(No Model.) 4 Sheets—Sheet 1.

M. LEVY.

DIAPHRAGM FOR CAMERAS.

No. 532,326. Patented Jan. 8, 1895.

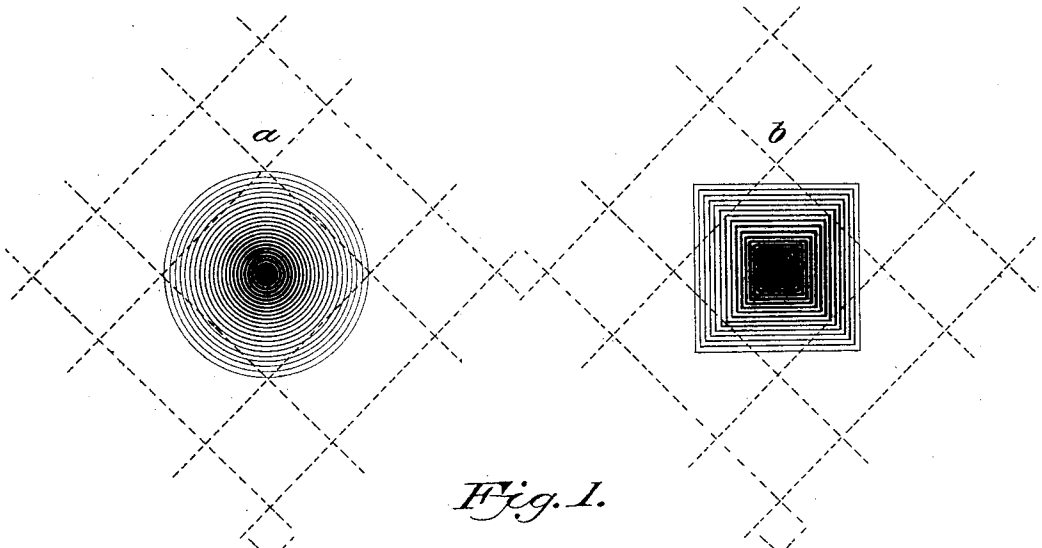


Fig. 1.

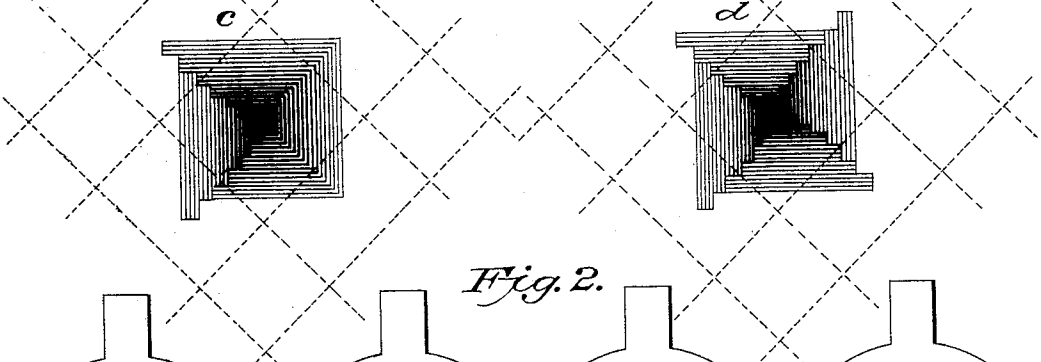
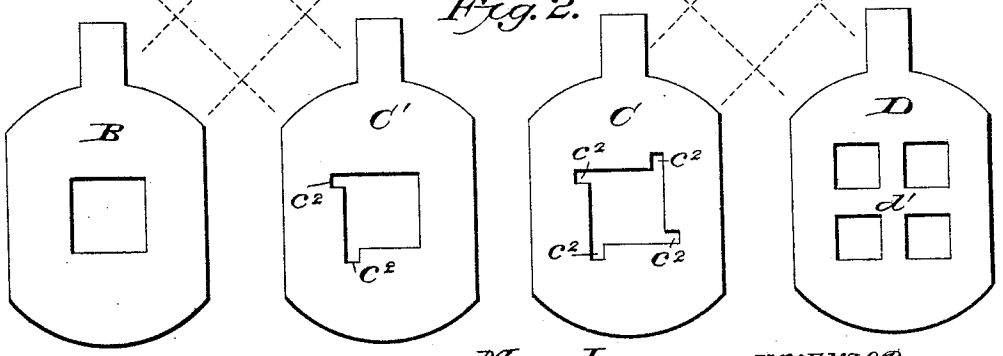


Fig. 2.



