eye. Not only can an enlarged image of a microscopic object be formed for illustration, but professors in colleges will find it a ready means to produce negatives of a suitable size from which may be made transparencies or magic lantern slides for exhibition to classes or the public.



If this is done in the daytime, a room from which all white light is excluded should be selected; but if used at night, as in most cases it would be, the operations may all be performed in the midst of a family group for their interest and amusement, and to impart to them knowledge of the minute life or organisms of the world which the microscope alone can reveal.

Scovill's Photomicroscopic Equipment,

— CONSISTING OF —

1 Scovill Special Half Plate Camera.
1 Multum in Parvo Lantern, with Double Condenser.
1 dozen 4½ x 5½ size B Keystone Plates to make Negatives; also
1 dozen 3½ x 4¼ size A Plates for Transparencies.

Price, Complete, $18.00.

The presumption is that you are provided with a microscope. If not, we recommend the purchase of one from a regular dealer in microsoopical goods.

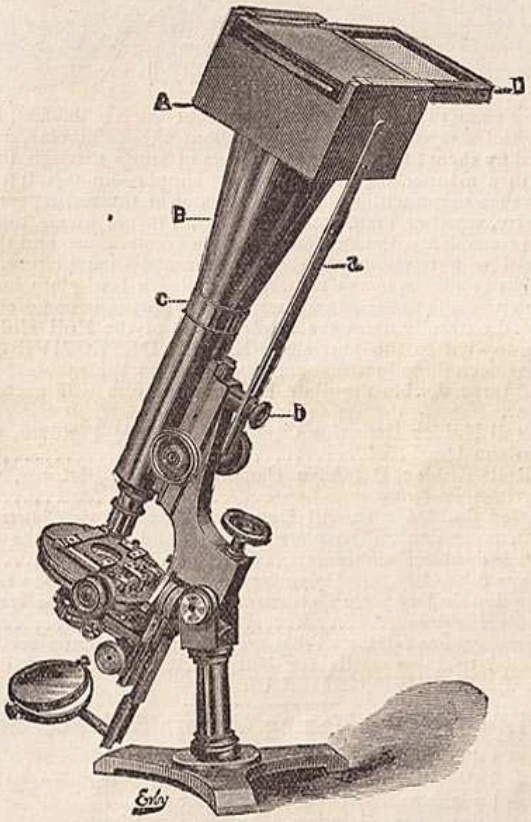
Circular containing directions for use sent with each outfit.

MERCER PHOTOMICROGRAPHIC

CAMERA.

Size, 2¾x3¼.

——Price, $6.50.——



This Camera is provided with a Brass Cone and Plate Holder with Ground Glass attached, to slide back and forth in the carriage, as desired.

THE SCOVILL DETECTIVE CAMERA.

It has not come to be generally known, but such is the fact, that Artists of renown and shrewd Detectives carry about these Cameras, and pictures are secured by them for their different lines of study through their instrumentality in a manner which is perfectly simple—in fact, it requires no skill other than to get within the range of focus of the unsuspecting victim. As the party, whether man, woman, or child, is not aware that anything unusual is transpiring, the expression of the countenance and the pose are not arranged with reference to their appearance in a picture. A quick working lens is hidden in the camera, and also a few plate holders. By pressing on a spring the whole operation of exposure is completed.

It followed naturally upon the introduction of the Roll Holder that it should be applied to the peerless SCOVILL DETECTIVE CAMERA, and this has been done in a manner that displays the greatest ingenuity. Instead of three double dry-plate holders, but one will accompany the Roll Holder.

Scovill's Roll Holder Detective Camera, for 3¼x4¼ Pictures, with Morrison Lens.....$65 00

Scovill's Roll Holder Detective Camera, for 4x5 Pictures, with Morrison Instantaneous Lens..... 75 00

The price for the 3¼x4¼ Scovill Detective Camera, with Morrison Lens, three double Dry-plate Holders, and room in the case for six double Holders..... 50 00

The price for the 4x5 Scovill Detective Camera, with Morrison Lens, three double Dry-plate Holders, and room in the case for six double Holders..... 60 00

Many amateurs have declared that the pleasure of picture-taking was not fully revealed to them until they had procured and tried one of the SCOVILL DETECTIVE CAMERAS.

