The stereoscopic manual / by W.I. Chadwick.

THE Stereoscopic Manual.

BY

W. J. Chadwick.

AUTHOR OF THE "MAGIC LANTERN MANUAL," HON. SEC. STEREOSCOPIC CLUB, PRESIDENT SOUTH MANCHESTER PHOTOGRAPHIC SOCIETY, &c., &c.

SECOND EDITION.

JOHN HEYWOOD,
DEANSGATE AND RIDGEFIELD, MANCHESTER;
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PREFACE.

THE origin of this little Manual was a series of articles published in the "British Journal of Photography" in 1888-89, and I tender my thanks to the editor for permission to re-publish them in book form. I am perfectly aware that the subject could be extended, and that a book ten times the size of this would not contain all that could be said. However, if the following few pages serve the purpose for which they were written, both reader and writer should be satisfied, and nothing further need be said.

W. I. CHADWICK.

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PREFACE TO SECOND EDITION.

THE fact that the First Edition of 2,000 copies of this Manual was disposed of in a few months is sufficient reason for issuing a Second. There have been a few corrections and additions—but practically this edition is a reprint of the first.

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THE STEREOSCOPIC MANUAL.

BINOCULAR VISION.

WHEN an artist makes a drawing "from the round," as from a bust, when he depicts architectural subjects, or the common objects which surround us, when he paints a portrait from life, or depicts a landscape on his canvas, he has various devices open to him to give suggestion of depths of distance and of solidity.

In the copying of a plaster cast, the solidity is indicated by the shading, in a portrait by the combination of the lights and tints, in the case of an architectural subject by geometrical perspective, and by the shadows in the landscape, or by both of these, and by what is known as "aërial perspective," too, which may briefly be described as the dimming and the veiling of distant objects by the intervening air.

These various means, however, at their very best, do but make the suggestion of solidity or depth. The suggestion is often very good, and is frequently described as "stereoscopic." But it is not stereoscopic, inasmuch as it does not produce the illusion of solidity; for the various objects in the picture could not be mistaken for solid objects, "sensible to feeling as to sight."

When we look at a photograph, our impression of solidity is limited to the extent of the light and shade. When we close one eye, and view a painting or photograph with the

other eye, the suggestion of solidity is considerably increased. With a single eye we can form certain not very perfect notions of length and breadth, but two eyes are absolutely necessary to form a judgment of depth and thickness.

Now, reader, has it ever occurred to you to ask yourself the question, Why has man two eyes? How is it that the birds which fly in the heavens above, the beasts which roam the earth beneath, and the fishes which swim in the waters that are under the earth, *have all two eyes?* How is it that they need more than one and less than three?

It is true that there are certain apparent exceptions to this rule. The mole was long imagined (erroneously) to be blind; certain fishes which inhabit the everlasting dark waters of the Great Kentucky Cave are said to have no appliances for seeing, and certain insects are said to have, not one, but *several hundreds* of lenses in each of their two eyes. These seeming exceptions, however, only prove the rule. In the absence of light, any number of eyes, whether large or small, would be destitute of use, and as for the number of "facets" in certain flies' or insects' eyes, their use, whatever it may be, is clearly subordinate to the principle of vision with two eyes; for whatever the number of facets we find, they are found on *two* eyes.

What, then, is this enormously important principle of seeing with two eyes, or of binocular vision, as it is termed? Writers on this subject are very fond of saying that the eyes suggest certain considerations to the mind, and propound as it were certain dogmas for its belief. This is one way of putting it, but it is not a good one.

What the eye suggests to the man who has been born blind, but who has received the power of sight from the instrumentality of the surgeon's knife, is that the objects which he sees are in *contact* with the eyes; and the suggestion is not true.

What the eyes do, is to present two pictures for the inspection of the brain; and what the brain does, is to learn through the instrumentality of the other senses and by the process of experience what these pictures mean.

That the pictures formed respectively in the right eye and in the left are in reality and of necessity dissimilar, is by no means difficult to show, both from theory and experiments of a simple kind. If we hold a dinner plate at arm's length before one eye, and in such a position that with that one eye only we only see its edge, without the position being altered the other eye will be able to see something of the side which is nearest to itself; or if we hold the hand before one eye in such a position that the forefinger obscures the rest, when the other eye is opened all the fingers will be seen, and an effect with both eyes will be observed which no painting could possibly produce. This is stereoscopic, or the solid seeing effect of "binocular vision" of images which are not alike.

Now let us suppose photographs were to be taken of an irregular building in the middle of a field, first from one position of the field, and afterwards from another; it is clear they cannot be alike, and whilst any diminution of the distance separating two of these points of view will make the pictures less dissimilar, no amount of diminution will annihilate their difference so long as two points of sight remain,—each camera will always "see" more of one side than the other does, or will make more of one side when "seen." And, as has already been shown, this is what occurs when we view the solid objects from each eye alternately, because we have viewed the objects from points of sight differing by the distance our eyes are apart.

Though modern discoveries are necessary for the construction and employment of various instruments for the produc-

tion of such pictures, and to assist in conveying them to the brain, no modern discovery is necessary for the perception of what has just been said. To perceive the truth of it needs but the ordinary power of observation and a competent faculty, as Newton entitles it, of "using one's reason rightly."

But to make this matter still more clear, we will suppose a photograph be taken of a square box. We should produce an outline such as would be seen by one eye placed in the position of the lens. Now, by removing the camera to a position two and a half inches to one side, we should produce another outline, and we see more of one side of the box than is shown in the previous picture; this is what would be seen by the other eye. Then, of course, these pictures are not alike, and if we caused them to overlap they would not coincide, and we should still see two different pictures, for they could not be united as one.

If, now, the reader will "use his reason rightly," he will be able to comprehend the fact that if these two dissimilar pictures—pictures such as would be seen in nature by each eye—were to be presented to each eye at the same angle or convergence that would be necessary when both eyes were used in viewing natural objects,—that is to say, if the pictures were placed side by side (at suitable distances), and the right eye photograph viewed with the right eye, and the left eye photograph viewed with the left eye, the brain would combine them, and we should see only one, as in nature; and if these conditions were fully and correctly observed, we should perceive the same solidity and relief from the pictures that is due to binocular vision when observing natural objects. The twin camera when properly constructed produces the dissimilar pictures, and the stereoscope when properly constructed presents them to the eye.

It has been shown that when we view a solid object, a living person, a landscape, &c., with each eye alternately, we see different pictures, or dissimilar ones, because we have viewed the objects from points of sight differing by the distance our eyes are apart; but when we view an object with both eyes it appears single, whilst it is obvious a distinct image is projected on each retina. *When we see an object distinctly, we only see a point of that object singly at a time; all other points are seen double and indistinctly, because the image of them falls on portions of the retina which do not give distinct vision.* In proof of this, hold the forefinger of the right hand at a distance of six inches from the nose, and hold the finger of the left hand behind, at a distance of say 18 inches from the nose (12 inches behind the near finger); now, by looking attentively at the near finger, the optic axes will converge to one particular spot, and the left-hand finger will appear double and indistinct; if, now, we look attentively at the further finger, the near finger will in turn appear double. It will be perceived that in converging the optic axes to the near finger the image of the distinct finger is out of the optic axes, and "*falls upon portions of the retina which do not give distinct vision,*" for it will be remembered that when we observe an object distinctly, the optic axes converge to a particular point, and the nearer the object be to the observer, the greater will be the convergence, and conversely the more distinct the object the less will be the convergence.

The eyes, too, are capable of the most rapid movement, and with so great a precision, that their axes may be united at several points in succession by muscular motions, which are almost instantaneous, and it is *by greater or less convergence that we are able to judge objects to be nearer, or more remote.* To illustrate this fact, let a small object be suspended

by a cord from the chandelier of a room with the interior of which we are not familiar. If we close one eye and enter the room with a pair of scissors in hand, and walk deliberately to cut the cord, the probability is that we shall not correctly estimate the true distance, and so fail on the first trial. Another simple experiment is to try to snuff a candle with one eye closed. When the two eyes are open there is no difficulty in performing either of these experiments, thus establishing the fact that a very imperfect idea of distance is obtained from the focussing arrangements of a single eye, but as has been said, and cannot be emphasised too strongly, *that when two eyes are used, the optic axes converge to the single point, and where these axes meet the single image is seen.*

But this successive convergence is not necessary to the impression on the mind of solidity; for the images which are outside the optic axes—double or indistinct—*make us conscious of their presence*, and the mind associates them with solidity or distance. If the number of the page on the left-hand corner of this book be intensely looked at, it will be quite distinct; at the same time, however, the number on the right-hand page cannot be distinctly recognised, nor can any other part of the book as it lies open before the reader, but he is nevertheless conscious of its presence, and the brain will associate the whole with a solid object of a certain size.

THE THEORY OF THE STEREOSCOPE.

The word stereoscopic implies the property of being visible as a solid, and the stereoscope, it has been said, is an instrument which is intended to present two pictures to the eyes for the inspection of the brain. The simplest form of stereoscope would be a plain box having a central division, with a suitable pair of pictures at one end, and two holes, about two and a half inches centres, at the other end, for if through these holes the optic axes were directed, perfect stereoscopic effect would be revealed. (It will be noticed that lenses, &c., are here dispensed with.) Now let us consider the size of the pictures and the dimensions of the box.

When we look at a tree in nature, a mile away, we view it with so little convergence of the optic axes as to be termed *practically parallel vision*, and as it is "by greater or less convergence that we judge distance," we must view the photograph of that tree with "practically parallel" vision, for it must be remembered that if we observed the tree with a *greater* convergence of the optic axes, we should not estimate it at its true distance, but at a nearer distance; and as our eyes are only two and a half inches apart, it is clear that the image of the tree in the two photographs must *not be more* than two and a half inches apart. This dimension, then, at once settles the size of the photographs at not more than two and a half inches each in width.

Now we will consider the length of the box that would be necessary.

With normal vision we are unable to observe pictures or anything else distinctly or conveniently at a nearer distance from the eye than eight inches; therefore the box must be at the *least* eight inches long, and, as will presently be shown, to appreciate natural size and perspective, all photographs—large

or small—whether for the stereoscope or as single views, must be observed at the same angle that was embraced by the lens employed when taking the original negative; or in other words, they must be observed at a distance from the eye equal to the length of focus of the lens employed.

This, then, establishes the fact that at least an eight-inch focus lens would be necessary for the production of these pictures, which are only two and a half inches wide, and such lenses would not include sufficient angle to be at all times consistent. Wider angle lenses are therefore more generally employed; then the pictures must be observed at correspondingly wider angles. Thus, if four-inch lenses are used with which to take the negative, the pictures must be seen at four inches from the eyes, and to do this the introduction of lenses in the stereoscope are absolutely necessary, for it will be manifest that if the pictures produced by four-inch focus lenses were observed at eight inches distance, they would appear very much smaller; in fact, they would appear just one half their true diameter. The introduction of lenses in the stereoscope, however, are simply to shorten the focus, and to place them at the right distance for observation. Now we arrive at the important point, that to appreciate the natural distance in the view—the third dimension—the natural convergence of the optic axes only must be maintained, which in the present case is said to be "practically parallel"; therefore only the centres of the lenses of the stereoscope must be used, and this is the correct principle. Then the stereoscopes of commerce are constructed on a wrong principle, as will now be shown.

The stereoscope of Brewster is provided with two lenticular prisms, mounted with their thin edges nearest together (sometimes whole lenses are employed, but as the centres of

these often measure as much as two inches and seven-eighths to three inches, only their inner edges can be used; therefore they are used as prisms). The images are refracted by each prism in an outward direction towards the thicker portion of the prism (or the centre of the lens)—and the optic axes follow the line of refraction, *and thus converge by force;* uniting at a point where the axes cross, the images are said "to overlap, and so coalesce."

Now, we are bound to admit that by the displacement due to the prisms the images are caused to overlap, but it cannot be admitted that they coincide, since we know that the two images are not alike. Then the coalescence due to the refracting stereoscope is incomplete, and the mind does it in the end.

But the "forced convergence" due to the prisms is unnatural, for the "tree situated a mile away," which would in nature be viewed by "practically parallel vision," would now (using prisms) be seen by a convergence due to something held only at arm's length. The true distance, then, is not appreciated, and the impression left for the inspection of the brain is that of a little model instead of a natural-sized tree.

In concluding this chapter, the reader is reminded that, when the centre of the lenses of the stereoscope are used, their only use is to bring the pictures within the range of normal vision, and the pictures must not be mounted at more than the distance our eyes are apart, which is approximately two and a half inches.

When the pictures are mounted at a wider interval than two and a half inches, the centre of the lenses in the stereoscope cannot be used, and they must be separated so as to use their insides, thus making them into prisms, and the greater the separation of the pictures the greater necessity there will be to use these prisms, but in doing so we arrive at the convergence theory, which has been shown to be wrong.

APPARATUS—CAMERAS.

Having devoted the first two chapters to the subject of binocular visions and the theory of the stereoscope, we must now proceed to the consideration of some practical points in connection with the production of stereoscopic photographs.

The early stereoscopic photographs were taken by single camera, fitted with only one lens. They were generally provided with an extra baseboard and an arrangement of parallel levers, or something of the kind, by means of which the camera was moved a few inches (or as much as was considered necessary) between the first and the second exposure, it being necessary, as has already been explained, that for stereoscopic effect two dissimilar pictures, taken from different standpoints, are required.

There are many objections to the single camera, and it is claimed that the late J. B. Dancer, of Manchester, was the first to construct a twin camera provided with twin lenses. However that may be, it is quite certain that he did construct some of the earliest of these improved instruments, and although they were heavy and clumsy affairs compared with others of a more recent date, the principle involved was the same.

The earlier twin cameras were constructed without bellows bodies, being simply plain wooden boxes with a central wooden division, and when two lenses were not obtainable, one was made to answer the purpose by a sliding front board, shifting the lens from one side to the other between the exposures, as in the old single camera. Sometimes this method is resorted to nowadays, and it answers well enough when the conditions are favourable, but for animated nature or objects in motion, instantaneous effects, &c., two lenses must be used.

