W. C. HUEBNER.

PHOTOGRAPHIC METHOD.

APPLICATION FILED MAY 19, 1911.

1,093,134.

Patented Apr. 14, 1914.

5 SHEETS—SHEET 1.

Fig. 1.

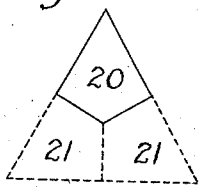


Fig. 3.

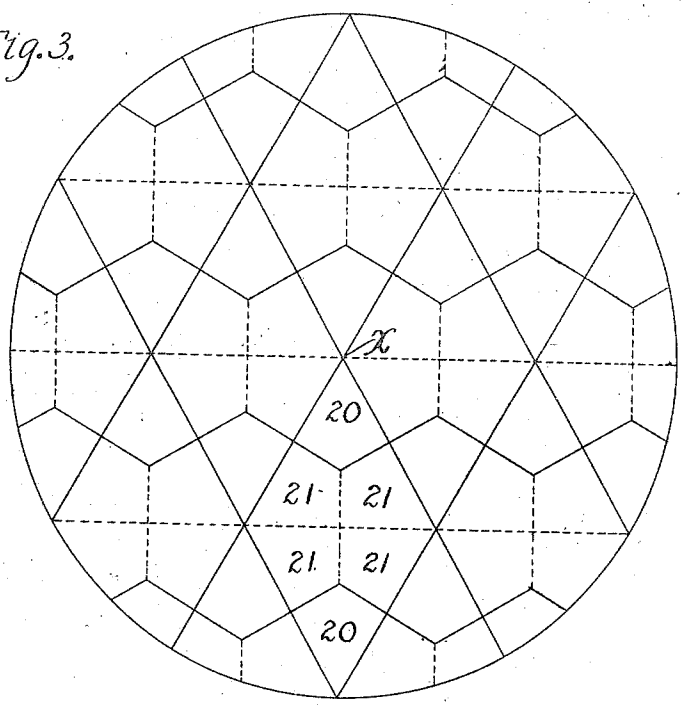


Fig. 2.

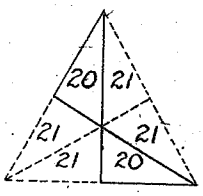
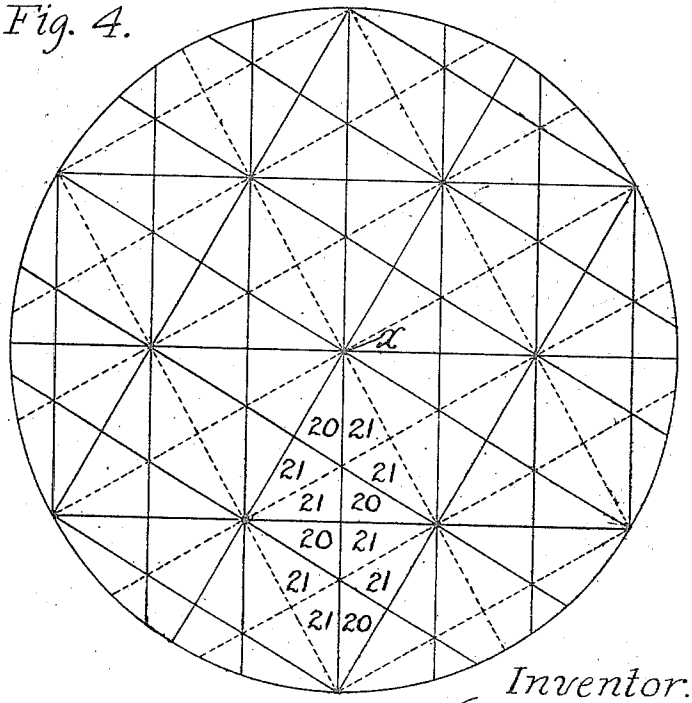


Fig. 4.



Witnesses.

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5 SHEETS—SHEET 2.

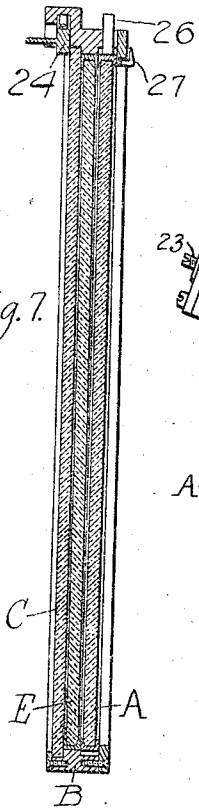


Fig. 7.