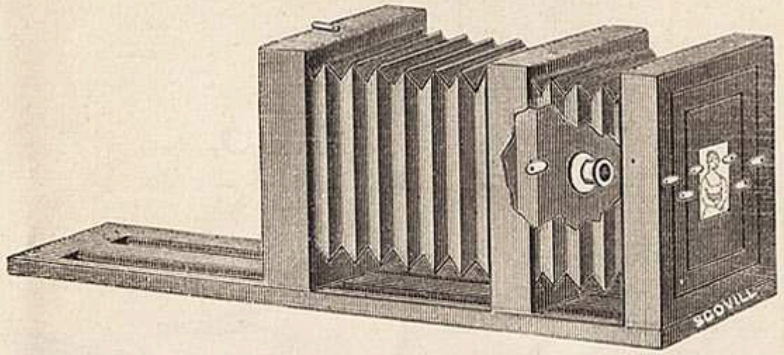
Scovill's Outfit for Making Lantern Slides consists of

1 doz. Thin Crystal Glass.
2 " Black Mats.
1 package Black Adhesive Paper.
1 doz. 3¼x4¼ Gelatino-Albumen Dry Plates.
1 package S. P. C. Pyro and Potash Developer.
2 4¼x5¼ Solid Glass Pans.
1 lb. Hyposulphite Soda.

The above, packed in wooden case, price complete..... $3 50

For enlarging, reducing, or copying Negatives to make Lantern Slides, we recommend the use of one of the Scovill Enlarging, Reducing and Copying Cameras.

The Scovill Enlarging, Reducing and Copying Cameras.



When ordering, please specify number and sizes of kits wanted.

Size, 6½x8½,	Price, $30.00	Size, 11x14,	Price, $60.00
" 8x10,	" 35.00	" 14x17,	" 72.00
" 10x12,	" 48.00		

Size, 14 x 17, - - $72.00.

Special sizes and styles made to order.

The form of construction of this new Camera is made apparent by the illustration here shown. The experienced copyist will not need any such simple directions for use as we append.

DIRECTIONS FOR USE.

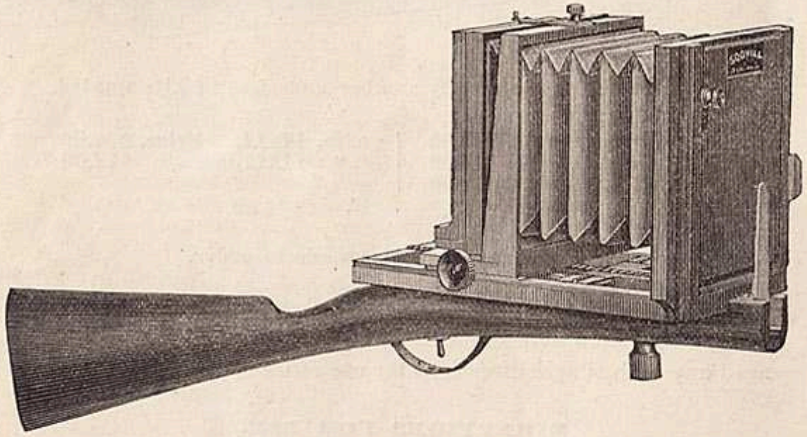
To copy a negative in the natural size, place it in the kit on the front of Camera and button it in. Attached to the center frame of the Camera is a division upon which, on the side toward the Camera front, a Lens is mounted. Suppose this to be a quarter-plate Portrait Lens, the focal length of which we will suppose to be 4 inches—draw back the center frame and the Lens twice the focal length of the Lens (8 inches); slide the back frame with ground glass the same distance from the center frame. To enlarge with the same Lens to eight times the size of the original, the center of the Lens must be 4½ inches from the negative, and the ground glass be 36 inches from the center of the Lens. To reduce in the same proportion, reverse and have 36 inches from the center of the Lens to the negative, and from the center of Lens to ground glass 4½ inches.