When bellows bodies were introduced, twin cameras were constructed with twin bellows, both being attached to one front and one back. But the expanding bellows division fitting inside a single bellows body, thus dividing the camera into two parts, was a happy idea suggested by the late George Warton Simpson. There are, however, objections to this "bellows division" when using long and short focus lenses in the same camera; the elastic bands necessary to keep it in position when short focus lenses are used become too tight, and put a great strain on the body of the camera when long

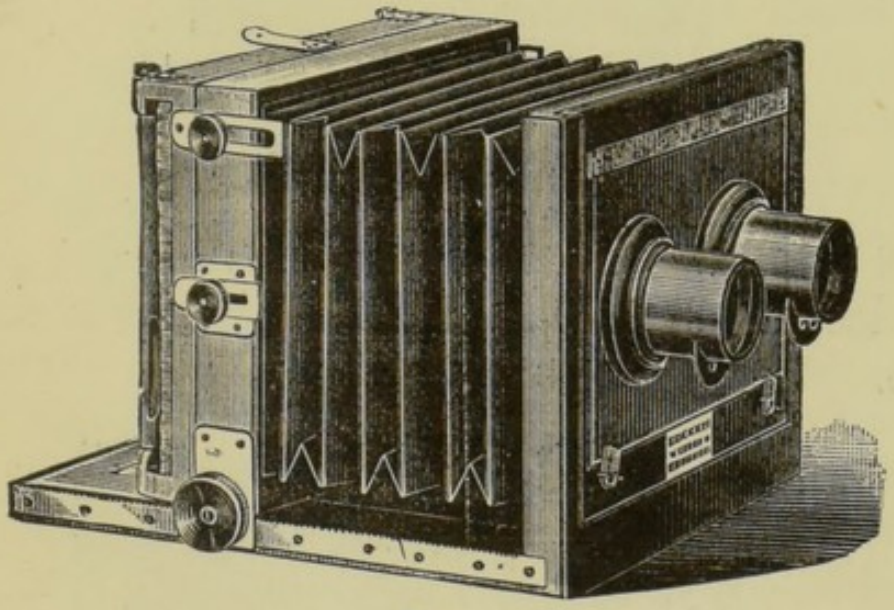


Fig 1.

focus lenses are employed, and sooner or later cause the camera to become shaky. The writer has devised a spring roller and curtain division (which is now the subject of a patent), and with this it matters not whether the shortest or longest focus lenses are in use, no appreciable difference in the strength of the spring is observable, and the necessary adjustment for a "swing back" is perfectly automatic. Its application to the camera is exceedingly simple; it may be removed in an instant when single views are required, and replaced in as short a time when the camera is required for stereoscopic work.

Fig. 1 is an illustration of a modern stereoscopic camera, and shows the arrangement of the "swing back" with the centre of motion in the axes of the lenses. The lens board,

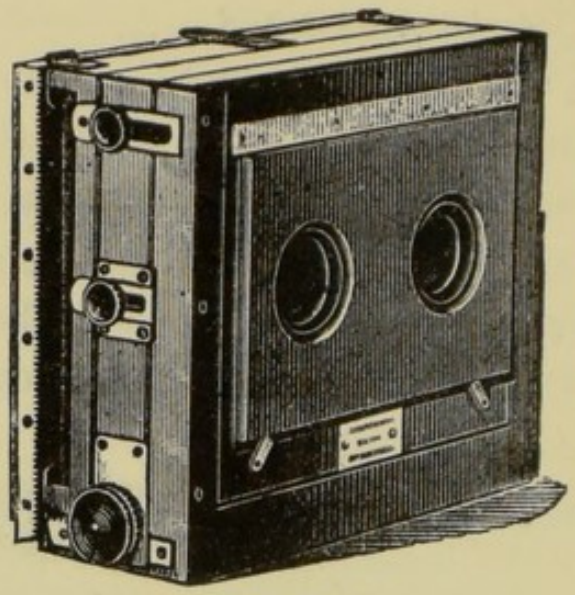


Fig. 2.

as will be seen, is removable, and may be reversed so as to carry the lenses inside the body of the camera, as shown in Fig. 2.

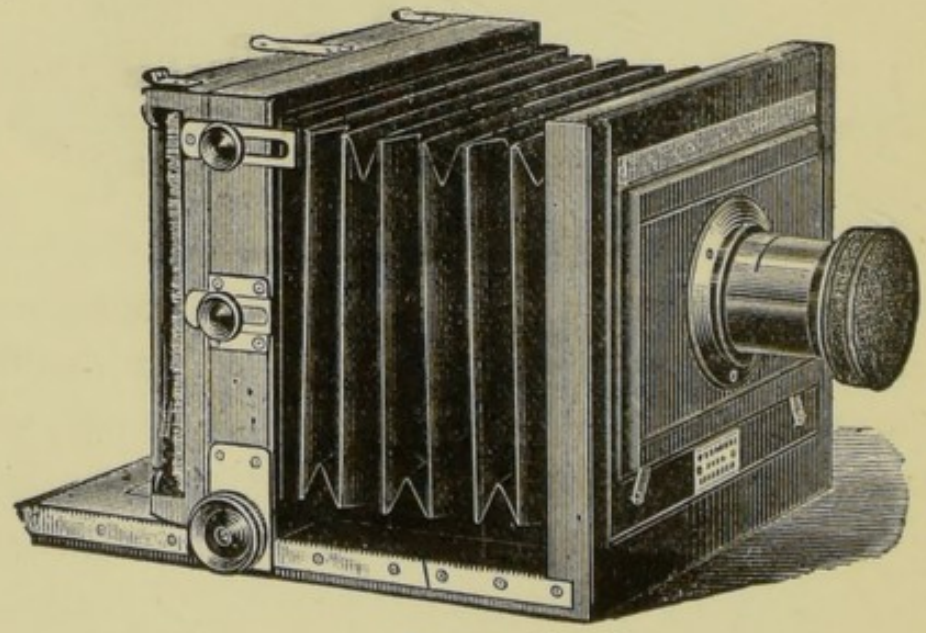


Fig. 3.

Fig. 3 illustrates the same camera, but with the stereoscopic lenses removed, and a single lens (for single views) in position.

SIZE OF NEGATIVE.

The size of plate must next occupy our attention. The size of picture for the stereoscope is governed by the *width*, which, as has been said, should be $2\frac{1}{2}$-in., but even if we exceed this size, say up to $2\frac{3}{4}$, we shall find a plate $6\frac{1}{2}$-in. long quite sufficient. The height of a stereoscopic picture is not very important. They can be seen by the stereoscope with equal comfort from three to four inches in height, and may be trimmed and mounted in various shapes, thus—round, square, cushion-shape, or upright, as best suits the composition of the picture.

When the pictures are printed on paper, they may be mounted up to 4-inch deep, and cabinet cards used for the mounts; but when printed as transparencies on glass, the old size, $3\frac{1}{4}$-inch deep, will generally be found sufficient and most convenient.

To sum up the advantages one way and the other, we have finally decided that the best size of negative plates is $6\frac{1}{2} \times 4\frac{1}{4}$, a standard size known as "double quarter"; it is half a "whole plate," and double the size of a "quarter plate," this being not only the best size for stereoscopic work, but a most convenient and useful size for single views also; the length equal to once and a half the depth is considered a more artistic proportion for single views than the ordinary English half plate ($6\frac{1}{2} \times 4\frac{3}{4}$).

SIZE OF PICTURE.

The writer has known many practical photographers (who ought to know better) take exception to stereoscopic pictures on account of their diminutive size, they professing to admire larger and more imposing work. Such objection, however, is only to be excused by those who have not studied the subject. Every photographer should know that when he focusses an image on his ground glass, and views that image at a distance from the ground glass equal to the focus of the lens employed, he observes it at the exact same angle that he would view the natural object if his eye was placed in the position occupied by the lens, and therefore he views it in natural magnitude.

To prove this, let us focus an object on the ground glass of the camera, say a landscape; now turn the camera round and remove the ground glass, and also remove the lens; if now the eye be placed at the lens aperture, that is to say, in the position previously occupied by the lens, we shall see exactly the same subject that we saw on the ground glass—no more and no less—for we are now looking at the natural object with the unassisted eye, and the range of vision is restricted by the frame of the camera to the angle embraced by the lens. We are now in a position to realise the fact that if we make a photograph three inches square by a five-inch focus lens, and we view that photograph at five inches distance from the eye, we observe it at the same angle at which it was taken, and it will be percieved that a picture three feet long viewed at five feet distance, a twelve-inch picture viewed at fifteen inches, and a three-inch picture viewed at five inches distant, would all convey the same apparent magnitude.

Then there is no advantage in large size pictures for the stereoscope. It is quite true we are unable to observe pictures with normal vision at five inches distance; therefore lens are introduced, as has already been explained.

APPARATUS—LENSES.

It has already been stated in the last chapter that there is no advantage to be gained in large size pictures for the stereoscope. "But surely," said a friend, "the large picture will contain more *amount* of subject. Take my 13 × 9 plate for a single view against your $3\frac{1}{4}$ square picture. I can get a two-acre field on my plate from a certain standpoint when using my 12-inch focus lens." "Yes," I reply, "and I can get the exact same amount of subject on my $3\frac{1}{4}$ plate by using a 3-inch focus lens, for the angle embraced by the two lenses is exactly the same; but the chances are in favour of the smaller image being the best, because smaller lenses are usually more perfect instruments than large ones."

But the tendency nowadays is not to use too short a focus lens, or to work at too great an angle. Most of our best pictures are produced by lenses working at narrower angles (longer focus), and it must be stated that what applies to single pictures applies equally to stereoscopic work so far as concerns the angle of view or the composition of the picture. Thus, if a 9-inch focus lens is considered about the best for a half plate, a lens half that focus length would be equally suitable for a stereoscopic picture.

As there are various kinds and constructions of photographic lenses, the tyro naturaliy asks which is the best; and in answer to this question there is no "best," for the kind most suitable for one purpose may be quite unsuitable for

another. For instance, if portraits are required, a portrait lens should be used; though a landscape lens may be made to do duty, but it would not be the *best*, and *vice versa*.

Landscape lenses are divided into two classes, viz., what are called "single" achromatic landscape lenses, and "doublet" landscape lenses. These latter are known as symmetrical, rectilinear, and a dozen other names, generally given to them by dealers.

The single achromatic landscape lenses are, to outward appearances, composed of one piece of glass (but in reality there are two or more glasses cemented together), with a stop or diaphragm in front. These "single" lenses are the best for landscape work, pure and simple; say for sea views, mountain, river, and lake subjects, trees or figure subjects, ruined castles, &c., &c. They give more brilliant pictures than "doublet" lenses; their only drawback is that when of short focus—or in other words, when working at wide angles—they bend the lines at the margin of the picture, which are straight in nature, this bending taking the form of what is known as "barrel" shape distortion. If, however, the stop or diaphragm were fixed *behind* the single lens, the straight lines in nature would be distorted in the contrary direction—that is to say, would curve inwards at the centre, or produce what is technically known as "pincushion" distortion. But when two single lenses are placed one on each side the diaphragm, as in "doublet" lenses, the distortion of one lens is corrected by that of the other, and we produce the lines straight, "symmetrical," or "rectilinear," or as they are in nature; therefore, for architectural subjects, this latter class of lenses should be used, and the shorter the focus or the wider the angle embraced, the more necessary it becomes to use "doublet" lenses, and *vice versa*. In our own practice a

doublet lens is never used where a single one will do ; and, as has been already stated, where the lens is of moderately long focus for the plate in use, the less necessity there is for doublet lenses, no matter what the subject may be. If the amateur can only be provided with one lens, say on a tour in the Isle of Man, the English lakes, or North Wales, a single landscape lens is the best ; but if he must photograph the interior or exterior of Chester Cathedral, York Minster, or Westminster Abbey, then he must use a double-lens.

These doublet lenses are again divided into two classes, known as "rapids" and "wide-angle;" the latter are intended for architectural views in confined situations, such as interiors, &c. The "rapid" series are generally the more useful of the two ; they are second best for landscape work, very good for instantaneous work, fairly good for portraits, and best of all for copying.

However, to sum up the requirements of amateurs who may wish to do "all round" work—landscapes, architecture, portraits, &c., &c., with one lens—a rapid rectilinear will be found the most useful ; but for stereoscopic work doublet lenses are not necessary even for architecture or interiors, except when working at wide angles *(short focus)*. A pair of 5-inch single archromatic lenses will be the most useful ; a pair of 7-inch of the same class will be the next best (these should be constructed to fit the same mounts). The next useful will be a pair of short focus doublets.

It might not be out of place here to remind the reader that the longer the focus of a lens in proportion to the dimensions of the plate used, the less it becomes necessary to use doublet lenses, such as rectilinears or symmetricals, to produce straight lines, or for architecture. This rule applies in all cases, whether for stereoscopic or single views.

SEPARATION OF LENSES.

When mounting a pair of lenses on a stereoscopic camera, it is important that they be placed on the same horizontal plain, but the vexed question is, at what distance apart they are to be mounted? Authorities differ on this question, and as there is no fixed law we must be guided by a little common sense.

It has already been pointed out in the previous chapters that if we view a solid object, a living person, a landscape, or a building with each eye alternately, we shall see different pictures, or dissimilar ones, because we have viewed the objects at points of sight differing by the distance at which our eyes are apart, but when we view an object with *both* eyes it appears single. The nearer the object be to the observer the greater dissimilarity there will be when viewed by each eye alternately, and to see *near* objects distinctly with both eyes requires a greater convergence of the optic axes than to see more distant ones. It follows, then, that, as the nearer objects require a greater convergence, the greater will be the relief, and if our eyes were separated at a greater distance than they are, the convergence would be greater still, and more relief would be manifested. This might be an advantage for distant observations, but as our eyes are separted at an interval of only $2\frac{1}{2}$ inches we are obliged to estimate very distant objects by other means, such as the apparent magnitude of known objects—men, cattle, trees, houses, &c., the vivacity of tints and colours, distinctness of outline, &c. Thus, it will be perceived that the greater the distance separating the lenses, the greater will be the relief in the resulting picture, and it might seem to be correct that if we desire to see the pictures with the relief and perspective due to nature, the lenses should be mounted

at the distance that our eyes are apart—viz., $2\frac{1}{2}$ inches. But by studying the criteria above and the distance giving power of the eye, in which the photographic image is inferior, we may safely conclude that for most landscape subjects such as an amateur would care to photograph, we can increase something upon $2\frac{1}{2}$ inches without any apparent exaggeration of relief, and 3 inches separation has been found in practice to be the best, though for portraits or very near objects $2\frac{1}{2}$ or $2\frac{5}{8}$ is ample, for as has now been shown, the wider apart the lenses are mounted, the greater the relief will be, and this effect has in the old days of the stereoscope been carried to extremes, producing exaggerated relief, quite unnatural and vulgar. For distant views, mountain, lake, or extensive river scenery the use of long focus lenses produce more general relief, and 7-inch focus lenses are not too long for hundreds of views in our English and Scotch mountain districts.

The lenses should be of equal foci, though a slight difference does not seriously affect the result, providing both images are sharp and well defined. For instance, a friend of the writer bought a "so-and-so" lens, and some time afterwards he met with an opportunity to purchase cheaply another similar lens by the same maker. They were not made for or intended as a pair, but upon trying them for stereoscopic work, he discovered one to be six inches focus and the other $6\frac{1}{8}$-inch focus; an eighth of an inch was cut from the rim on the flange of the shorter focus lens, so that they were each made to project a sharp image, and the writer has seen many beautiful pictures made by these same lenses, the little difference in size of image not being a very serious objection. The diaphragms in each lens, too, should be alike, else one side of the negative will be more exposed than the other, and will look bad when viewed in the hand; but in the stereo-

scope a slightly over-exposed and a slightly under-exposed picture would combine fairly well. Iris diaphragms are not definite enough for stereoscopic work, and should never be used.

It may be mentioned here that some commercial plates are apt to give a thinner image on one end, no doubt caused by the uneven coating. This defect in a negative for a single view is not often observed until it is printed and mounted, and sometimes not even then. But if a stereoscopic negative be taken on such a plate it might pass observation until printed and mounted, but at this stage it would be easily discovered, for by cutting and transposing the prints (to be afterwards explained) the lighter and darker portions would be brought together, or perhaps a light and a dark print might be the result from such a negative; and although this is a defect, as already stated, if not too serious it will be ameliorated by the stereoscope.