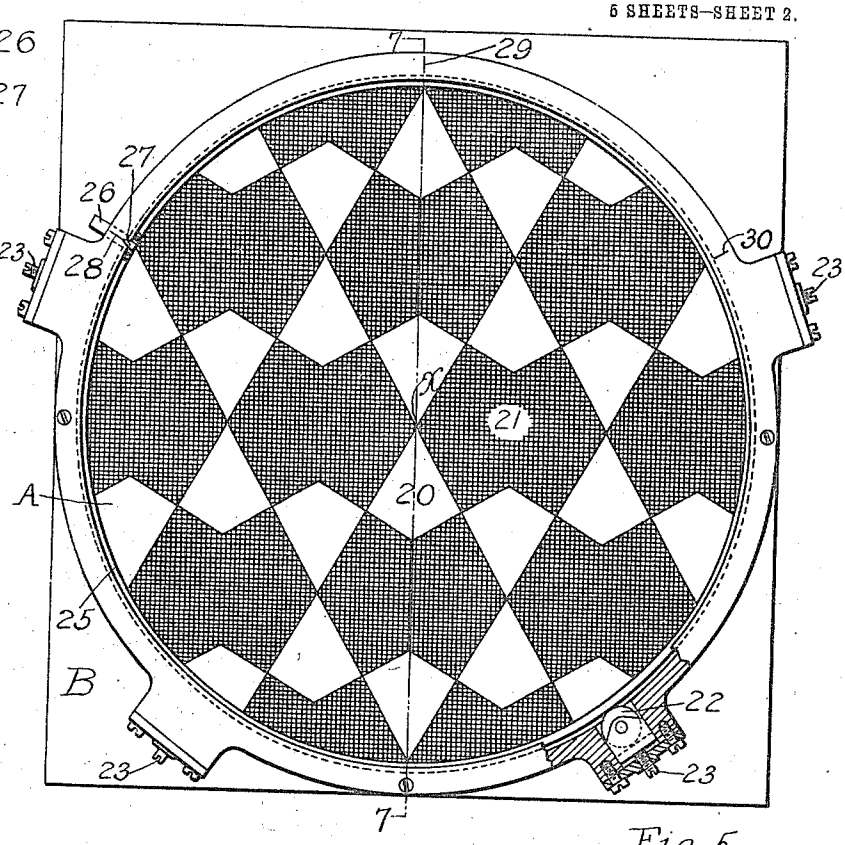


Fig. 5.

Fig. 6.

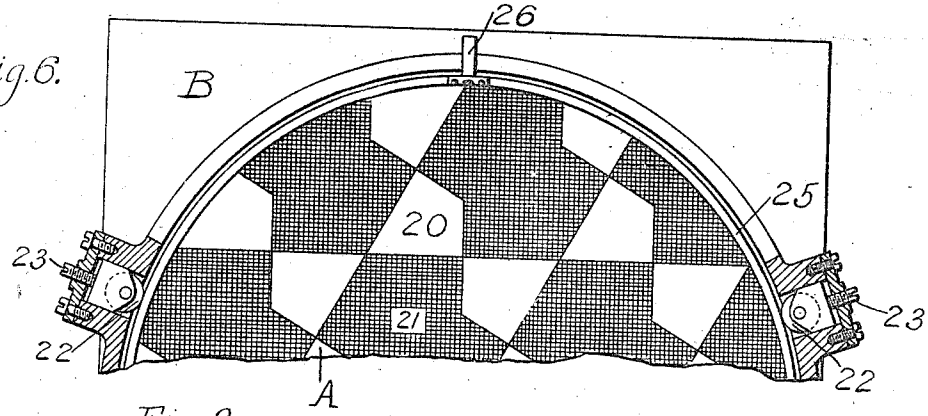
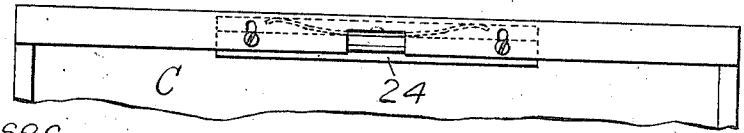


Fig. 8



Witnesses.

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5 SHEETS—SHEET 3.

Fig. 9.