WITNESSES

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DIAPHRAGM FOR CAMERAS.

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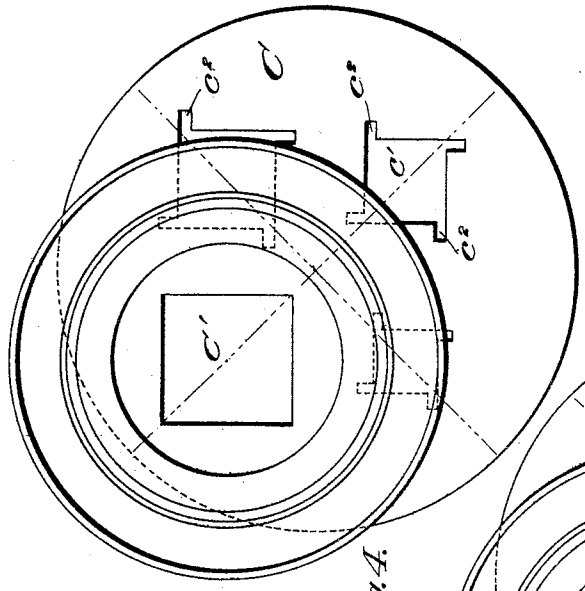

Fig. 4.

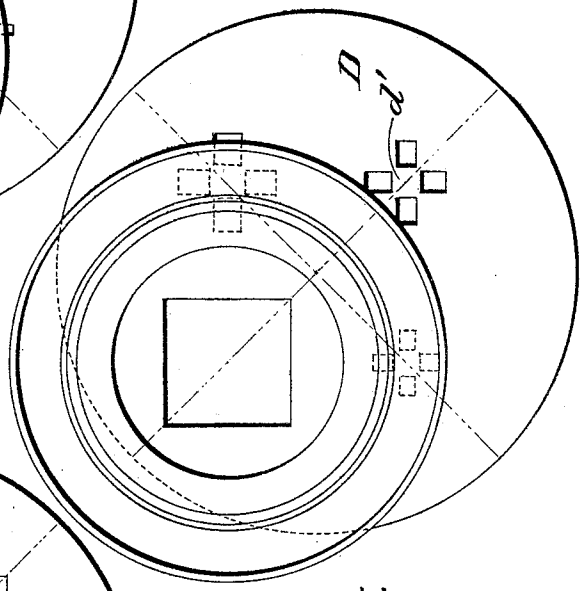

Fig. 5.

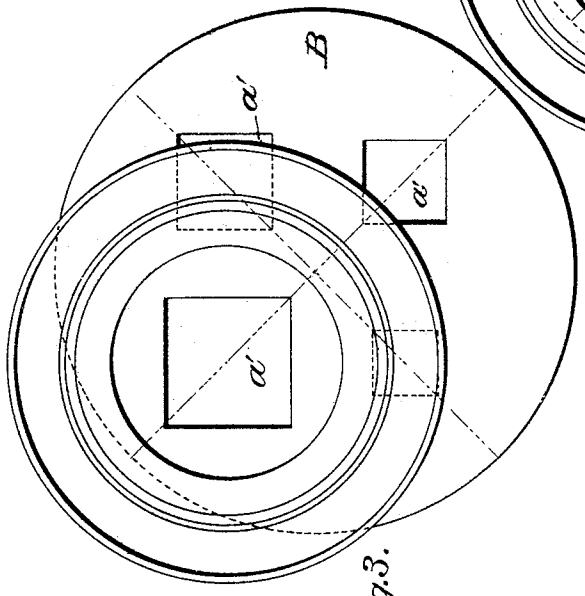

Fig. 3.

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Fig. 7.