However, these irregularities just mentioned are not to be cultivated

PAPER SLIDES—TRANSPOSING AND MOUNTING.

In the preparation of stereograms, whether as paper slides or transparencies on glass, a system must be adopted, and some special apparatus is absolutely necessary.

One of the causes for the decline in stereoscopic work many years ago is attributable to imperfect mounting of the prints, and it is really surprising to find how ignorant the "old stagers" who made stereoscopic pictures twenty and thirty years ago are on this subject. They tell us now of the various dodges which they invented to facilitate the work, and one cannot help thinking how much better it might have been if they had given some study to the theory of the stereoscope before posing as inventors. Amateurs of to-day are quite as liable to fall into the same groove, for we know of hundreds who do not bother about making pictures; the novelty to them in photography is inventing a shutter or possessing a camera with some idea of their own carried out, or looking into what is the latest patent, the longest range of focus camera, plate lifters, actinometers, patent washing troughs, &c., &c. We know that buying fiddles is one man's craze, and have in our own mind an amateur photographer whose fancy is to buy every dark room lamp which he sees advertised. Of course, dealers in photographic apparatus are not to blame, unless they lead their customers astray, and in matters stereoscopic it is quite easy to do that, for the writer has seen dozens of cameras converted into stereoscopic instruments with the lenses mounted at 2 inches and 2¼ inches apart, and whole plate cameras have been supplied with the lenses mounted at 2¼ inches centre. This is wrong in every way; the lenses are too near together, and the plate far too large. A stereoscopic twin camera makes two pictures *independently*,

just as though two separate cameras were used (only the two pictures are on one glass). Thus it will be seen each picture is *inverted independent of the other*. When we hold a stereoscopic negative in the position which the plate occupied when exposed in the camera, viz., upside down, with the film furthest away from the observer, the picture on the right hand side was taken by the right hand lens. If we make a print from this negative and view it right side up, we shall find the picture taken by the right hand lens to be on our left, because to view the prints we have inverted the whole—the two pictures together—and not each picture *independently*. This is just what we do not require for stereoscopic observation. As has already been explained, the picture taken by the right hand lens must be seen by the right eye; therefore it must be mounted on the right hand end of the card mount, and to do this the double print must be cut through the centre, the pictures divided and transposed.

It has been said that the best distance at which to mount the lenses on the camera is 3 inches, but it will be found upon careful examination of a negative taken with lenses so mounted, that corresponding objects in the extreme distance *only* measure 3 inches from centre to centre, corresponding objects in the foreground of the negative will measure more than 3 inches, but when the prints have been cut and transposed these differences in measurement will be reversed, and in a correctly mounted stereoscopic slide the objects in the foreground are at nearer centres than the distant object; thus, "the nearer the object the greater will be the convergence of the optic axes." This, of course, applies to stereoscopic observation also.

The trimming and mounting of the prints next claim our attention. The correct distance at which the prints should

be mounted is $2\frac{1}{2}$ inches. Therefore, each picture cannot be more than $2\frac{1}{2}$ inches wide, and this is correct when the centres of the lenses in the stereoscope are used. If, however, the pictures are cut to larger dimension, say $2\frac{5}{8}$ or $2\frac{3}{4}$, they may be mounted at one-eighth of an inch separation—that is to say $2\frac{3}{4}$ or $2\frac{7}{8}$ centres, and we may extend to three inch centres, but in such cases the insides of the lenses of the stereoscope must be used, and the difficulties in natural observation are soon manifested.

The width of the picture is understood, but the centres of the pictures must be explained. The measurement from centre to centre refers to the distance between an object in one picture to the corresponding object in the other picture, and this measurement is not alike in foreground and distance of the same picture. The illustration, Fig. 4, will make this matter clear.

The black margin represents the card mount of a stereoscopic slide, and the light portions represent the pictures or photographs. If a slightly refracting stereoscope be applied to this illustration, the middle line, "moon," will appear far away, whilst the other lines will in turn approach the observer. The circular margin will appear still nearer. The reason is that the margin is at nearer centres than any of the lines, and requires a greater convergence. Moon, being at the greater distance apart, requires less convergence, and it has been explained that "it is by greater or less convergence that we appreciate distance."

In Fig. 5 we have another similar illustration; it is intended to represent a staircase, with handrail. When a stereoscope is applied to this, the relief is almost astonishing, and if the distance separating the two drawings be measured it will be found that the bottom steps are about $\frac{1}{8}$ inch nearer together

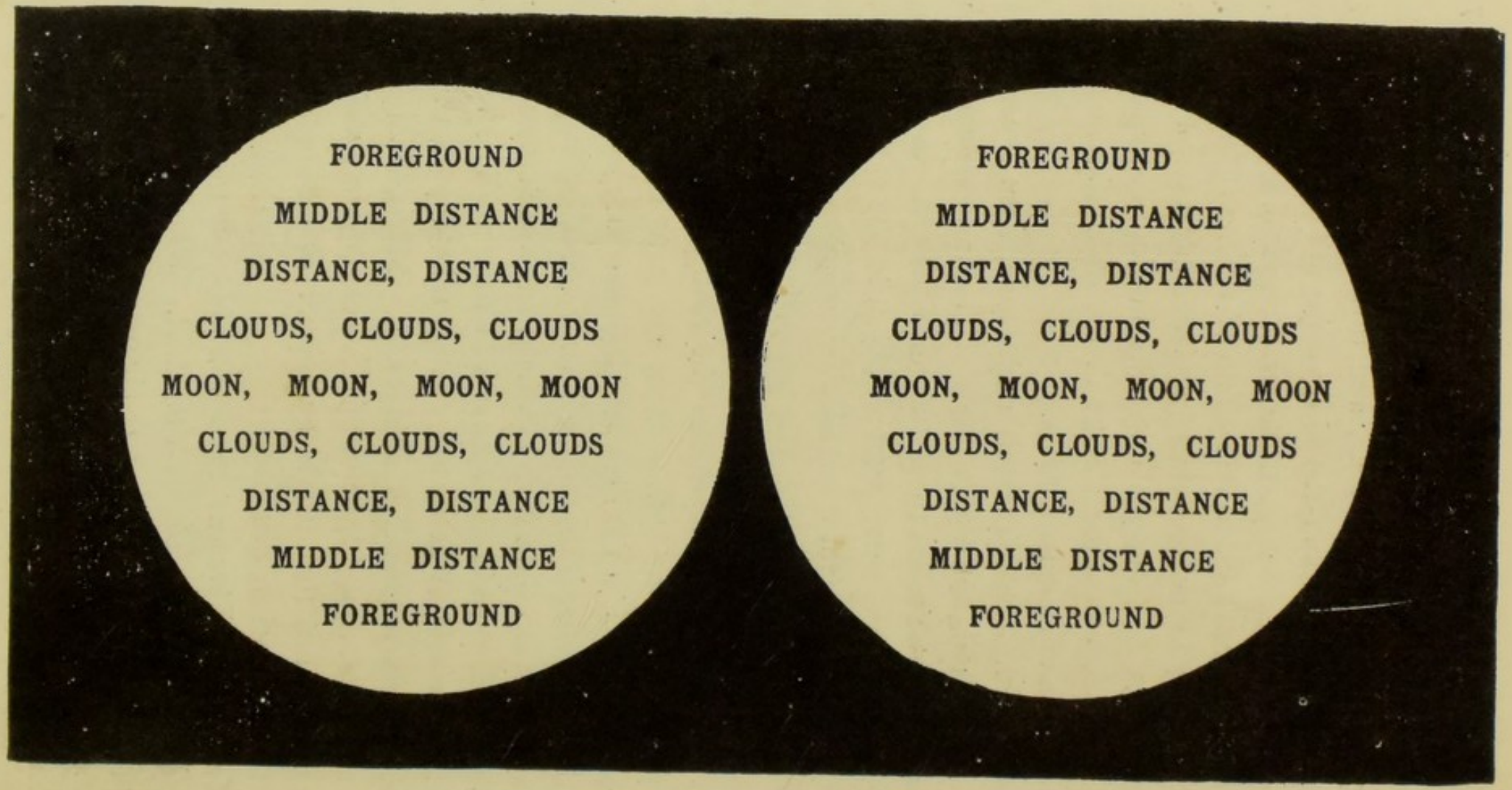


Fig. 4.

This illustration, mounted on card for the stereoscope, will be forwarded by post on receipt of two penny stamps.

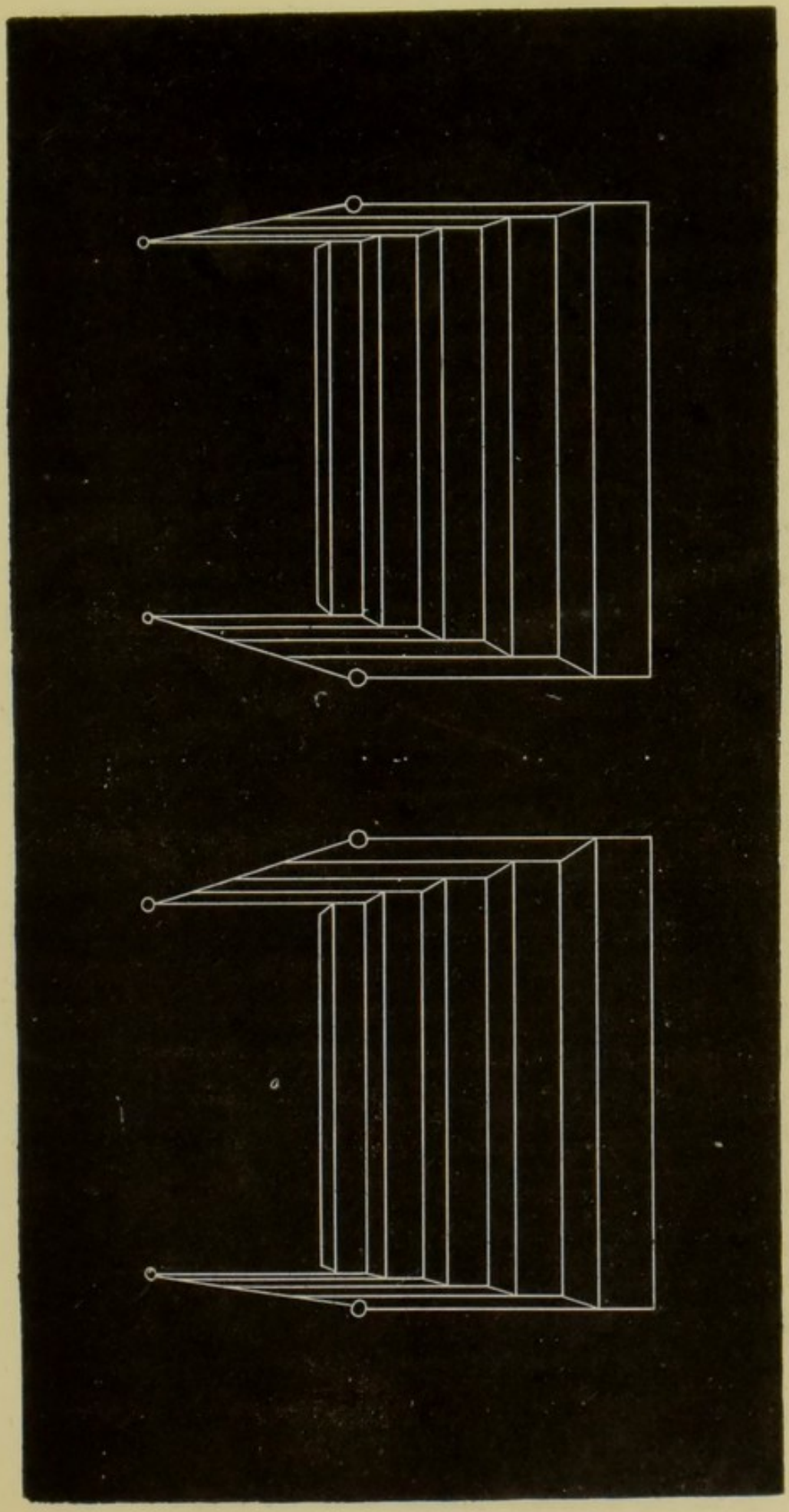


Fig. 5.

than the top steps, and more convergence will be required to see the bottom steps than when looking at the top steps.

It is impossible for any observer to see *distinctly* any two pairs of steps at the same time; when looking at the top step, and before the next below can be seen distinctly, something must be done; that "something" is an alteration in the convergence of the optic axis.

It was customary in the old days of the stereoscope to mount stereoscopic slides on green or buff coloured cards, with no space between the prints, but by mounting them on a black or chocolate card, leaving a space between (in the centre), and allowing a little more subject on the right hand side of the left hand picture than is seen on the right of the right hand picture, we obtain relief between the view and the mount, which greatly enhances the beauty of the whole. This latter may seem complicated at first thought, and as the tyro is very liable to forget and confuse his "rights" and "lefts," and thus get wrong, we will try to impress the subject upon our minds by performing little experiments.

Place a teacup on the table, say a yard in front of you, and look at the outside of it with each eye alternately. You will be able to see more of its outside surface on the right hand side with the right eye, and more of the left hand surface with the left eye; but when we look *inside* the cup we shall see more of the *left* hand side with the *right* eye, and therefore more of the right side with the left eye; and as we desire to mount our pictures showing relief from the mounts, or as though the picture was beyond the mount (as though we were looking through the aperture), we require to produce the effect of a hollow, as the inside of the teacup, and thus, when mounted, we require to see more subject on the left-hand side of the right-hand picture than is to be

seen on the left-hand side of the left-hand picture, and by remembering the cup experiment we shall not easily forget the way to cut the prints. But it all comes in the end to this: the prints require cutting so that when mounted the subject in the immediate foreground of each picture is wider apart than the centre of the prints bodily.

Much might be said in describing the different methods that have been adopted by various professional and amateur photographers for facilitating the printing and mounting of stereoscopic pictures. Almost every worker had his own particular "dodge." Some took to cutting and transposing the negatives before printing, others to "masking" the negatives, others again printed from folded strips of paper, &c., &c. But as we are writing for amateur photographers, and not for large producers, we shall confine our remarks to the most suitable method for amateurs—that of cutting and transposing the prints. A fact which cannot be too strongly impressed upon the tyro is that in the practice of stereoscopic work *system must be adopted*, and this system is reduced to the utmost simplicity by a few inexpensive appliances. The following standards have been mentioned previously, and are here repeated: Size of plates for negatives, $6\frac{1}{2} \times 4\frac{1}{4}$ inches, lenses mounted on camera at 3-inch centres, paper prints cut to $2\frac{1}{2}$ inches wide, with $\frac{1}{8}$ inch difference in the subject as explained, and these, when mounted with $\frac{1}{8}$ inch of mount showing between the two pictures, will measure $2\frac{3}{4}$ inches from centre to centre of subject (always meaning the foreground objects). Chocolate-coloured mounts with burnished edges should be used. Cabinet size cards are used when the full depth of the print is maintained, but when they are cut to $2\frac{3}{4}$ inches deep, cards $6\frac{3}{4} \times 3\frac{1}{4}$ are adopted.