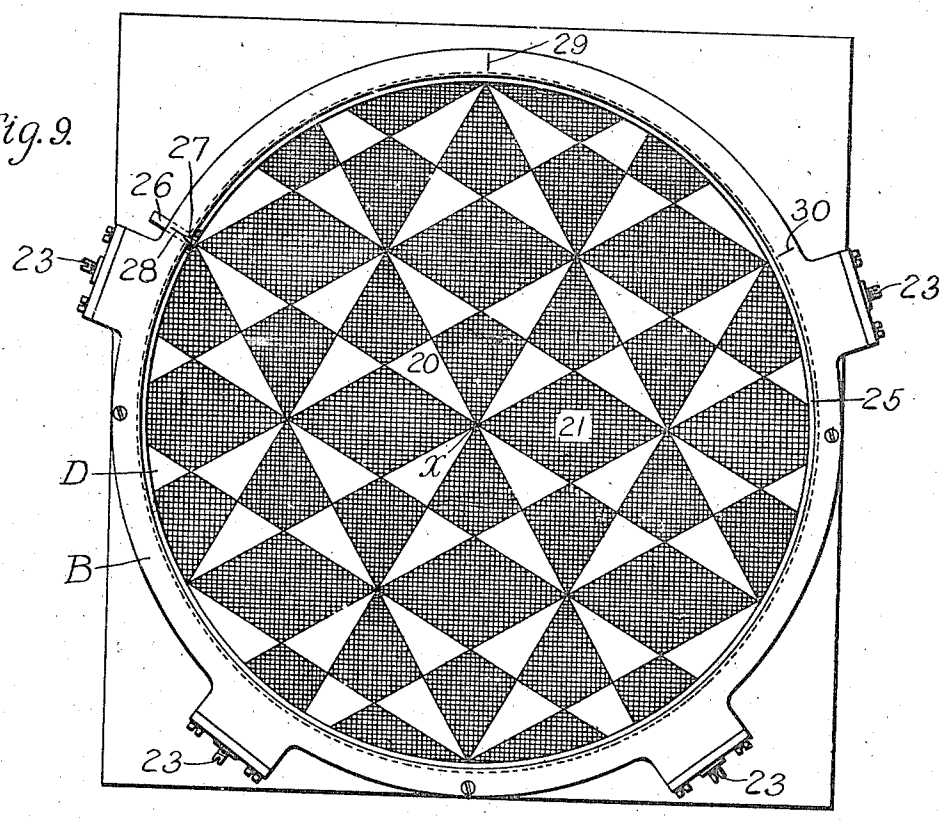


Fig. 10.

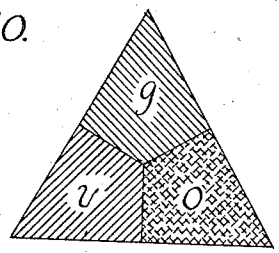


Fig. 12.

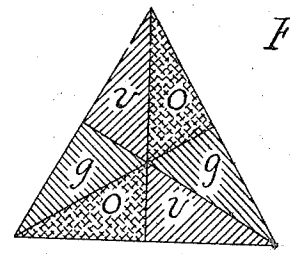


Fig. 11

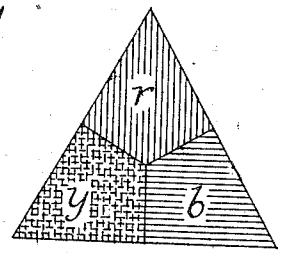
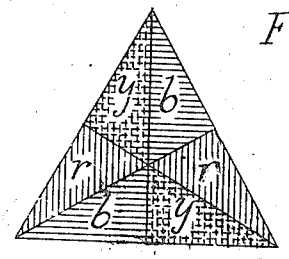


Fig. 13.



Witnesses.

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PHOTOGRAPHIC METHOD.

APPLICATION FILED MAY 19, 1911.

1,093,134. Patented Apr. 14, 1914.