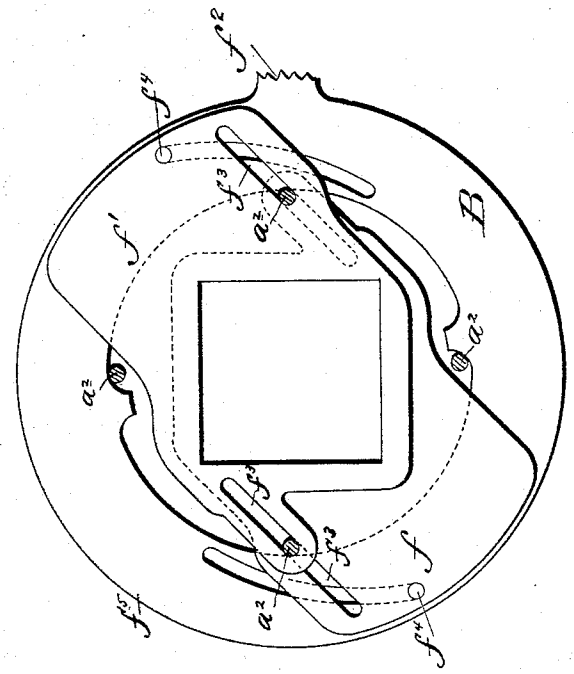
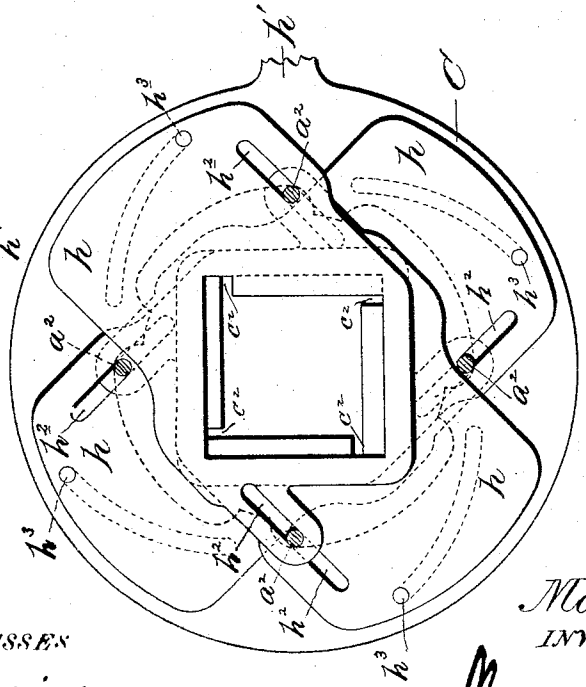


Fig. 6.



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DIAPHRAGM FOR CAMERAS.

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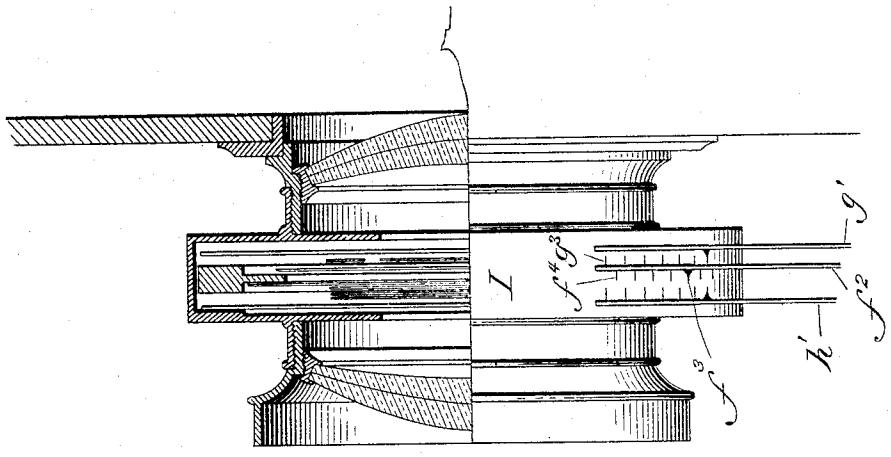

Fig. 9.