As previously explained, the distance of the foreground in front of the camera (when the view was taken) alters the

distance of centres on the negative the nearer the foreground, and the more than 3 inches centres it will measure, and of course it will be the same in the print before cutting; thus, if we arrange to trim the picture by a stone in the foreground, that stone (which will be represented in each picture) will measure more than 3 inches centres; we have therefore constructed three cutting shapes in sheet metal as at Fig. 6. The apertures in each are alike, but their centres are different, viz., 3 inches, $3\frac{1}{8}$, and $3\frac{1}{4}$, and are marked Nos. 1, 2, and 3. After the prints are washed and dried, and before cutting, lay them face down, with the sky or upper part of the pictures furthest away. Now mark on the back with a

Fig. 6.

lead pencil the letter R on the right hand side as the print lies face down; this is simply a distinguishing mark to prevent the right and left pictures getting "mixed" after cutting. Next, turn the prints face side up, take one by one, and lay on a sheet of glass or zinc, and apply one of the cutting shapes, Fig. 6, adjust it so that in each aperture the base line is cut through exactly the same object in the foreground of each picture. There should now be a little more subject, say $\frac{1}{8}$ of an inch at the *right* hand side of the *right* hand picture than is disclosed on the right side of the left picture. If this is so, the two prints may be cut, each with one sweep of a Robinson circular cutter, as illustrated in Fig. 7.

If, for instance, the subject be one with a near foreground, and we apply No. 1 cutting shape, we should not find the pictures in accordance with the principles already stated; then try No. 2 or No. 3, but after a little experience, the proper cutting shape will be applied in the first instance.

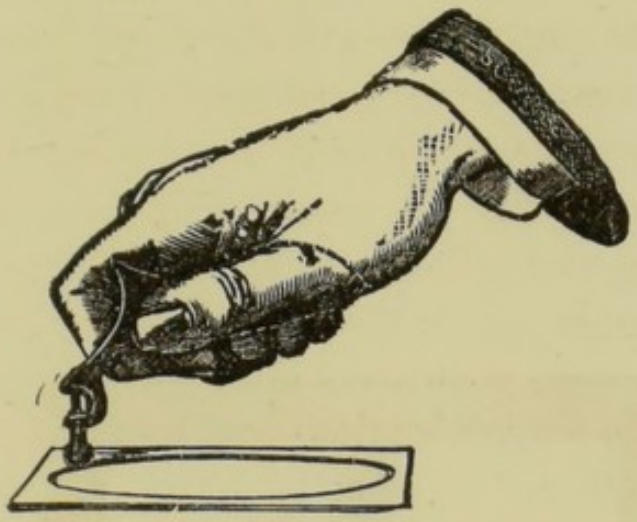


Fig. 7.

It must be again observed in these instructions, that in all measurements it is the foreground which must be taken into account, and the distance "will take care of itself."

The prints are now ready for mounting. That with the pencil mark "R" on the back is to be mounted on the right-hand end of the card; the other on the left, and they will be found to be transposed.

NOTE.—This print cutter, Fig. 7, must not be confounded with other print cutters sold by dealers. The wheel in Robinson's cutter is very small, and rotates in the handle or holder.

When attaching the first picture to the mount, to ensure its right position, use a guide made from a spoiled mount. It must be the same width, but one-sixteenth of an inch longer than half the length of the card; thus, supposing the mounts be six inches and a half long, the guide must

measure three inches and five-sixteenths long. This is placed lengthwise upon the end of the mount and held in position by two American clips, one on each side. It is to be *flush* with one end, and will project to one-sixteenth of an inch past the centre of the mount. The first print is placed with its inside edge practically touching the guide, which latter is now removed for the second print. It is now quite easy to adjust the second print to one-eighth of an inch separation.

Stereoscopic pictures must be deeply printed and full of detail; prints which look *flat* and wanting in vigour (when viewed in the hand) often make the best stereoscopic slides. If the prints are too lightly printed, or there be too much contrast, they present a "hard" and "snowy" appearance in the stereoscope; therefore, stereoscopic negatives should be well exposed, "soft," and full of detail. Pretty looking, brilliant negatives, do not always yield the best prints. Before concluding this chapter, we will again impress upon the reader the importance of cutting the prints through the same base line; therefore, when working small size plates, like the old-fashioned size, $6\frac{3}{4} \times 3\frac{1}{4}$, it is absolutely necessary to observe that the camera be *level* when the plate is exposed, and those who understand the importance of this will at once perceive the necessity for a tripod stand, and the fallacy of stereoscopic work being attempted by holding the camera in the hand; "detective" cameras may do fairly well for *single pictures*, where a little out of square is of small consequence.

TRANSPARENCIES ON GLASS.

A stereoscopic slide printed on paper may be very nice, but it cannot compare with a good transparency on glass. It has been said many times, and it is a fact, "There is nothing produced by photography more beautiful than a really good stereoscopic transparency."—"The more perfect transcript of nature than photography is capable of rendering."

To print transparencies for the stereoscopic we have first to consider by what kind of light they are to be produced, daylight or artificial light? Then we must decide by which method they shall be printed, contact or camera printing.

If we decided in favour of daylight, then there is no question about camera printing being the best. But if artificial light is to be used, that is to say, if we are to make transparencies in the evening, contact printing must be adopted. There is no practical means of equally illuminating a stereoscopic negative by artificial light to be suitable for camera printing, unless by large condenser and limelight, and in most cases such apparatus would be out of the question.

TRANSPARENCIES.—CONTACT PRINTING.

Contact printing for the stereoscope may be proceeded with in various ways. For instance, the negatives may be cut and transposed, or printed from in an ordinary printing frame, and the *transparency* cut and transposed, and bound up between two cover glasses. But these methods are not so suitable to amateurs as that of printing by a special frame made for the purpose. Of course, contact printing implies dry plates; and two or three years ago the writer argued very strongly in favour of other processes than the gelatine dry plates of commerce, but since

then great improvements have been made in dry plates, and at the present time the "Transparency plates" of Mawson and Swan, and Messrs. Thomas and Co., leave nothing to be desired.

The special printing frame is illustrated at Figs. 8, 9, 10, and 11. The principle of the frame is to print each picture separately, and in doing so to transpose them thus: By printing the left hand side of the negative on the right hand side of the transparency plate; then to transpose the negative and prepared plate, and print the right end of the negative on the left end of the transparency plate.

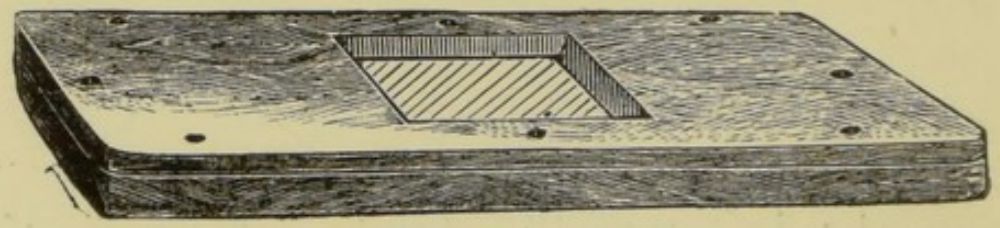


Fig. 8.

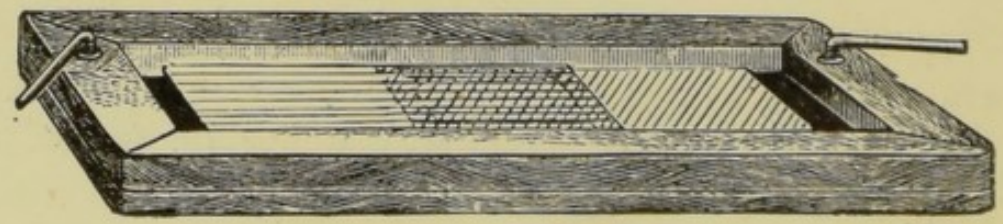


Fig. 9.

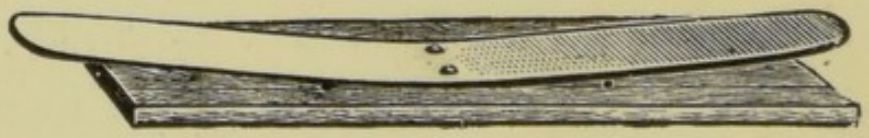


Fig. 10.

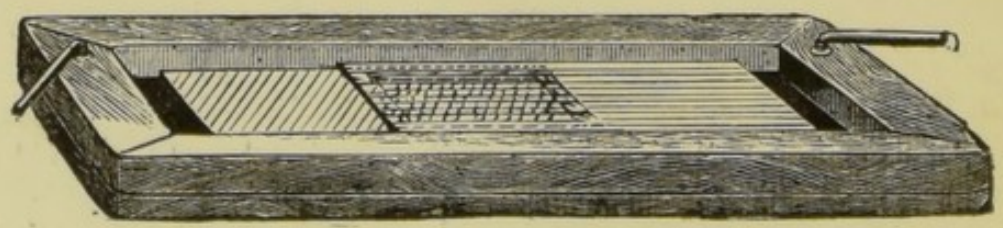


Fig. 11.

The figures 8, 9, 10, and 11 represent a frame for printing transparencies the full size of the negatives.

The front of the frame (Fig. 8) is of solid wood, with an aperture in the centre, through which the printing is done. The frame should be 10½ inches long *inside*, the aperture two inches and seven-eighths wide, and exactly in the middle.

In Fig. 9 the negative shown by diagonal lines has been placed in the frame, film side up, and adjusted with its left side over the aperture. The sensitive transparency plate is shown by horizontal lines, adjusted with its right end over the negative and the aperture in the frame. The back, Fig. 10, is now placed in position, held by the spring and two holders, shown in Figs. 9 and 11. After exposure, the relative position of negative and plate must be changed, as shown at Fig. 11, where the right end of the negative and the left end of the transparency plate are now over the aperture, and ready for the second printing.

The adjustment of the negative over the aperture will now be explained.

It has been previously said that the beauty of a stereoscopic slide is greatly enhanced by producing the effect in mounting of seeing the picture through an aperture, or behind the mount, and this being the most effective style, we confine our remarks to it, which is simply to print the pictures at two inches and seven-eighths centres, and to insert a paper mask similar to those used for lantern slides (only a double one) between the transparency and the cover glass, the centre of the mask being about one-eighth of an inch less than the centres of the pictures.

When adjusting the negative for the first printing, as in Fig. 9, observe some particular object, say the edge of a stone, or something of the kind in the foreground, *that is cut*

by the left edge of the aperture, and by a piece of cardboard to serve for a guide, the plate is applied in such a position that the centre of it is cut by the left edge of the aperture; the back of the frame is now applied and printing performed. We now remove the sensitive plate, refresh our memory with the "stone in the foreground," and slide the negative to the position, as in Fig. 11, adjusting the particular "stone in the foreground" as for the previous printing, apply the plate by use of the guide, which is now turned to the other end, and if made correctly, it will produce the two pictures side by side with a clean cut line between them, without any space or

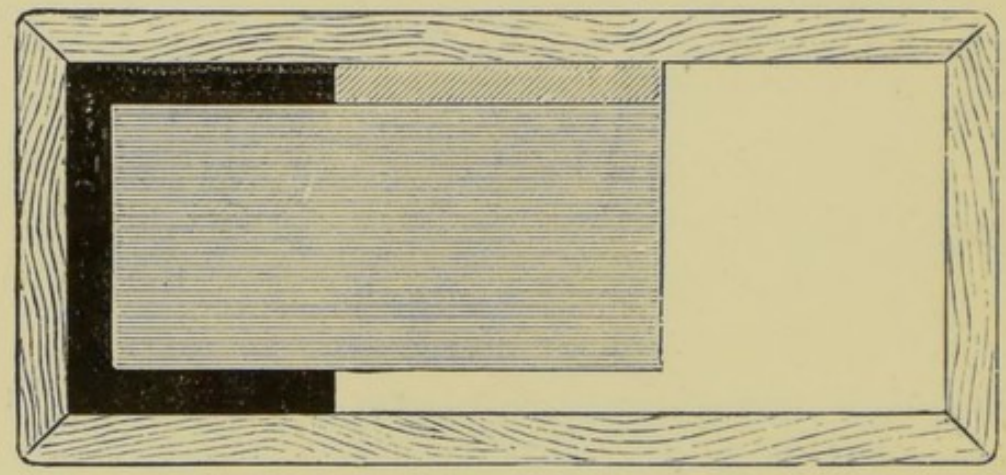


Fig. 12.

overlapping. (If, however, there is a space left between the two pictures, the guide is not the right length for the plate, or the aperture is not in the centre ot the frame.)

So far we have considered the printing of a transparency from a negative of the *same size.* We will now consider making the standard size transparencies ($6\frac{1}{2} \times 3\frac{1}{4}$) from larger negatives. Of course in this case the printing frames must be made correspondingly larger, and provided with suitable guides, enabling various portions of the negative (*via* more or less foreground) to be printed from.

The illustrations 12 and 13 show such a frame for $6\frac{1}{2} \times 4\frac{1}{4}$ negatives.

In Fig. 12, the negative, represented by diagonal lines, has been placed in the frame first, with the left hand side over the aperture for printing; on the top of the negative the guide is placed, indicated by the white portion, and this is pushed close against the right hand end of the frame. The transparency plate, indicated by the horizontal lines, is next placed in position, with its right end over the left end of the negative, and is pushed *close* against the guide as shown; the back of the frame is now applied and printing proceeded with.

After the first printing, the plate and guide must be

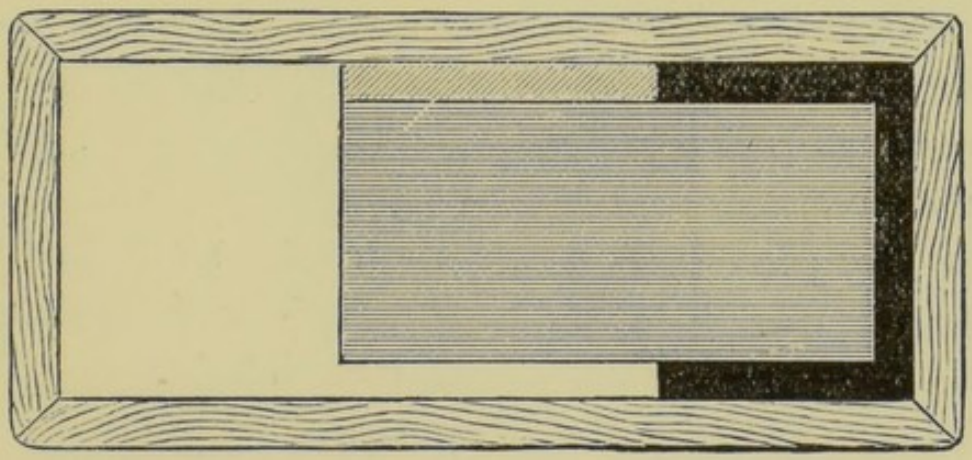


Fig. 13.

removed, the negative again adjusted, as already described; the guide is turned over and placed at the other end with the plate, as shown in Fig. 13. It is now ready for the second printing.