5 SHEETS—SHEET 4.

Fig. 14

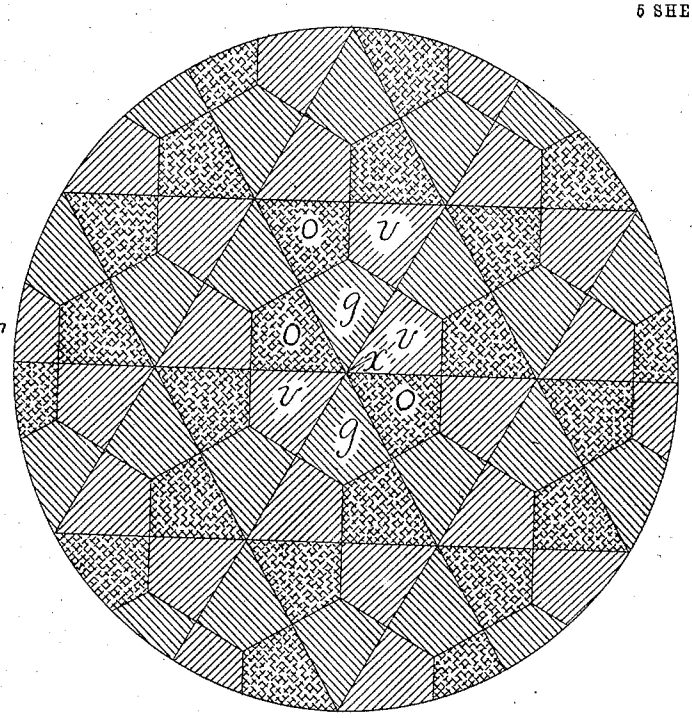
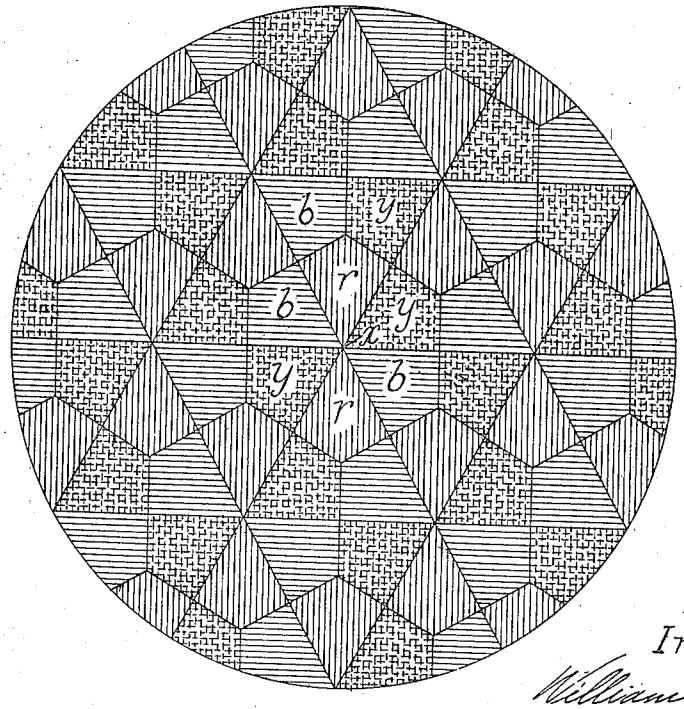


Fig. 15



Witnesses.

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PHOTOGRAPHIC METHOD.

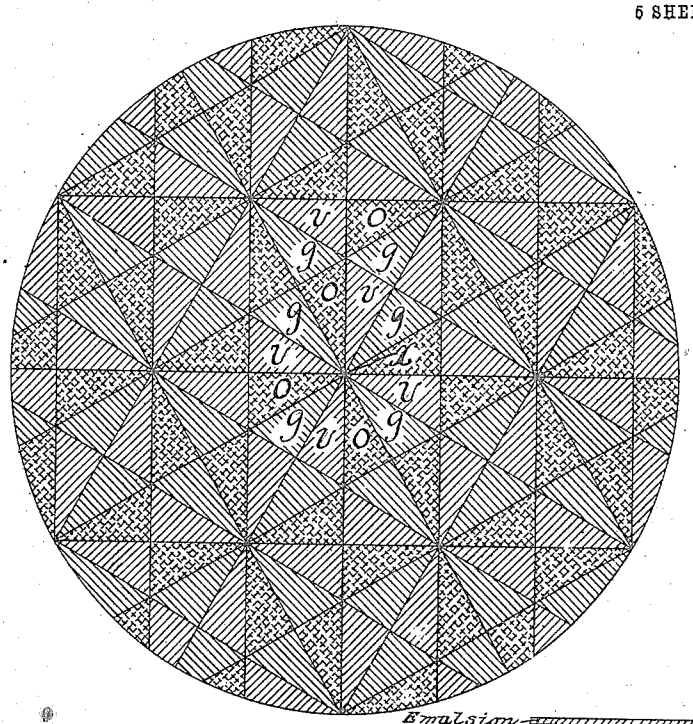
APPLICATION FILED MAY 19, 1911.