KILBURN GUN CAMERA,

For 4x5 Pictures.

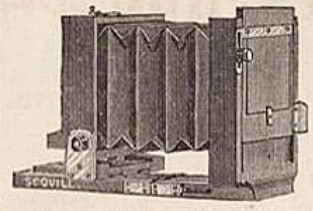
Price, $27.00.

Gunstock Attachment only $5.00.



A popular method of hunting lately introduced is in conformity with the laws of Mr. Bergh's Society for the Prevention of Cruelty to Animals. It never results in the death or even maiming of fish, flesh, or fowl, yet all three may be easily bagged. The weapon used is a late invention called the gun camera. It consists of a small camera mounted on a gunstock and provided with sights and triggers. Its ammunition is chemicals instead of powder and lead. It is both breech and muzzle loading, is light and simple in construction, and is used like an ordinary shot-gun. When a bird rises, it must be brought to the shoulder, a dead aim taken at the feathered object, and the trigger pulled. There is a slight shock as of an explosion, the bird flies on to cover unharmed, leaving its picture on the sensitive plate in the camera. It is all done in a moment of time. The plate is removed, another inserted, and the hunter is ready for the next object. The amateur may go forth with two dozen dry plates as his stock of ammunition. If he fire with precision at any stationary or moving object, he may be absolutely sure of bringing it down.—*New York Tribune.*

THE PETITE CAMERA.



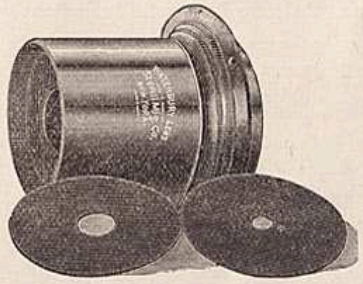
This camera was made to suit the refined taste of one of Vassar's fair students. The design on the part of the manufacturers was to reduce the impedimenta for an outing to the minimum, providing a 3¼x4¼ camera (to make negatives of suitable size for lantern slides), with single swing, folding bed, vertical shifting front, and other desirable improvements. So well has the design been carried out that many ladies will follow the example of Vassar's pupils, and learn the fascination of picture-taking with one of these finely-polished mahogany cameras. Gentlemen in search of a pocket camera need not seek further. The Petite Camera and an enlarging camera will by many be considered a satisfactory and complete equipment for such photographing as they desire to do.

PRICE.

Petite Camera with one double dry-plate holder.....$12 00
Same Camera with Scovill's adjustable (feather weight) tripod and canvas bag, with shoulder strap..... 17 00

WATERBURY LENSES.

Provided with a Set of Stops.



Notwithstanding what may be said or imagined to the contrary, it is a fact that many of the most exquisite photoggaphs ever produced have been taken by the single achromatic lens, which is composed of a bi-convex lens made of crown glass, cemented by a transparent medium to a plano-concave lens formed of flint.

PRICE.

No. 1, Single.....	$3 50	No. 2, Single.....	$4 50
" 1, Matched pair	7 00	" 3, "	8 00

OUTFITS FOR INSTANTANEOUS PHOTOGRAPHY.

Instantaneous Outfit No. 401.

CONSISTING OF

202 Outfit..... $22 00
Peerless Lens..... 12 50
Instantaneous Drop (wood) for front of Lens..... 1 50 — $35 00

Instantaneous Outfit No. 402.

202 Outfit..... 22 00
No. 1 Darlot Rapid Hemispherical Lens..... 15 00
Instantaneous Drop (wood) for front of Lens..... 1 50 — 38 00

Instantaneous Outfit No. 403.

202 Outfit..... 22 00
Morrison's Celebrated B Group Lens, with metal Drop.. 35 00 — 56 00

Instantaneous Outfit No. 404.

203 Outfit..... 30 00
No. 2 Darlot Rapid Hemispherical Lens..... 25 00
Instantaneous Drop (wood) for front of Lens..... 1 50 — 56 00

Instantaneous Outfit No. 405.