It will be seen that the guides not only fix definitely the position of the plate endways, but the tongue at the bottom, on which the sensitive plate rests, brings the plate to the centre of the negative, and preserves a true base line.

With a series of these guides, having tongues of various widths, almost any portion of the negative can be printed from; thus more or less foreground, sky, &c., can be included.

When the transparency is finished, a paper mask, with openings at $2\frac{3}{4}$ centres, is inserted between it and a cover glass, and when bound up with gummed edging paper is so far complete, but it will be seen that to view the picture in its natural position, the film side must be nearest the observer; the cover glass in front is to protect the film from injury; a ground glass placed behind the transparency is a great improvement, but it should be very thin, or the whole will present a heavy and clumsy appearance. Messrs. Thomas, and other dry plate makers, have recently introduced Transparency plates coated on the matt side of very fine ground glass, thus, when printed by contact, they simply require a *plain* cover glass in *front*, and if these are not quite so good as a *plain* glass Transparency, backed with the finest ground glass, they are certainly not far behind, and one very great advantage is that they are a *finished article* with only two glasses, though a fine ground glass in the stereoscope behind the picture is a very great improvement.

Some amateurs bind up their stereo transparencies with a plain cover glass only, utilising them also for lantern purposes; but this is not a good plan, for a perfect stereoscopic slide is much too dense and "flat" for the lantern, and such as would make good lantern slides are too "snowy" and "chalky" for the stereoscope.

TRANSPARENCIES—CAMERA PRINTING.

Many years ago the question was discussed in the pages of the *British Journal of Photography*—"Camera Printing or Contact Printing? for the Stereoscopic Transparencies."

There can be no two practical opinions on the subject when daylight is available, no matter by what process, wet or dry, Collodion or Gelatine, Camera Printing has decided

advantages (we do not here include the French method, which s the albumen dry process, because that is unique throughout, and has never been worked successfully except by the two firms who still use it).

But camera printing suggests a "copying camera," and such instruments are usually costly, and this idea might prejudice many. However, it need not, for by the addition of a wooden base board, with a box at one end and a special lens front, the ordinary camera used to take the negatives in the first place is converted into a most perfect copying camera at a very slight additional expense.

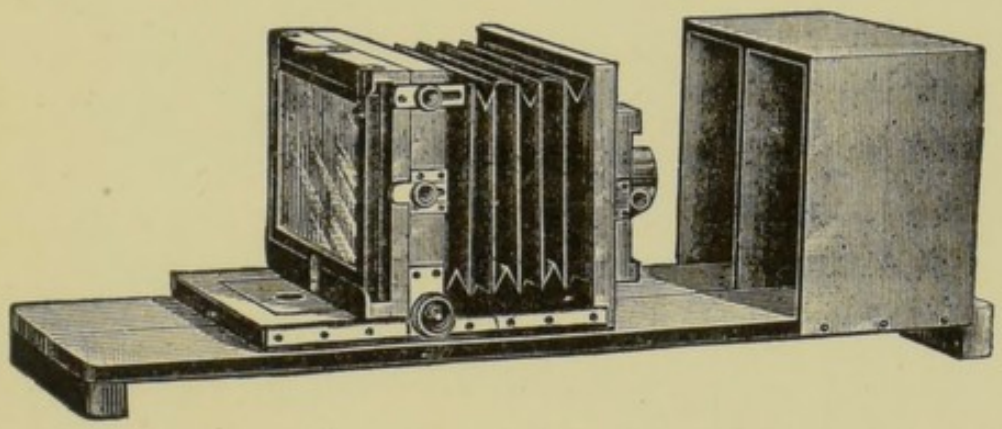


Fig 14.

The arrangement is illustrated at Fig. 14.

The ordinary twin camera is screwed by the tripod screw to the base board of the copying attachment, which is provided at one end with a box, at the end of which is an adjustable frame for carrying the negative to be copied. An additional front board is applied to the camera, provided with a simple arrangement for opening and closing the centres of the lenses, to reduce the centres of the transparencies (the centres of the negative being greater). The lenses may be those used to take the original negative, but

a pair of 3-inch doublets are better. The adjustment is by two independent screws with milled heads (one at each side or end of the lens-board), which actuate two lateral slides, on which the lens flanges are fixed. With this apparatus, the transparencies can be made the same size as the original negative, or they may be enlarged or reduced, or a portion of the negative only may be printed, depending upon the composition of the picture.

The apparatus may be used on a table, with a mirror, or a sheet of opal glass, or even a sheet of white paper, used as a reflector; or it may be used against the sky, without a reflector.

The negative should be placed in the apparatus with its film-side *out;* thus it is copied through its own glass support (not "film to film" as in contact printing); therefore the finished transparencies must be examined through *its* glass, with the film side furthest away from the observer. This simplifies matters, for a single ground glass placed at the back of the picture with a paper mask between is all that is required to protect the film from injury, and the whole has a better appearance, for we have now only two glasses instead of three (if a ground glass is used) as in contact printing.

The camera should be provided with two little brass strips and a turn button on the inside of the focussing frame of the camera. These are to hold a plain glass plate, to which is attached a black paper mask, such as is intended to be used when binding up the finished slide; thus only those portions of the picture intended to be seen in the finished slide are shown on the ground glass, and the adjustments can be made and the whole thing examined and proved to be right before the exposure is made. We may apply a stereo-

scope to the focussing screen, and, except that we view a negative instead of a positive, all the relief and beauty of the finished result will be revealed. We can adjust the picture "behind the mount" to the greatest exactness. Moon, clouds, and various combination effects may be produced, and, as already stated, all proved to be right before the actual exposure is made.

In concluding this article it should be explained for the benefit of those who have not followed the principles of the Twin Copying Camera, that, although only one exposure is made, by the twin lenses the picitures are properly transposed at the same operation, for each lens, when copying, projects the pictures *independently*, and so reverses them *independently;* thus, if the negative be held upside down, with the film away from the observer, this is the position the plate occupied in the camera when the negative was made, and the pictures to the right, as the negative now stands, was made by the right hand lens, and if we copy this negative from the same position, the right hand lens copies this right end of the negative, *but it inverts it*, and the left hand lens inverts the left side also, and thus transposes in a single operation.

TRANSPARENCIES—COMBINATION PRINTING.

Stereoscopic photography is very fascinating, but combination printing for the stereoscope would be much more so if it were properly understood. It is well known that microphotography and photo-micrography are extremely interesting branches of our art, but they will not suit everybody, neither will combination printing for the stereoscope. Some amateurs desire only to produce large single pictures, and after

a time grow tired of that—then, perhaps, take to making bromide enlargements, &c., &c.

It is quite true, and may safely be stated, that there are thousands of amateur photographers to-day, who have never had the opportunity of seeing a combination Stereoscopic Transparency. This fact is not surprising, for they have been principally confined to the productions of one man, the late Mr. Charles Breese, who undoubtedly stood alone in this particular branch of photography. The method of their production was kept a *secret*, and the theory and principles by which such wonderful results were attained had been studied by very few, but some idea of the appreciation these stereoscopic pictures secured may be imagined from the fact that a guinea each slide was readily paid, and it is said that a Paris firm offered Mr. Breese a large sum for the negative, by which one slide had been made, with instructions to reproduce it.

About the time of the decline in popularity of the stereoscope Mr. Breese died, and we are indebted to two gentlemen, Mr. A. S. Ashley Oakes and Mr. John Harmer (who were both, though at different periods, intimately associated with Mr. Breese), for the publication of the *modus operandi* of the late Mr. Breese. The communications of these gentlemen were published in the *British Journal of Photography* during the year 1878.

A combination picture may be described as *one* picture printed from *two* or *more* negatives, the simplest form of which is, perhaps, a Single Landscape printed from one negative with the clouds "*printed in*" from another negative (a cloud negative); this of course is a very common practice.

But in the case of a stereoscopic combination picture, the subject requires a little more consideraton, or we might find

upon examination in the stereoscope that the clouds occupied a position *in advance* of the foreground, or else too far in the distance (see illustration, Fig. 4). A moonlight scene is another illustration of a combination picture, and was a favourite subject with Mr. Breese.

The landscape or seascape (taken in daylight, of course) is printed from one stereoscopic negative, in the usual way. The clouds are next printed upon a second glass from another negative (a cloud negative), but as such centres as correspond for distance when viewed in combination with the landscape previously printed ; the moon is next printed upon a third glass from a moon negative, the centres of which are so adjusted by the copying camera as to suit the clouds and landscape ; then all three glasses are bound up together, forming one picture.

Mr. John Harmer has so clearly described the details, we cannot do better than give his own words. Mr. Harmer says : "Suppose it be required to make a moonlight effect ; two stereoscopic negatives will be necessary—one a negative (say) of cloud effects taken with the sun on it ; the other a negative of the moon, its position on the plate corresponding as nearly as possible with that of the sun in the other. Attention to this will save trouble. If the sun's light were very strong, he would have a tolerably clear patch in the positive transparency ; if he were partially obscured, or his light weak, as in early morning or late in the evening, his limit would be well defined. Either case would not involve much trouble—the latter rather more, perhaps, because if the moon were taken with the same lens as the cloud effect, it would require to be slightly enlarged to exactly fit the place occupied by the sun's image. But as there is nothing on the moon's

negative but its image, the operation is not a very difficult one with the aid of a magnifier.*

"When the negatives have been procured, the next thing will be to put that of the clouds into the front carrier of the copying camera, *face outwards*, arrange its position on the focussing screen (about 2·6 or 2·7 inches between the two similar objects, one on each foreground), focus, make a transparency, dry, and varnish. Now take out the cloud negative and put that of the moon into its place, but *face outwards.* The camera slide (dark slide) with its shutter opened, holding the transparency (of the clouds) *back inwards*, is to be put into its place in the camera till the operation of getting the moon right for size and position has been performed, which—with the means of enlarging or reducing that the camera should afford, and the rising, lateral, and dividing motion of its lens-carrying front—should not be very difficult of accomplishment. When this has been so far completed that it appears near the mark to the unassisted eye, view with the stereoscope for the purpose of ascertaining whether the moon is right for distance.

"If the moon appears too near, separate the lenses slightly. The stereoscope will show, while this is being done, the extraordinary phenomenon of a moon travelling through space at a terrific rate. If too far, move the lenses nearer together. A few trials will soon give the moon its proper distance. Focus on the ground-glass, try the moon again for distance, &c. Make a transparenecy, which must be of medium strength, dry, and coat with ground-glass substitute—a little wax dissolved in amber varnish being about the best I know, and was the only one used by Mr. Breese. Some narrow strips of thin cardboard must now be gummed round

* That is to say, enlargement by the copying camera.

the surface near the edges of the moon transparency; it is then ready to have that of the cloud effect superseded upon it. If the work has been accurately performed, the two may be fixed at once.

"What has been said about the production of a moonlight effect equally applies to the combination of clouds and landscapes, the introduction of figures, &c."

Having spoken of moon negatives, we would say a word or two more on the subject.

Some time ago, when travelling on the banks of the Mississipi, the writer called upon a justly celebrated photographer, who exhibited some of the finest landscape photographs to be seen in America. "Here is one," said he, "an ice subject, which lends itself beautifully for a moonlight effect, so I have printed it with a moon." Yes, we replied, it is very nice, but the moon is much too large for the picture. "Well, I don't know about that; I guess it's purely a matter of taste. Can you tell me what size the moon should be for this picture?" Yes, you say the picture was taken by a 16-inch focus lens; well, to-night turn your 16-inch lens to the moon and measure the image projected on the focussing glass; you may enlarge a little on the size, but the lens with which you took the picture will give the size for the moon. "Well, my dear sir, I confess never to have thought of that, and guess you're about right." The next day we met again. His first words were, "Say, Chadwick, my moon was more than twice too big."

From this the reader will gather that when a moon negative is required for a composition picture it should be made by lenses of the same focal length as those used to take the landscape picture.

There is no difficulty in making stereo moon negatives on

a clear night; with gelatino-bromide plates the time of exposure is practically instantaneous.

A very simple method of introducing the moon in a *lantern* picture is by means of a fine steel pen sufficiently loaded with ink (not too full); drop a spot of ink on the varnished side of the negative—in the right place, of course—and allow it to dry. The spot, if not disturbed, will dry opaque and a perfect circle. But of course this "dodge" will not answer for stereoscopic slides.

THE STEREOSCOPIC CLUB.

MEETING, Monday, June 14, at Brooklands, Manchester. Mr. W. J. Cunliffe (President) in the chair.

Mr. W. I. CHADWICK, referring to a "Monocular" stereoscopic camera exhibited at the previous meeting, said it was quite possible to make stereoscopic pictures by any single-view camera, and that before Dancer, of Manchester, introduced the twin-lens camera all stereoscopic pictures were made by single-lens instruments; thus, first a plate was exposed on a certain subject, next the camera and lens were moved as much as was considered necessary—generally by means of a sliding baseboard—and a second plate exposed; thus, two slightly dissimilar negatives were produced, from which the prints were made. Such an arrangement, however, was entirely useless for moving objects, and it would be seen that for such subjects as sea and sky, landscapes with figures or cattle introduced, and even for foliage subjects—except under the most favourable conditions—the single-lens camera was quite out of the question.

In support of what had been said, Mr. Chadwick exhibited a stereoscopic slide, the portrait of a gentleman made by a single lens camera at two exposures. It was seen that under each exposure the sitter had been still enough and was clearly distinct in both pictures; but between the first and second exposure a movement in the position of the head had taken place, and when the slide was viewed by the stereoscope the effect was very grotesque—that of the ghost of a head nearly twice the natural size, with four eyes, two noses, and a mouth of extraordinary length.

The lecturer, continuing, said he did not know of any amateur pursuit that could boast of so many inventors, patentees, writers, and

teachers, as were to be found amongst photographers. To some extent it had always been so, and he presumed it would remain so, though modern inventors had not yet begun to assert themselves to any great extent in stereoscopic matters, but were willing to be led by some of the older hands, who were supposed to know more about the subject, and it would be contrary to the objects for which this Club was formed to allow false theories and erroneous practices to pass unchallenged. It has been contended by several writers in recent publications that, as the optic axes naturally converge to some particular spot when viewing natural objects, so the axes of the lenses should converge in like manner; and it has been stated by some of these writers that this alone is the correct theory for making stereoscopic photographs. The illustration, Fig. 1, is reproduced from an

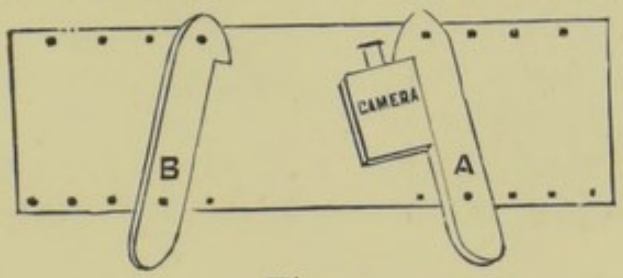


Fig. 1.

article written in support of this convergent theory, and is intended to represent a baseboard, on which are two adjustable bars or guides, A and B. Against one of these the camera and lens are placed, and an exposure made; the camera is then moved to the left-hand guide, and a second exposure made. Thus the axes of the lens converge (the amount of convergence, as the author states, is exaggerated in the drawing).