1,093,134.

Patented Apr. 14, 1914.

5 SHEETS—SHEET 5.

Fig. 16.



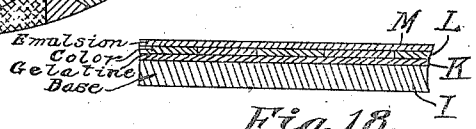
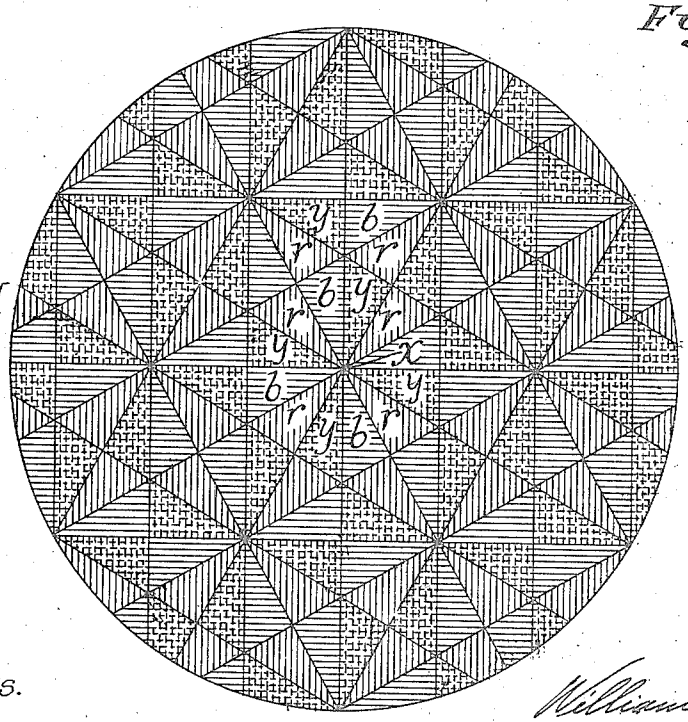


Fig. 18.

Fig. 17.



Witnesses.

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UNITED STATES PATENT OFFICE.

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PHOTOGRAPHIC METHOD.

1,093,134. Specification of Letters Patent. Patented Apr. 14, 1914.

Application filed May 19, 1911. Serial No. 628,286.

To all whom it may concern:

Be it known that I, WILLIAM C. HUEBNER, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Photographic Methods, of which the following is a specification.

This invention relates to the fractional exposure of sensitized surfaces for the production of black and white or multi-color work by means of a rotatable screen of peculiar construction, a corresponding multicolor light filter and a corresponding multicolor base, either separately or jointly.

In the accompanying drawings, consisting of five sheets: Figure 1 is a diagram showing a triangular group of three units of the screen. Fig. 2 is a diagram showing a triangular group of six units of the screen. Fig. 3 is a diagrammatic view of a screen according to Fig. 1, with the transparent units shown in full lines and the opaque units indicated by dotted lines. Fig. 4 is a similar diagrammatic view of a screen according to Fig. 2. Fig. 5 is a partly sectional elevation of a screen according to Figs. 1 and 3, mounted in a holder. Fig. 6 is a fragmentary elevation, partly in section, showing the screen shifted to the next position. Fig. 7 is a section on line 7—7, Fig. 5. Fig. 8 is a fragmentary rear elevation of the holder. Fig. 9 is an elevation of a screen according to Figs. 2 and 4, arranged in a holder. Fig. 10 is a diagram showing a triangular group of three units of a multicolor filter. Fig. 11 is a view of three corresponding units of a multicolor base. Fig. 12 is a diagram showing a triangular group of six units of a multicolor filter. Fig. 13 is a view of six corresponding units of a multi-color base. Fig. 14 is a view of a multicolor filter according to Fig. 10. Fig. 15 is a view of a corresponding multicolor base. Fig. 16 is a view of a multicolor filter according to Fig. 12. Fig. 17 is a view of a corresponding multicolor base. Fig. 18 is a sectional view, on an enlarged scale, of a multi-color base.

Like reference characters refer to like parts in the several figures.