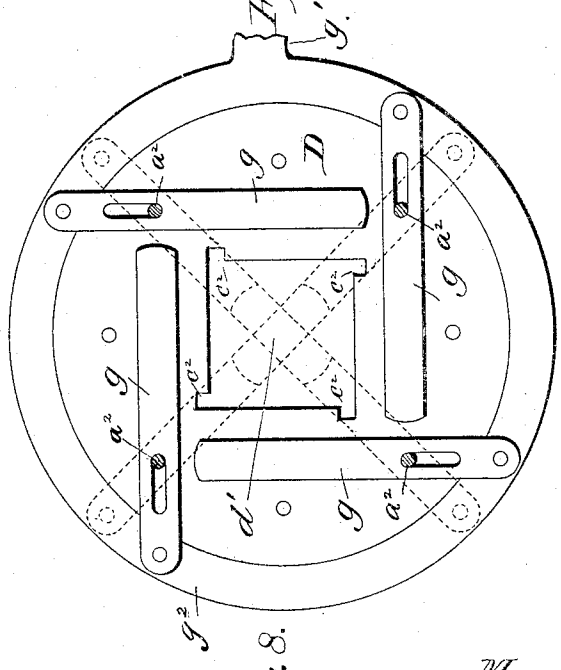

Fig. 8.

WITNESSES

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UNITED STATES PATENT OFFICE.

MAX LEVY, OF PHILADELPHIA, PENNSYLVANIA.

DIAPHRAGM FOR CAMERAS.

SPECIFICATION forming part of Letters Patent No. 532,326, dated January 8, 1895.

Application filed August 31, 1893. Serial No. 484,458. (No model.)

To all whom it may concern:

Be it known that I, MAX LEVY, a citizen of the United States of America, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Diaphragms for Cameras; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The invention relates to improvements in diaphragms for photographic lenses, the same being especially designed for use in the production of half-tone photo-mechanical engravings, the improvement relating particularly to the means of producing negatives through cross-lined screens.

The invention is based upon the fact that in making the so-called half-tone negative through a cross-lined screen the effect is to produce upon the sensitive plate through each aperture of the screen a perfect reproduction of the opening in the lens through which the light is admitted. Following out this discovery and drawing the equivalent of the opaque cross-lines of a screen upon paper, and further drawing upon the diagram a series of squares representing the lens-aperture with their sides at an angle of forty-five degrees with said cross-lines (see Diagram *b*, Figure 1), it will at once be seen that there are formed opaque squares where the lines overlie or cross, and these opaque squares are brought out more prominently than would be the case with a round lens-aperture or with a square aperture the sides of which are arranged in the same position relative to the lines of the screen. Furthermore, there are many instances in which a diaphragm with a square aperture will not sufficiently accomplish the result desired, and this is notably the case where the subject to be reproduced has relatively dark high lights and light shadows, or, as commonly expressed, the subject is "flat" or wants contrast or "brilliancy." In such a case I extend either two or four of the corners of the square aperture, these extensions being of relatively small size as compared to the main aperture, and the light transmitted through them in an ordinary exposure is only sufficient to produce in the highest lights of the subject an action which will respond to the subsequent processes of intensification. In effect the result is somewhat analogous to the case of a round aperture where a small stop is used for the general subject and a larger one for the high lights, both openings operating at the same time; but, as will be seen by reference to a diagram as above indicated, the light admitted by the excess of aperture in the foregoing analogy will fall only between the intersections of the opaque lines of the screen, thus greatly exaggerating the tendency to form the desired dots and without undue loss in the sharpness of the lines.

In still further applying my invention, if an aperture of proper size as related to the distance between the screen and sensitive plate and having the central light blocked out be used for a portion only of the entire exposure the light admitted through the multiple aperture can be made to fall on the sensitive plate only on those portions between the intersections of the black cross-lines and the highest lights may be in this way almost entirely acted upon without apparent detriment to other portions of the picture.

In practice in dealing with subjects of greatly varied character it is often found desirable to change the character of the aperture during the progress of a single exposure.

This invention may be applied more or less successfully in a variety of ways all of which are essentially dependent on the same factors. First, there may be at hand simply an assortment of removable diaphragms, as shown in Fig. 2, which have formed therein different-sized apertures, some square and some with extended corners, and these may be used separately for an entire exposure or changed during the progress of the exposure; second, a revolving disk fitted to the lens-tube as commonly in the case of "revolving diaphragms" may be provided with a series of apertures of different sizes or forms as before mentioned, and this method may be still further amplified and improved by having two or more independent disks of this character, so that one set of apertures may be used to

modify the other (see Figs. 3, 4 and 5), and third, there may be used a combination of mechanically variable apertures that will give a choice of any desired opening from a square of any size with no projecting corners to a similar square with large projecting corners, and also to a square of any size with the central light blocked out, so that any aperture may be used throughout a complete exposure or may be varied at will during the progress of the exposure. (See Figs. 6, 7 and 8).