203 Outfit..... 30 00
Morrison's Celebrated C Group Lens, with Instantaneous metal Drop..... 40 00 — 69 00

The same Chemicals and Printing Requisites can be procured for the above as for common Outfits.

Lenses for Obtaining Instantaneous Pictures.

B Morrison's Celebrated Group Lens, with metal Drop.....each, $35 00
C " " " " " ..... " 40 00
CC " " " " " ..... " 50 00
No. 1 Darlot Rapid Hemispherical Lens, with wood Drop.... " 16 50
" 2 " " " " .... " 26 50
" 3 " " " " ... " 36 50
Imitation Dallmeyer Lens..... " 9 50
" " Lenses, matched for Stereoscope Work, per pair, 17 00

Morrison's Wide-Angle View Lenses.

PATENTED MAY 21, 1872.

These Lenses are absolutely rectilinear; they embrace an angle of fully 100 degrees, and are the most rapid *wide-angle* lenses made.

No.	Diameter of Lens.	Size of Plate.	Equivalent Focus.	Price, Each.	
00	⅝ inch	2½ x 2½ inches	1¾ inches	$25 00	These 3 sizes will fit into 1 flange.
0	¾ "	3 x 3 "	2¼ "	25 00	
1	⅞ "	4 x 4 "	3 "	25 00	
2	1 "	4 x 5 "	3½ "	25 00	These 5 sizes will fit into 1 flange.
3	1 "	4½ x 7½ "	4½ "	25 00	
4	1 "	5 x 8 "	5¼ "	25 00	
5	1 "	6½ x 8½ "	6½ "	25 00	
6	1 "	8 x 10 "	8 "	30 00	
7	1¼ "	11 x 14 "	10½ "	40 00	These 2 sizes will fit into 1 flange.
8	1¼ "	14 x 17 "	14 "	60 00	
9	1½ "	17 x 20 "	17 "	80 00	These 2 sizes will fit into 1 flange.
10	1¾ "	20 x 24 "	22 "	120 00	

REMARKS.—Nos. 1 to 6 are all made in matched pairs for stereoscopic work. The shorter-focused Lenses are especially adapted for street and other views in confined situations. For general purposes, a pair of No. 5 Lenses will be found most useful.

Morrison's Instantaneous Wide-Angle View Lenses.

With full opening, these lenses have all the extreme depth for which the Morrison Regular Wide-Angle Lenses are noted. They work with extreme rapidity, and will cover an angle of 90 degrees sharp. Furnished with a pneumatic drop and a set of diaphragms.

Diameter of Lens.	Size of Plate, Full Opening.	Size of Plate when Stopped Down.	Focus.	Price.	With Rotary Exposer.
⅞ inch.	4 x 4 inches.	5 x 7 inches.	5½ in.	$30 00	
1 "	4 x 5 "	8 x 10 "	8 "	35 00	
1¼ "	5 x 8 "	10 x 12 "	10 "	40 00	$60 00
1⅝ "	8 x 10 "	14 x 17 "	13 "	45 00	65 00

Protectors for any of above Lenses..... $12 00
" C Group Lenses..... 12 00
" CC " " 17 00

Darlot Hemispherical Wide-Angle Rectilinear View Lenses.

These Lenses embrace an angle of 90 degrees, and are valuable for taking views of buildings, interiors, etc., in confined situations, where those of longer focus cannot be used.

	Back Focus.	Size View.	Price.
No. 1,	2½ inches	For Stereoscopic Work, each	$12 50
" 2,	3 "	" " "	15 00
" 3,	5 "	8 x 10	20 00
" 4,	8 "	10 x 12	25 00

Darlot Rapid Hemispherical View Lenses.

These Lenses embrace an angle of from 60 to 75 degrees; are quick-acting, perfectly rectilinear, and provided with central stops. Will be found very fine lenses for landscape and outdoor groups; also for copying engravings, maps, architectural subjects, etc.

	Back Focus.	Size View.	Price.
No. 1,	5½ inches	5 x 6	$15 00
" 2,	9 "	5 x 8	25 00
" 3,	10½ "	8 x 10	35 00

No. 1 can be had in matched pairs for Stereoscopic work.