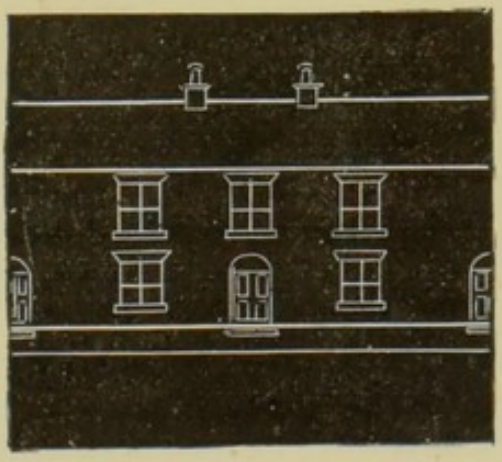


Fig. 2.

But this converging-lens theory is, the lecturer said, entirely wrong. Every photographer knows that to photograph the elevation of a building with parallel lines, as at Fig. 2, the sensitive plate must

occupy a position parallel to the face of the building, with the axes of the lens at right angles, and if the plate and the axes of the lens be oblique, as at A, Fig. 1, we should produce the face of the building in perspective, as at Fig. 3, and if the camera be moved to B, Fig. 1, the plate again oblique to the face of the building, we should again produce the lines in perspective, but in the opposite direction, as at Fig. 4; and, if two such pictures were mounted for stereoscopic observa-

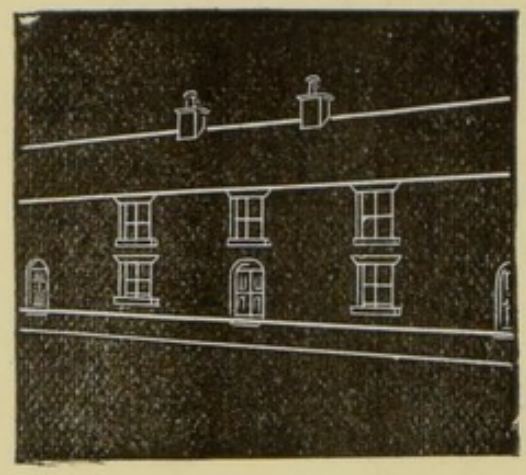


Fig. 3.

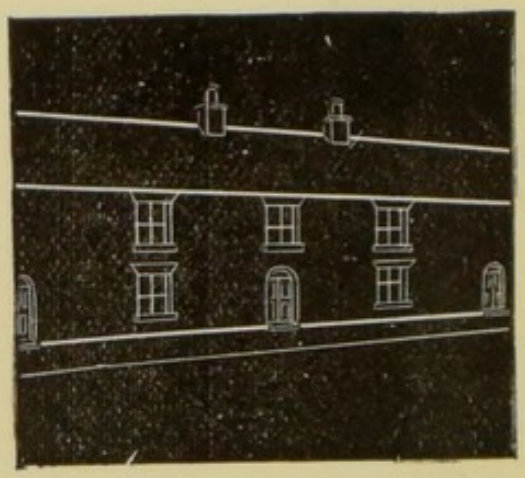


Fig. 4.

tion, they would not coalesce, and, by the stereoscope, only a mass of confusion would be visible, as at Fig. 5, where the lines, as at Figs.

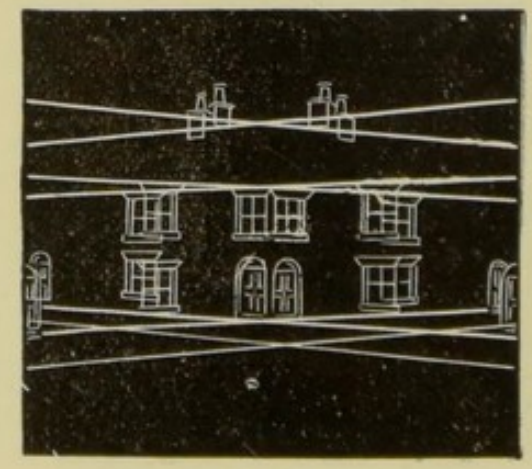


Fig. 5.

3 and 4, are seen to cross each other, instead of which they ought to be parallel, as at Fig. 2.

Other illustrations and blackboard diagrams were used to show that the stereoscopic camera should be provided with twin lenses, having their axes parallel and the plate at right angles to their axes.

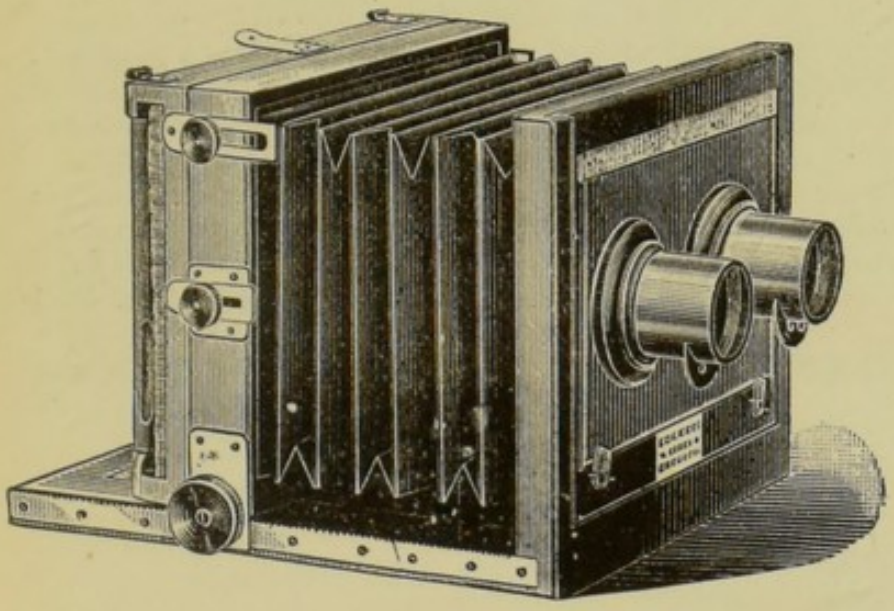
JOHN HEYWOOD, Excelsior Printing Works, Manchester.

W. I. CHADWICK'S PATENT

STEREOSCOPIC CAMERA.

Equally suitable for SINGLE VIEWS,

LANTERN SLIDES, &c.



Two Front Boards supplied, one for Stereoscope and one for Single Views.

SIZE.—When fixing upon the most convenient size, many things were considered, and 6½ by 4¼ *(Double-quarter plate)* decided upon as the best and most generally useful. It is a standard size, so that Dry plates can be obtained from any Maker, and most Dealers. For **Stereoscopic** work it is the best size, and equally so for Lantern work. For **Single Views** it is of the nicest and most artistic proportions, viz., length equal to once-and-a-half the depth.

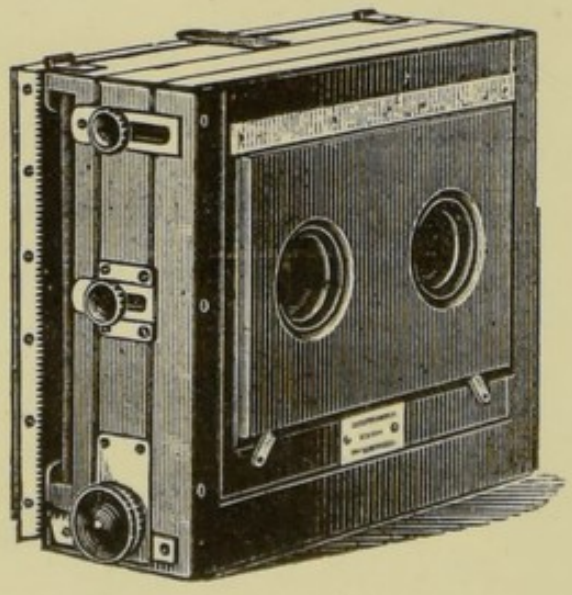
WEIGHT.—The reduction of every ounce in weight has had most serious consideration; at the same time no advantage either in utility, durability, or appearance has been sacrificed, and yet I firmly believe this to be the lightest practical camera (of the best make) ever offered. *It must be understood, I do not compete with Toy or "too cheap" apparatus. The weight of Camera and Twelve Slides (for Twelve 6½ by 4¼ plates) is under 5lbs.*

GENERAL CONSTRUCTION.—The Camera consists of a landscape-shape body, provided with a parallel leather bellows the full width, and the front is also the full width, made rigid with the base board, and at right angles to it. *This is as it should be;* there is no necessity for folding or swinging fronts, and no practical photographer ever saw any use in them. See what such practical men as H. P. Robinson, Captain Abney, and others say.

Dallmeyer says, **on the use of the Swing Back**—"*To attain the same end, other expedients have been devised, such as curved fronts, hinged fronts, &c., in each case substituting a moving or swinging lens for a swing back. But these can only be classed amongst the makeshifts, and should be avoided. A little consideration suffices to show that any movement or inclination of the lens at once displaces its axis with reference to the centre of the plate or picture, and, apart from this, a movement of the lens is more difficult to control. It may fitly be compared to the laying hold of the* SHORT *end of the lever, and no mechanic would resort to such a practice. In fine, the lens, or Camera front, should be a fixture by construction, made truly square with the base and sides of the Camera.*"

The swing back in this Camera is correct in principle; the centre of motion is in the axis of the lens, and as near to the surface of the plate as possible; this is as it should be. Swing backs, hinged from the bottom (sometimes as much as two inches below the bottom of the plate), are wrong in principle; they are complicated in use, and the extra adjustment and re-focussing required often preclude their use altogether. Dallmeyer says: "*The swing back, as its name implies, properly belongs to the back of the Camera, and, if the centres of motion of the swing are coincident with the axis of the lens, or the centre of the plate, as in the old construction of portrait cameras,* SO MUCH THE BETTER."

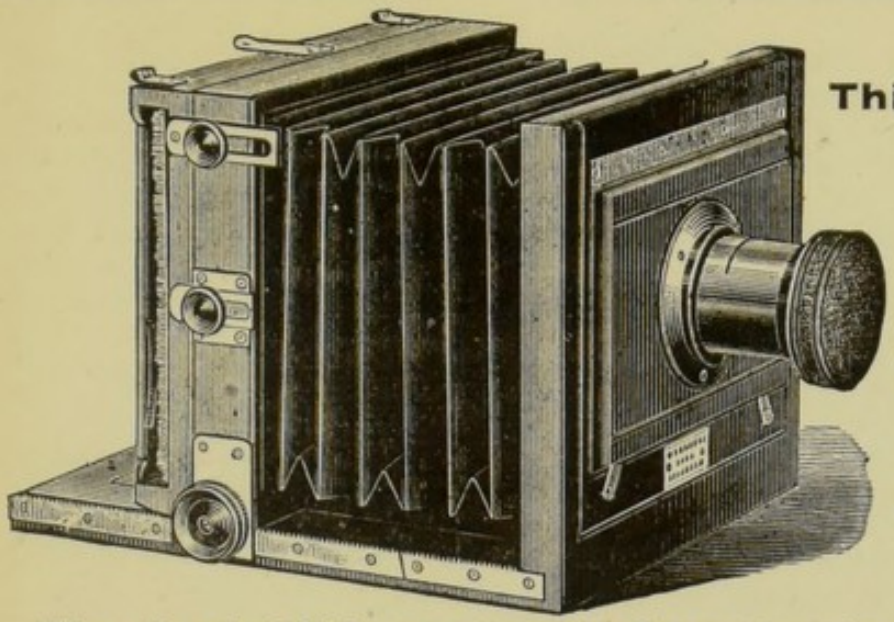
THE STEREOSCOPIC DIVISION is a Spring Roller and Curtain, perfectly automatic and removable in an instant for Single Views AND THE SUBJECT OF A PATENT.



Lens Board turned round, carrying the Lenses inside body of Camera.

The Stereo front board is made reversible, so that when packing up the Camera, it may be turned round and the Lenses carried inside the body of the Camera, thus saving the trouble of unscrewing them every time, besides economising space.

THE DOUBLE RACK AND PINION for focussing is a perfect mechanical arrangement.

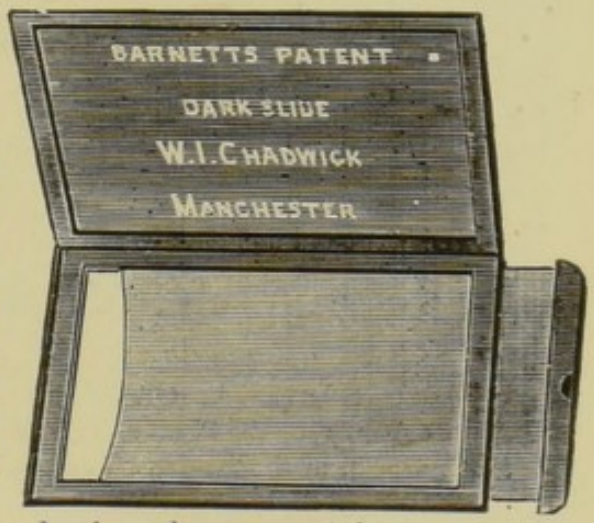


This is the same Camera

With Lens for Single Views; of the most artistic proportion, viz., Length equal to once and half of Depth.

The Dark Slides are Barnett's Patent (American).

As a practical photographer I recommend these to other practical photographers, for they have a decided advantage over English Dark Slides. We must admit that the *best* English Dark Slides are splendid specimens of cabinet work—(*I do not refer to the "too cheap" things sold with* 20/- *or* 40/- *Sets*)—and, from their style and construction, to be efficient they cannot be *too well made*; but their "style and construction," which is the same as adopted 25 or 30 years ago, without any improvements, is unnecessarily elaborate for the purpose for which they were intended (entailing the best workmanship, and, therefore, expensive).



These DARK SLIDES are an improvement, both in construction and material They are single slides, each containing only one plate, therefore less risk of exposing the wrong plate (as in Double Dark Slides). The Shutter, which is a composition something like vulcanite (but lighter, and not so brittle), is made to draw *right out*, when exposing the plate. There are no hinges to get out of order and admit light, as in English Dark Slides. The Shutter is easily drawn and replaced, without fear of either sticking at the bottom or scratching the film, as in all Metal Dark Slides and other clumsy contrivances.

THEY ARE LESS THAN HALF THE WEIGHT, AND NOT HALF THE PRICE (for the same number of Plates) of the *best* English Dark Slides; they are extremely durable, easy to charge with plates, nice in appearance, besides other advantages.

FILMS may be used in them if desired, and more conveniently than in any other Dark Slides.

PRICE LIST

CAMERA.

CAMERA FOR PLATES $6\frac{1}{2} \times 4\frac{1}{4}$ (*double quarter*), equally suitable for SINGLE VIEWS, *landscape or upright*, STEREOSCOPIC, and LANTERN work, and provided with a folding base board (*without front projections*), parallel bellows body, perfectly constructed swing-back (centres of motion in the axes of lens and in centre of plate, *as it should be*), rising and falling front, with a lens board for Single Views, having a lateral slide, and a perfect rise and fall motion (above and below the centre) for upright or landscape shape pictures ; also a stereoscopic lens board, and patent expanding Roller Curtain division (removable for Single Views), complete with SIX DARK SLIDES... £5 15 0

Quarter plates may be used in the Dark Slides without "carriers" by placing two together, side by side, and as the Stereo division divides the body of the Camera into two parts, the quarter plates may be exposed separately.