In practising this invention a screen is employed which is provided with transparent portions or units which are uniformly distributed over the area of the screen and occupy preferably one-third of the total area thereof, while the opaque portions occupy two-thirds, and which screen is capable of rotary adjustment so that the sensitized surface can be exposed through the screen by placing the latter successively into each of three positions, 60° apart. In each of these positions the screen exposes numerous, equally distributed points on the sensitized surface which in the aggregate cover one-third of the surface, so that the three exposures through the screen in its three successive positions cover the entire area of the sensitized surface. The three exposures produce on the sensitized surface printing points which are separated more or less according to the distance between the screen and the sensitized surface and according to the opening of the lens diaphragm. Each exposure can be separately timed, as may be desired, and the operation can be repeated with the screen in each or some of the exposing positions, as may be deemed desirable.

In operating with a half tone screen of the usual kind the entire area of the sensitized surface is exposed at the same time, while by means of the fractional screen herein described only one-third of the sensitized surface is exposed at a time, two-thirds being covered by the opaque portions of the screen. The distance existing between the screen and the sensitized surface reduces the area on the latter which is exposed by a screen unit, thus producing proper printing points in the manner of half tone work. The angular form of the units facilitates the formation of proper printing points during the subsequent treatment of the negative. The screen area is divided into angular units arranged about a common center x. These units are combined in groups of three, as represented in Fig. 1, or in groups of six, as represented in Fig. 2, or in groups of a greater multiple of three, as may be preferred. Fig. 3 is a diagrammatic view showing the relative arrangement of the transparent and opaque units or areas arranged in groups of three, as represented in Fig. 1, 20 representing the transparent units in full lines and 21 the

opaque units in dotted lines. Fig. 4 is a similar view showing the relative arrangement of the units arranged in groups of six, as represented in Fig. 2, in which arrangement each unit shown in Fig. 1 is bisected.

In Fig. 5 a circular screen A having the arrangement of units shown in Figs. 1 and 3 is represented in a circular holder B in which the screen is so mounted that it can be adjusted by a rotary movement to stand in either of three positions, 60° apart. The holding and adjusting devices can be constructed in any suitable manner. As shown, the screen is mounted to be capable of rotation between holding rollers 22 in the holder, which rollers can be adjusted inwardly and outwardly by screws 23. The sensitized negative C, Figs. 7 and 8, may be removably held in the holder by a spring clamp 24, or other suitable means. The screen is provided with a circular marginal frame 25 which bears against the holding rollers, and with a handle or finger-piece 26 by which it can be turned and which projects through a slot in the frame. The arc through which the screen is required to be moved is 120° and the screen is adjusted to stand in either of the three positions, 60° apart, which positions can be conveniently secured by means of a pointer 27 and register marks 28, 29, 30 on the holder. In the position of the screen shown in Fig. 5, the pointer 27 is in register with the mark 28 and the transparent portions or units 20 of the screen expose one-third of the area of the sensitized surface which is being exposed. By shifting the screen to the next position, 60° to the right in Fig. 5, in which position, shown in Fig. 6, the pointer 27 coincides with the register mark 29 on the holder, the transparent portions of the screen are shifted 60° to the right of the position previously occupied and correspondingly new portions of the sensitized surface are exposed while the portions previously exposed are covered. By shifting the screen to the third position, in which the pointer 27 is in register with the register mark 30, the transparent portions of the screen are again shifted 60° to the right and the remaining portions of the sensitized surface are exposed, while the portions which were exposed in the first and second positions are covered. By placing the screen in the three described positions successively the transparent portions or units of the screen reach in three steps or stages the entire area of the sensitized surface and one-third of the total area is exposed at a time. The screen can be shifted back to the first or the second position and the exposure can be repeated in either of the three positions as may be necessary for producing the desired effect. Negatives so produced, when developed, fixed and dried in any suitable manner, can be used in black and white work in the ordinary manner for printing or reproduction and produce a finer tone gradation than can be secured by a half tone screen of the usual kind in which the entire area of the sensitized surface except the portion covered by the lines of the screen is acted upon at the same time.

In Fig. 9 a screen D having its units arranged in groups of six, as in Figs. 2 and 4, is shown in the holder B. The rotary adjustment of the screen permits the screen to be adjusted exactly to each position so that the total effect is to join the successive exposures without leaving vacant spaces except in so far as the exposed points on the negative are separated in order to produce proper printing points.