Scovill's "Peerless" Quick Acting Stereoscopic Lenses,

FOR PORTRAITURE OR VIEWS.

The Lenses are especially designed for Stereoscopic Photography, and are so constructed that they will work well for interiors or exteriors.

They are particularly adapted for instantaneous work.

Diameter of Lenses, 1⅛ inch; focal length, 3⅛ inches.

By removing the back lens and substituting the front combination, a focal length of 5½ inches is obtained.

They are supplied with six Waterhouse diaphragms in morocco case.

Price, per pair..... $25 00 | Waterbury View Finder..... $3 00

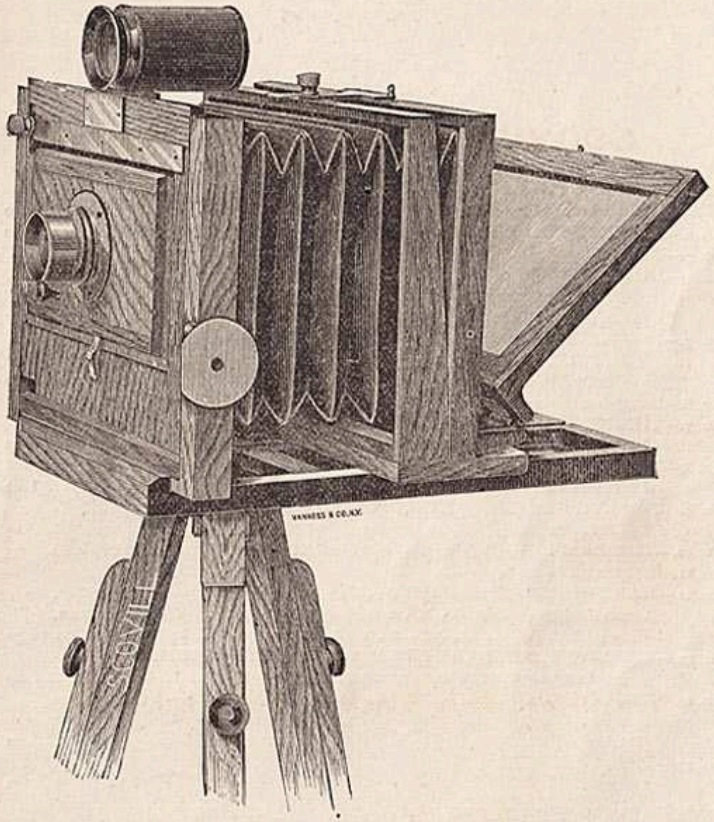
ALL STYLES OF LENSES SUPPLIED.

A New Departure in Morrison Wide-Angle Lenses.

(*Extract from* PHOTOGRAPHIC TIMES, *Vol. xiv, page 277.*)

Opening the velvet-lined morocco case presented to us for our inspection, we find partitioned-off space containing an ordinary 5-inch Morrison Wide-Angle Lens, on which the front and back combinations are distinctly marked with the figure 5. Beside this, in cells, are four mountings with lenses of varying focal lengths, each marked in white with a number. By unscrewing the back combination marked 5, and putting in its place the mounting marked 6, a lens of 6-inch back focus is obtained. Again, by removing both these cells and replacing them with the two marked 8, a lens of 8-inch back focus is the result. By screwing in the front combination marked 5 and the back combination marked 4, a lens of 4-inch back focus is obtained. Putting a front combination marked 8 and a back marked 6, a focus of 7 inches is produced. Thus the operator has a choice of five focal lengths with the one lens. Price for the whole, $80.

A complete descriptive Price List of Outfits, Accessories, Dry Plates, Chemicals, Transparency Frames Dry Plate Holders, and View Albums, accompanies each Outfit, or is mailed free upon application.



'76 Camera, with Morrison Lens and Waterbury View Finder.

LATE PUBLICATIONS

—OF—

SCOVILL MANUFACTURING CO.

NEW YORK.

SCOVILL'S PHOTO. SERIES.

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