EXTRA DARK SLIDES for SIX PLATES £1 0 0

Weight of Camera and Dark Slides for 12 *Plates*, $4\frac{3}{4}$ *lbs.*

HALF PLATE SIZE ($6\frac{1}{2} \times 4\frac{3}{4}$). We do not advise this size, but supply in special cases ..... extra £0 5 0

Waterproof Cases.

SUPERIOR CAMERA CASE, made to contain Camera, Dark Slides for 6 or 9 Plates, Lenses, Focussing Cloth, &c., with Sling Strap and Handle to carry in the hand £0 16 0

CASE FOR SIX EXTRA DARK SLIDES. When Camera is in use, this case can be placed inside the larger case £0 4 0

This system of Cases has met with universal approval.

When preferred, a Case can be supplied to contain 12 Slides, with space for Instantaneous Shutters, &c., &c..... £1 0 0

LENSES.

Specially constructed for these Cameras.

High-class Optical Instruments. Every one tested previous to delivery.

STEREOSCOPIC.

NOTE—During the past few years I have supplied more Stereoscopic Lenses than all the manufacturers and dealers in the world put together.

Pair Stereoscopic Rapid Landscape Lenses, 5-in. focus, with Rotating Stops ; largest working aperture, $\frac{F}{11}$ and covering a ¼-plate well, with full aperture even when the front is raised ... £2 10 0

Pair Extra Lenses, 7-in. focus, fitting same mounts..... £1 10 0

I have frequently used one of these Lenses for covering the whole of the 6½ × 4¼ plate (for a single picture), though, of course, I do not recommend it as the best lens for that size plate.

Pair Stereoscopic Wide Angle (*short focus*) Doublet Lenses, with Rotating Stops, fitting same flange as above ; largest working aperture, $\frac{F}{11}$ £4 10 0

NOTE—*Iris Diaphragms are not suitable for Stereoscopic Lenses ; the index is not definite enough to adjust a pair of diaphragms exactly alike.*

For Stereoscopic work Doublet Lenses are not necessary, even for architecture or interiors, except when working at wide angles (*short focus*). A pair of 5-in. Single Achromatic Lenses will be the most useful ; a pair of 7-in. of the same class will be the next best (specially constructed to fit the same mounts). The next useful will be a pair of short focus Doublets.

LENSES FOR SINGLE VIEWS.

Rapid Rectilinear Lens, for Single Views, on 6½ × 4¼ or half plates, with removable hood, Waterhouse Stops ; largest working aperture, $\frac{F}{8}$ £2 10 0

If with Iris Diaphragms.....extra 0 10 0

Wide Angle Symmetrical Lens (Doublet), for Architecture or Views in confined situations ; largest working aperture, $\frac{F}{11}$..... £2 10 0

Iris Diaphragms .....extra 0 10 0

Rapid Landscape Lens for Single Views, on 6½ × 4¼ plates, of 8 or 9 inches focus..... £1 15 0

Iris Diaphragms..... extra 0 10 0

LENSES BY ROSS, DALLMEYER, WRAY, OR OTHER MAKERS.

Focussing Magnifier—Achromatic £0 4 0

TRIPODS.

Tripod Stand, alpinstock.....	£0	15	0
Do. folding and sliding leg	1	0	0
Do. do. do. very best	1	6	0

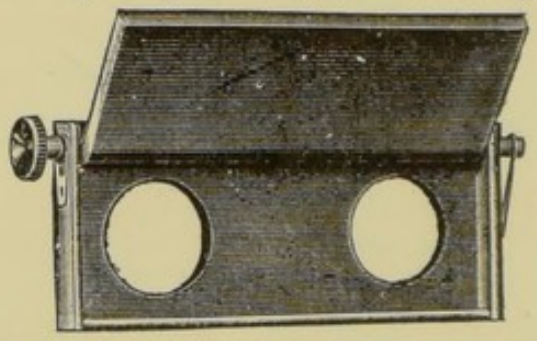
CHADWICK'S IMPROVED

FOCUSSING CLOTH.

To use it, find the button-hole at one end of the bag; fix this over the milled head of the focussing pinion: now spring the the elastic end of the bag over the back of the Camera; put your head in at the other end, and you will find it most comfortable to use. You need not remove your hat or ruffle a hair of your head. All light is excluded from the ground glass except that which comes through the Lens. To use a magnifying focussing glass, insert the left hand in the sleeve hole (which is now on the left hand side of the bag). **It need not be removed from the Camera for the introduction of the Slide or the drawing of the Shutter.**

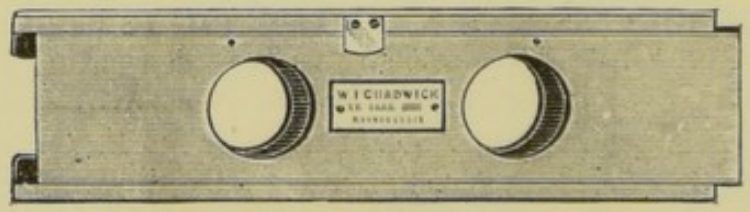
It is extremely light and folds up in a very little space; therefore it is **portable**—in fact, it is unique.

Price for Camera up to ½-plate 3/6; 10×8, 6/-; 15×12, 7/6.



STEREOSCOPIC FLAP SHUTTER £0 10 0

This is a most practical Shutter, and undoubtedly the most generally useful.

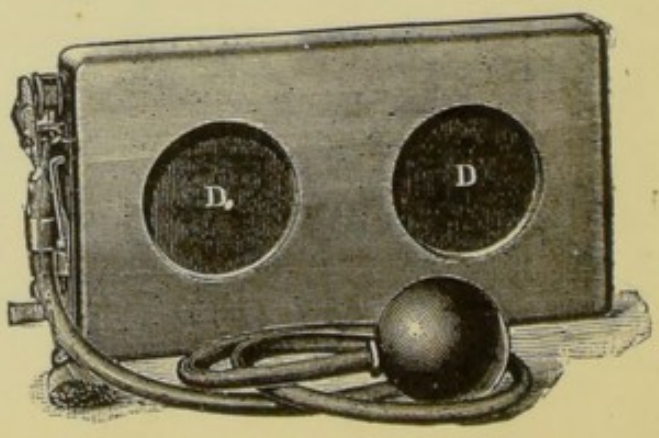


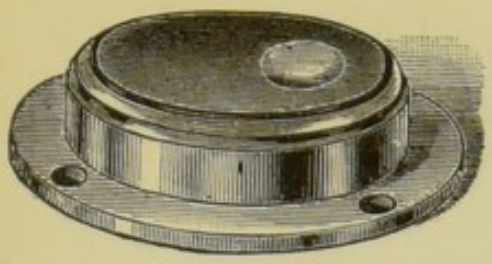
STEREOSCOPIC SLIDE SHUTTER, also very good, for Time and Instantaneous..... .... £0 6 0

KERSHAW'S STEREO. SHUTTER (New Patent), for TIME and INSTANTANEOUS ... £1 6 0

Thornton-Pickard Stereo. Shutter—

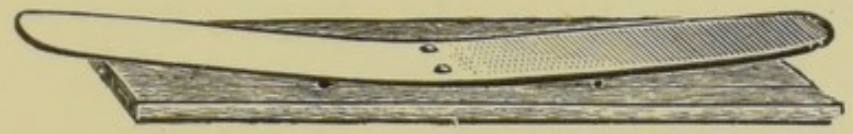
For Instantaneous only	£1	1	0
Time & Instantaneous	1	6	0
If with Speed Indicator extra	0	3	0

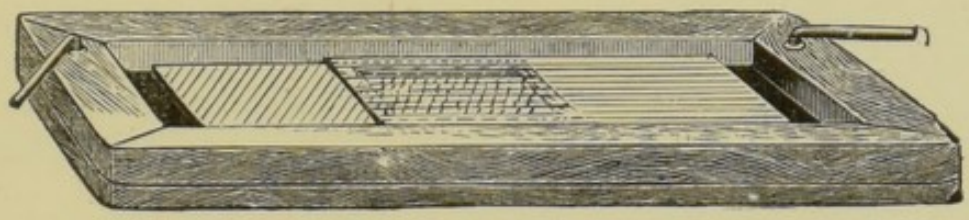




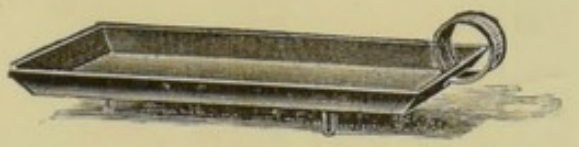
Levels—For screwing on Camera, 2/- and 3/- each.

„ For the Pocket (this is the handiest form), 2/6 each.

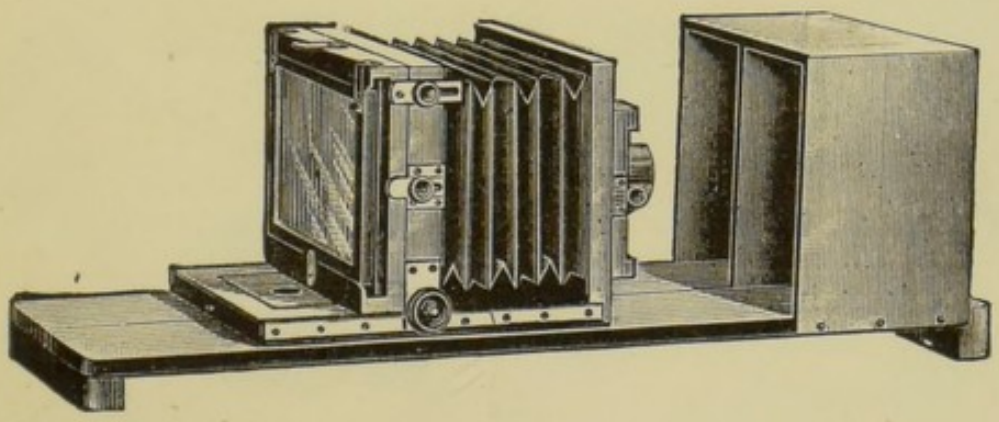




Stereo. Transparency Printing Frame ; correctly constructed, with guides and templates for Contact Printing ; velvet lined £0 7 6



Developing Trays, Stereo size, with handle and feet to keep from wet table, &c. ..... each £0 1 6



Stereo. Copying Camera Attachment, with adjustable front for Camera, to separate lenses £2 0 0

Masks (black paper) for Stereoscopic Transparencies, cushion shape, dome or round. (*These are correctly cut to suit the Special Transparency Contact Printing Frame*).....In Boxes of 3 dozen £0 2 0

(See *The Stereoscopic Manual.*)

Binding Strips, ready gummed, for Stereo or Lantern Slides (black) .....per Box £0 1 0

Transparency Plates—$6\frac{1}{2} \times 3\frac{1}{4}$ or $6\frac{3}{4} \times 3\frac{1}{4}$.

Mawson's .....per Dozen	£0	2	3
Thomas's ..... „	0	2	3
Coated on Fine Ground Glass..... „	0	2	6
Cover Glasses .... „	0	1	0
„ „ Finest..... ..... „	0	1	6

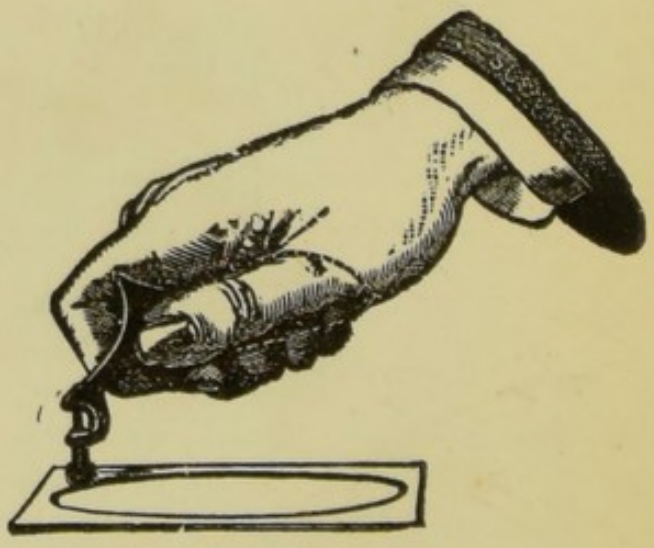
Finest Ground Glass for backing .....2/3 and 2/10

Stereo-Print Cutting Shapes, cushion shape or round—each £0 2 6

Set of three, different centres 0 7 0

Robinson's Wheel Cutter, for use with the above; imported direct from America £0 4 6

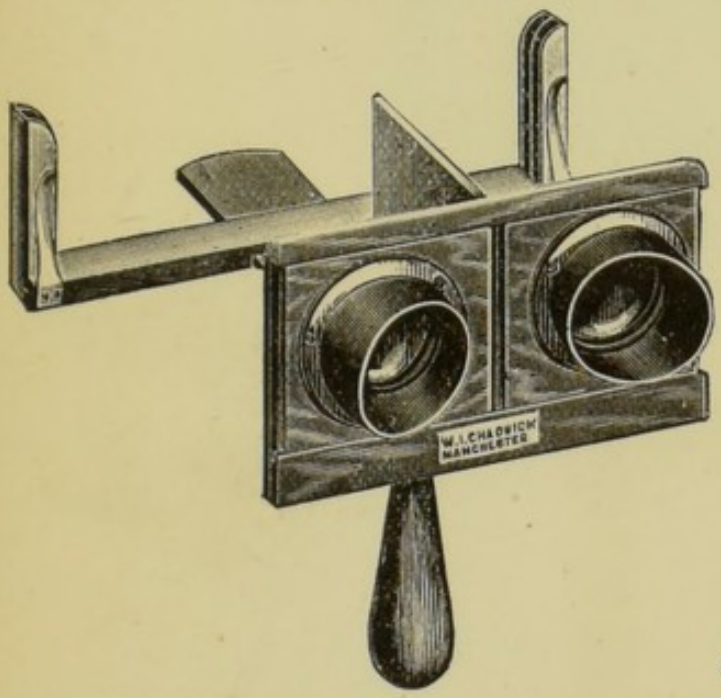
Mounts for Paper Slides, with burnished edges, Chocolate..... .per 100 £0 5 0



STEREOSCOPES.

THERE are hundreds of Stereoscopes in the market, (some at very low prices, and others at high prices) that are absolutely wrong in principle, and which few people can use satisfactorily.