This fractional screen, which may be called a trisector because it trisects the sensitized surface for exposure, can also be used in color photography, as will appear from the following description. If a color filter is used in connection with this screen the record produced on the negative is that of the color which is intercepted by the filter. As is well known, an orange filter permits yellow and red rays to pass through but intercepts blue rays and so produces on the sensitized negative a record of the blue rays; a green filter permits yellow and blue rays to pass through but intercepts the red rays and so produces on the negative a record of the red rays, and a violet filter permits red and blue rays to pass through but intercepts yellow rays and so produces on the negative a record of yellow rays. In other words, each color filter is practically opaque with reference to one color and transparent with reference to other colors and produces on the negative a record of the color with reference to which it is opaque, which record is caused by the failure of the intercepted light rays to act upon the sensitized surface on the negative. Upon removing the unaltered sensitizing material in the subsequent treatment of the negative, a transparent area is left where the unaltered material has been removed, and when the negative is afterward exposed in printing upon a sensitized surface the light rays passing through the transparent record portion so formed will produce a reproduction corresponding with the color which was intercepted. A different color filter can be used with the screen in each of the three positions, and a separate sensitized plate is used for each exposure, thereby producing three color-record negatives, one for each color, and each of these can be exposed for a greater or less time as may be desired. A fourth negative can be made for printing in black or a modification of black by exposing a negative successively through the filter in each of the three positions. In addition to the usual three colors which would be mainly

used in color printing, additional filters can be used in different shades or modifications of colors and records be made through these filters on additional negatives, which negatives would be used for producing corresponding additional printing surfaces for these modified colors. Each of these color records can be printed upon printing surfaces suitable for photo-mechanical printing. When these separated colors are printed from these printing surfaces they produce a multicolor print in which each color is printed in exact register, the effect being a clear rendering of each color. The recording of the colors can be manipulated in various ways so as to combine with one color one or more other colors which may be found desirable, for instance, the negative may be exposed for one color in one position of the screen and then the screen may be shifted to another position and this other exposure be made partially through the same filter or through another color filter so as to blend two colors, as may be desirable for producing the desired gradation of tone or shade of color.

The fractional screen or trisector can also be used in connection with a multicolor filter having units or areas of different colors arranged in the same order in which the units are arranged on the screen, so that the latter, when registered with the multicolor filter, will expose one set of filter units at a time and cover the rest. A simple and suitable arrangement of color areas or units on the filter comprises the three spectrum colors, green, violet and orange, which when separately exposed by the screen produce a record on the negative, respectively, of red, yellow and blue. This multicolor filter can be made by means of the above described screen in the following manner: A glass is covered with a sensitizing layer and exposed through the screen in one position thereof and the portion which has been exposed is covered with a suitable dye, which can be applied either before or after developing. After the unaffected sensitizing material has been removed the plate is covered with a protecting layer, for instance, a greasy solution, and a second sensitizing layer is put upon the plate and the process is repeated with the screen in the second position and with a second color. After that color has been protected the operation is repeated with the screen in the third position and with a third color. The result will be a spectrum color filter having its units in three colors, each color covering one-third of the area of the filter and having the units in exactly the same position in which the transparent and opaque units are arranged on the screen. The color units on the filter join each other closely and without overlapping.

Fig. 10 represents a group of color units on the multicolor filter composed of three angular units or areas arranged in the form of a triangle, as in Figs. 1 and 3, *g* representing the green unit, *c*, the violet and *o* the orange unit.

Fig. 12 represents a group of color units of the filter composed of six angular units or areas arranged in the form of a triangle, as in Figs. 2 and 4. In this arrangement each unit shown in Fig. 10 is bisected so that the group contains two units for each unit of the group represented in Fig. 10. These units can be further divided, if desired. When more than three units are arranged in a group the number of colors or shades of colors can be increased as far as the number of units in a group may permit.

Fig. 14 represents a color filter E with the trigonal units grouped in groups of three, as represented in Fig. 10, and arranged about a common center *x*. The units are greatly exaggerated in size and correspondingly reduced in number for the purpose of representation, the actual number ranging usually from 25,000 to 500,000, approximately, to the square inch, or from 4,000 to 80,000, approximately, to the square centimeter.

Fig. 16 represents a color screen F having the angular units grouped in groups of six, as represented in Fig. 12, and arranged about a common center *x*.

The angular form of the color units and their described arrangement permits the entire area of the filter to be covered with such units, leaving no vacant spaces between the units and also preventing the lapping of one color over the other in printing from the negative.