In the accompanying drawings, Fig. 1 is a diagram of the lines and spaces or apertures of a cross-lined screen, and upon this diagram are illustrated a series of shadows which represent the action of the light which passes through the openings in the screen when admitted through the different apertures in the diaphragm. In this figure "*a*" designates the effect of a round aperture as usually employed; "*b*," the effect where a square aperture is used and positioned as stated above; "*c*," the effect of a square aperture with two extended corners, and "*d*" that of a square with four extended corners placed as I prefer to place them. Fig. 2 represents the ordinary removable diaphragms with the various shaped apertures which I employ. Fig. 3 is a view of a removable diaphragm which is provided with a series of square apertures so arranged that as each aperture consecutively comes into the central position of the lens its sides occupy the same position relative to the camera. Fig. 4 is a view showing a similar diaphragm, the square apertures c' being extended at their corners c^2. Fig. 5 is a view showing a revolving diaphragm with a large rectangular aperture and a series of apertures, each of the latter consisting of a series of small apertures surrounding a central opaque portion. Figs. 6, 7 and 8 are views showing modifications, the diaphragms in this case being provided with variable apertures. Fig. 9 is a side elevation, partly in section, of a lens-tube showing the application thereto of the diaphragms illustrated in Figs. 6, 7 and 8, with handles for manipulating them.

In practice I sometimes utilize the three forms of diaphragms B, C and D as shown in Fig. 2 in a single exposure. The same results are attained by using the forms of diaphragms shown in Figs. 3, 4 and 5 which are pivoted within the lens-tube, in front or behind the lens or combination of lenses; but where a combination is used it is preferred to place the diaphragms at or near the center between the lenses of the combination. These diaphragms are arranged so that the apertures can be brought on a line with each other and with the axis of the lens, and they are placed as close together as possible. The same results may be obtained by using diaphragms as shown in Figs. 6, 7 and 8, in which instead of revolving diaphragms I use diaphragms which are mounted in the lens-tube centrally on a line with the axis of the lens; and the diaphragm shown in Fig. 6 is provided with slides $h\ h$ which when moved will give apertures of different sizes having extensions c^2 which increase and decrease in width with the size of the aperture.

The slides are mounted on fixed pins a^2 which pass through slots h^2 therein, and each slide is provided with a stud h^3 engaging curved slots in a disk h^4. The slides are superimposed and manipulated by the disk h^4 which has a projecting handle h' for that purpose.

In Fig. 7 a rectangular aperture is produced by the movement of the two slides f and f' on the fixed pins a^2 which pass through slots f^3 therein, the slides having studs f^1 which are engaged by curved slots in a disk f^5; and in Fig. 8 an aperture having the central light blocked out is produced by means of the movable arms $g\ g$ which are mounted on the fixed pins a^2 and are connected at their outer ends to a ring g^2.

The three different forms of diaphragms shown in Figs. 6, 7 and 8 are separately manipulated by the projecting handles f^2, g' and h'. The handle f^2 operating the two slides f and f' which form the square aperture has a pointer f^3 and on the lens-tube are graduations f^4, these indicating the size of the aperture in terms of the focal-length of the lens; and attached to the handle h' is a disk by means of which are manipulated the slides $h\ h$ forming the apertures with extended corners. When the two handles f^2 and h' are on a line with each other, or parallel, the projecting corners of the one aperture are constantly covered by the diaphragm having the square aperture, but as these handles are separated the pointers on the handles and the graduations on the lens-tube indicate the exact length of the projecting corners which are left exposed by the larger size of the square aperture of the diaphragm, Fig. 7. A third scale, g^3, serves to indicate the extent to which the central light is blocked out by the lapping of the four movable arms $g\ g$. A lens provided with diaphragms of this character when properly employed in a camera in connection with a cross-line screen will yield negatives far superior to those made by the means ordinarily employed.