THE WHOLE OF THE STEREOSCOPES IN THIS LIST ARE PERFECT INSTRUMENTS.—See *The Stereoscopic Manual.*



CHADWICK'S

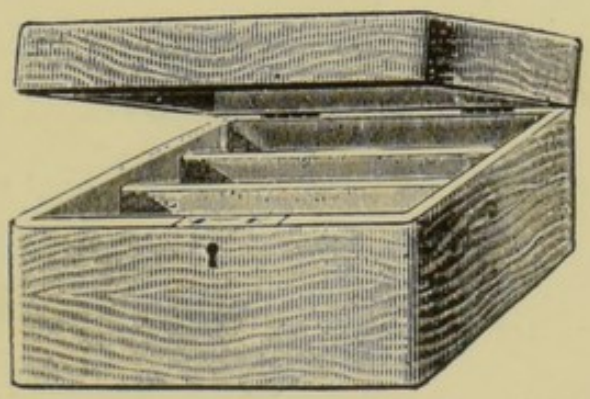
LENTICULAR Stereoscope,

With 5-in. Focus **Achromatic Lenses,** Brass Eye Shades, Double Metal Grooves for Transparencies, and an Extra Ground Glass,

17/6

If with movement to separate the lenses, 20/-

CABINETS for STEREO TRANSPARENCIES.



Mahogany or Walnut Box, to hold 3 dozen Glass Slides, with divisions, cloth padded top (inside), lock and key, &c..... £0 12 6

Cloth bound, Gilt Lettered Box 0 4 0

Telegraph Address—"STEREO, MANCHESTER."

THE CHADWICK

"Natural" Stereoscope

FOR TRANSPARENCIES ONLY.

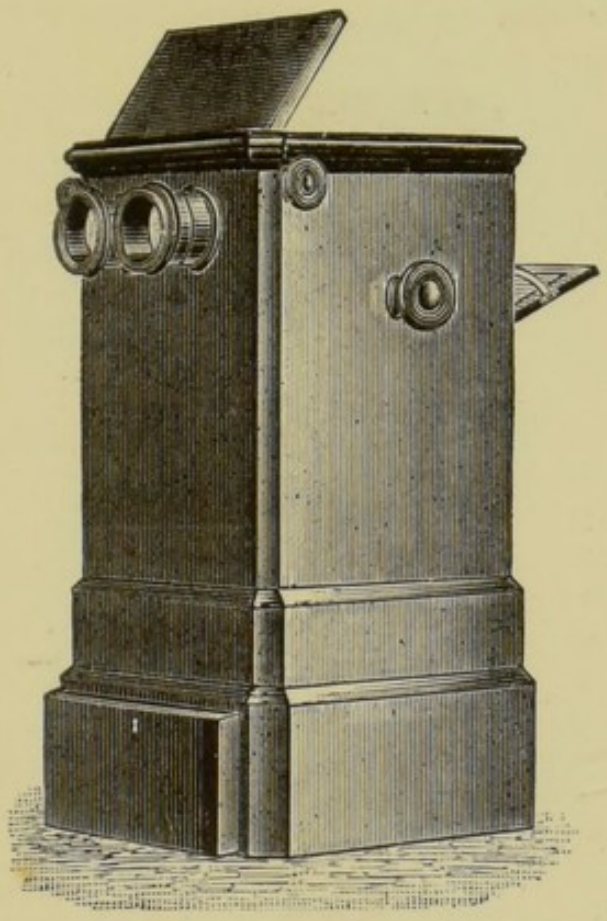
The lenses are achromatic, 5-in. focus, and of very superior quality ; in fact, they are similar to photographic lenses, and mounted in cells which screw into brass flanges. They are easily removed for cleaning, and provided with eye shades. The body is in Solid Walnut, highly finished.

Price		£1	5 0
Rack Focussing	extra	0	10 0
Movement to separate the Lenses	„	0	5 0
Telescopic Stand	„	10/- &	15/-

Telegraph Address—"STEREO, MANCHESTER."

REVOLVING STEREOSCOPE

TO HOLD FIFTY VIEWS.



Magnificently finished, in Walnut, with *Achromatic* Lenses of *large diameter*, Rack and Pinion Focussing, &c., for 50 Views, Paper or Glass £3 5 0

Bevel Corners..... extra 0 7 6

Mirror Reflector at Back..... ..... „ 0 7 6

Drawer at bottom ..... „ 0 5 0

PLEASE NOTE.—*These must not be compared with similar looking instruments of commerce; they are specially constructed for me with my own improvements, and can only be obtained through me.*

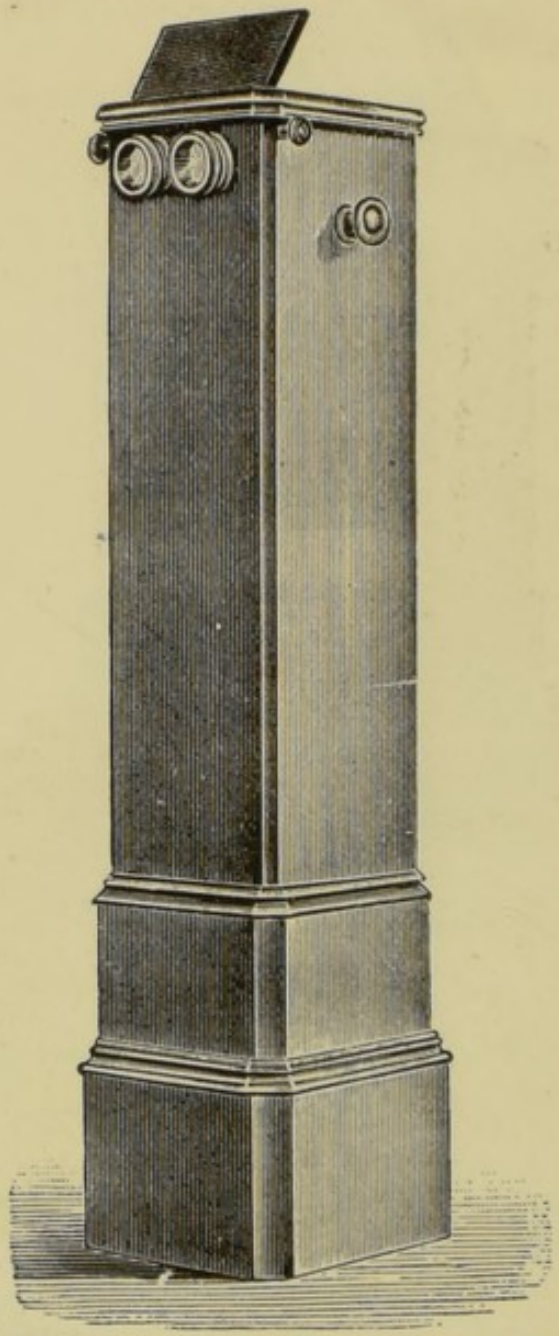
A cheaper Instrument can be supplied, similar in appearance, for ... £2 15 0

Telegraph Address.—"STEREO, MANCHESTER."

Revolving Stereoscopes.

TO HOLD 200 VIEWS.

This is the right height from the floor for the observer to view the pictures when sitting in an ordinary chair.



Highly finished, in Walnut, Oak, or Rosewood, with Achromatic Lenses of large diameter, Rack and Pinion Focussing, for 200 Views		£7	7	0
Mirror Reflector at Back	extra	0	7	6
Magnificent Handles, one each side, gilt	,,	0	12	6
A less elaborate Instrument		5	5	0

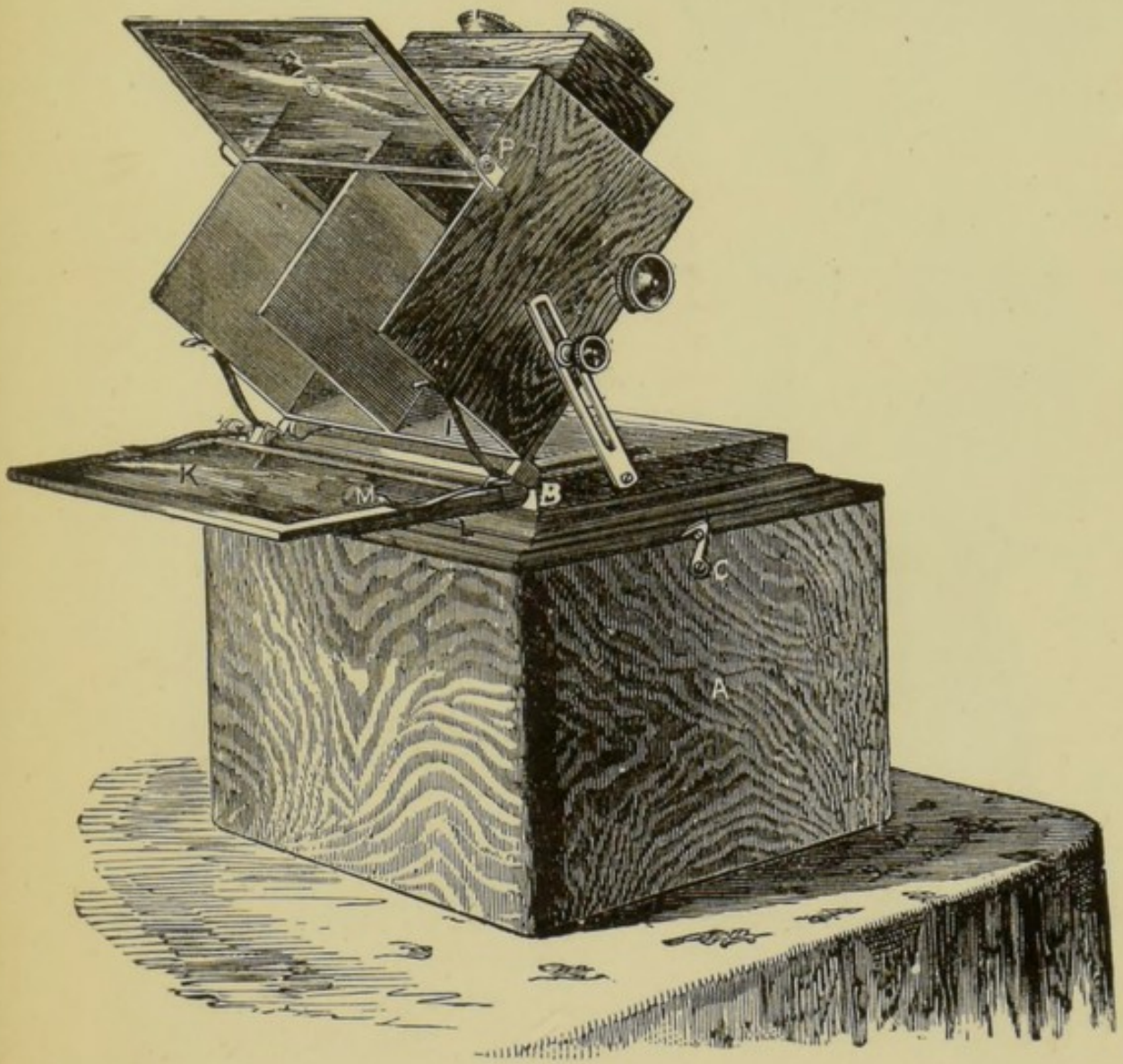
Telegraph Address—"STEREO, MANCHESTER."

Achromatic

TABLE STEREOSCOPE,

ADJUSTABLE TO ANY SIGHT.

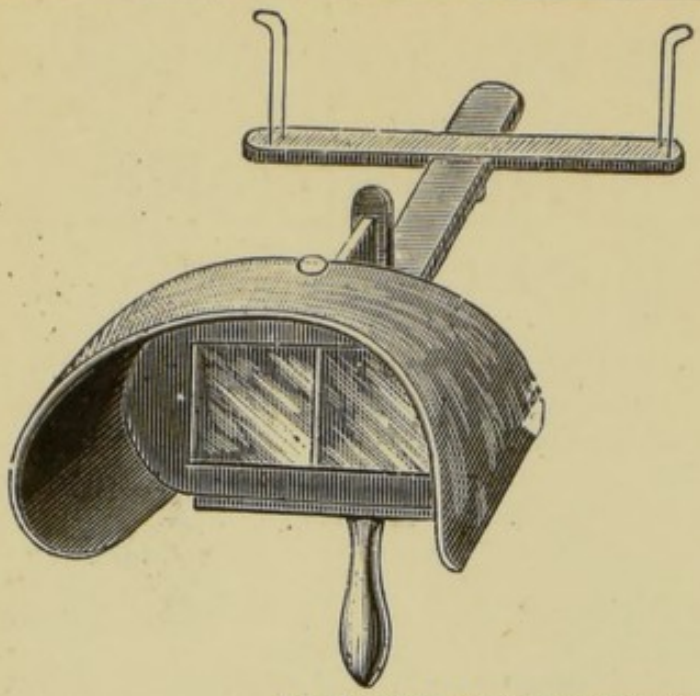
This Instrument may be unhooked at C and enclosed in the base A, which is a box support to elevate to a convenient height when used on an ordinary table.



PRICES :

Solid Walnut or Mahogany.....	£3	3	0
Tinted Reflector for Effects	0	5	0

Telegraph Address—"STEREO, MANCHESTER."



AMERICAN PRISMATIC

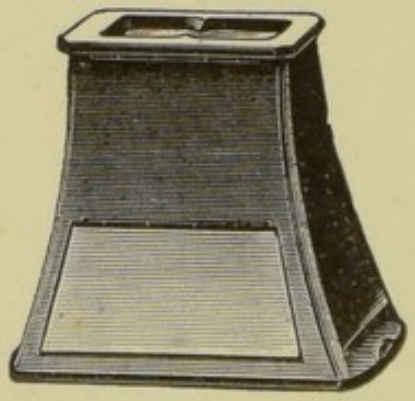
Stereoscopes

2/6 to 5/6 each.

We know of Stereoscopes, such as we supply at 2/6 each, being sold by dealers at 4/6, 4/9 and 5/- each.

BOX-FORM STEREOSCOPES.

Although we do not recommend this form of Stereoscope, we keep a few in stock, of the best make only. It was badly constructed instruments of this pattern that had much to do with depopularizing the Stereoscope some years ago.

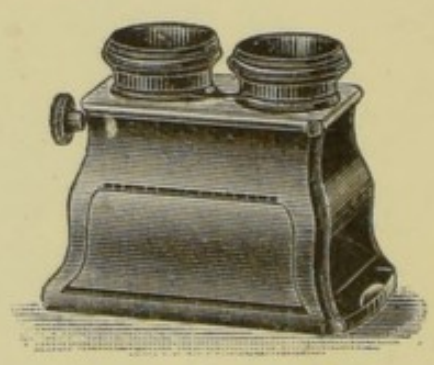


BOX PATTERN.

FIGURED WALNUT.

6/-, 9/-, and 12/6 each.

Inferior Instruments not kept in Stock.



ACHROMATIC

LARGE DIAMETER LENSES

Short Focus.

With Rack Adjustments.

All Selected Iustruments, in highly finished Walnut.

20/- 25/- 30/-

W. I. CHADWICK,

Expert in Photography,

2, ST. MARY'S STREET, MANCHESTER.

Pamphlets.—*1d. each.*

"INSTRUCTIONS FOR DEVELOPING DRY PLATES."

"INSTRUCTIONS FOR PRINTING."

"INSTRUCTIONS FOR ENLARGING" (Eromide)

Catalogues.—*Free for postage.*

PHOTOGRAPHIC: "An Amateur's complete Outfit."

STEREOSCOPIC CATALOGUE.

LANTERN CATALOGUE.

LANTERN SLIDE CATALOGUE.

LANTERN MICROSCOPE CATALOGUE AND PAMPHLET.