In making a so-called half-tone print the usual cross-line screen is employed in connection with the diaphragms hereinbefore described, and in reproducing a subject where the lights and shadows are pronounced the exposure would be through one of the square apertures alone, said aperture being arranged relative to the screen so that the dots are formed at the intersections of the cross-lines and the light projected behind the opaque lines of the screen between the intersections; but where the subject has relatively dark high lights and light shadows the exposure would be through all of the diaphragms consecutively, the square aperture being first used to give the central light, then the square aperture extended at its corners used so that

said extensions will assist in throwing the light beyond or behind the opaque lines of the screen between their intersections, and then the diaphragm with the central light blocked out is used to further intensify the light behind the opaque lines.

It is found that the exposure given by all the diaphragms consecutively intensifies the light on the parts of the negative behind the opaque lines between their intersections, which would not be accomplished by the ordinary regular aperture, and the result would be practically the same as if the subject had high lights and dark shadows.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A diaphragm for photographic lens-tubes provided with a rectangular aperture having extensions at the corners thereof, for use with a grating or screen for the purpose set forth.

2. In a photographic lens-tube, the combination, of a diaphragm having a series of rectangular apertures so arranged that as each of the apertures is consecutively moved to a central position on a line with the axis of the lens the sides of said apertures will occupy the same position relative to the axis of the lens, for use with a grating or screen for the purpose set forth.

3. In a photographic lens-tube, a diaphragm having a plurality of apertures surrounding a central opaque portion which is adapted to be positioned in line with the axis of the lens, for use with a grating or screen for the purpose set forth.

4. A lens-tube for the purpose set forth having a diaphragm with a square aperture the corners of which are extended as shown, and a second diaphragm with a plurality of apertures surrounding a solid portion the center of which is adapted to be positioned in line with the axis of the lens, substantially as shown, for use with a grating or screen for the purpose set forth.

5. In a photographic lens-tube, the combination, of a plurality of diaphragms, two of said diaphragms having apertures of a different character and a third diaphragm having a plurality of apertures surrounding an opaque central portion which is adapted to be brought into line with the axis of the lens, for use with a grating or screen for the purpose set forth.

6. In a photographic lens-tube, the combination, of a diaphragm having a plurality of rectangular apertures of different sizes with extended corners and a diaphragm having a plurality of square apertures of different sizes, the diaphragms being adapted to be moved to bring the apertures therein in line with each other and on a line with the axis of the lens, for use with a grating or screen for the purpose set forth.

7. In a photographic lens-tube, the combination, of a plurality of diaphragms each having a number of different-sized apertures, the apertures in the diaphragms being of different configuration, for use with a grating or screen and for the purpose set forth.

8. In combination with a photographic lens-tube, of a plurality of diaphragms each having an aperture of a configuration different from the apertures of the other diaphragms, the aperture in one of the diaphragms being rectangular and having extensions at the corners thereof and one of the other diaphragms having a plurality of apertures surrounding a central opaque portion which is adapted to be positioned in line with the axis of the lens, for use with a grating or screen for the purpose set forth.

9. In the art of making half-tone negatives the employment and combination of the following instrumentalities: a grating or screen which is positioned in front of the sensitive plate in the rear of the lens-tube, a plurality of diaphragms carried by the lens-tube, said diaphragms having apertures the sides of which are parallel with each other with relation to the axis of the lens and positioned in the lens-tube so that the sides of said apertures will be at an angle with the lines of the grating or screen, for the purpose set forth.

10. In a photographic lens-tube, the combination, of four slides having similar shaped apertures with extended corners and slots through which pass fixed pins, studs projecting from the slides, together with a disk having curved slots with which the studs engage, and means for moving the disk to increase or diminish the size of the aperture formed by the slides.

11. A diaphragm for photographic lens-tubes made up of a plurality of superimposed slides each having a rectangular aperture with an extended corner to present an aperture with extensions at all of the corners thereof, substantially as shown.

12. In a photographic lens-tube, a plurality of similarly shaped slides with apertures having extended corners and means for moving said slides in unison, of a pair of slides having rectangular apertures and means for moving them one upon the other, the adjusting means being so constructed that the size of the aperture formed by the diaphragm may be changed without changing the configuration thereof, and that the configuration of the aperture may be changed without varying the size of the aperture except at the corners thereof.

In testimony whereof I affix my signature in presence of two witnesses.

MAX LEVY.

Witnesses:
ADOLF HAUSSER,
JEFFREY ZANKSTON.