When the screen is so placed in register with the multicolor filter that its transparent portions coincide with one of the three or more sets of color units on the light filter, all other color units will be covered and protected from the light and light can pass only through the exposed set of units which are by this means separated from the other units. This screen so permits a separate color-record negative to be made for each color by exposing a separate negative to each color. In the case illustrated in the drawings one negative can be made for the blue color by placing the screen in register with the orange units on the light filter; another negative for the yellow color by placing the screen in register with the violet units of the light filter; and a third negative for the red color by placing the screen in register with the green units of the light filter. Each of these negatives, when developed, fixed and dried, can be used for producing photographically a printing surface for each color from which impressions can be produced in the appropriate colors, successively and in proper reg-

ister, thereby producing a multicolor print correctly representing the color object from which the negatives were produced.

In Fig. 7, the multicolor light filter E is represented as being arranged in the holder between the sensitized plate C and the screen A. The center of the screen should be in exact register with the center of the light filter.

The three color records made by the three exposures, one for each color, can be made on the same negative, if desired. When the three records are made on the same negative the three records, each of which is distinct and separate from the others, are assembled upon the same sensitized surface and can be separated in printing from the negative by means of the screen. For that purpose the negative is placed in exact register with the screen and the latter is placed successively in each of the three described positions and a print is taken from the negative in each of these positions. Each print is a reproduction of the color which corresponds with the record on the negative which is exposed by the transparent portions of the screen. By varying the duration of the exposures in making the color records on the negative or in printing from the latter, variations in color values may be produced.

The color-record negatives produced as herein described can also be used for producing color photographs upon a multi-color base, which may be paper, glass or other suitable material. The color areas or units are arranged on this base in exactly the same order or relative location as they are on the light filter and on the screen so that complementary colors on the base correspond with the spectrum colors in the light filter, the red units *r* on the color base corresponding with the green units *g* on the filter, the blue units *b* on the color base corresponding with the orange units *o* on the filter, and the yellow units *y* on the base with the violet units *v* on the filter, as indicated in Figs. 11, 13, 15 and 17. The colors which are applied to the base may be of any suitable nature, for instance, anilin or pigment, and can be applied by first coating the base I (Fig. 18) with a layer or film of any suitable foundation material, for instance, a layer K of gelatin, then printing each color L separately thereon in the proper location and finally covering the multicolor layer with a sensitizing layer M, preferably dry plate emulsion. If the color-record negative is placed in register with the color base in such manner that the negative bears the same relation to the base which it bore to the color filter while being exposed, the transparent color records which were produced by the green areas of the light filter will coincide with the red areas of the color base; the transparent records made by the orange areas of the light filter will coincide with the blue areas of the base, and the transparent records made by the violet areas of the light filter will coincide with the yellow areas of the base. If the multicolor base is exposed to the negative in connection with the fractional screen, which must be in exact register with the base and the negative, each color record can be printed on the base separately by placing the screen successively in the three described positions. The duration of each exposure can be regulated as may be necessary for producing the desired effect.

Fig. 15 represents a multicolor base G in which the complementary color units red, yellow and blue are arranged in the same order in which the spectrum color units green, violet and orange are arranged in the light filter E, shown in Fig. 14, in which each triangular group is composed of three units.

Fig. 17 represents a multicolor base H in which the complementary colors are arranged in units in the same order in which the spectrum colors are arranged in the light filter F, shown in Fig. 16, in which arrangement each triangular group is composed of six units. Upon exposing the multicolor base through the negative and the screen the light passing through the transparent color record on the negative acts only upon the underlying sensitizing material, while the rest of the sensitized surface will not be acted upon and will be removed, together with the underlying colors, in developing and fixing the base.

Color-record negatives made as herein described can also be used for printing upon a color base without resort to the screen or trisector. In that case the base is exposed in a suitable manner with the color-record negative placed in register with the color base, as above described. The colors will be fixed upon the base by the light acting upon the sensitizing material in those parts of the base which are in register with a transparent color record on the negative. When this color base has been developed, fixed and dried it forms a color photograph in exact accordance with the color values represented on the color-record negative and in exact accordance with the color object from which the color-record negative was produced.

The herein described methods and apparatus are also capable of use in producing motion pictures in which case the film on which the pictures are produced is exposed through the multicolor filter.

I claim as my invention:

1. The herein described improvement in photography which consists in exposing to light a sensitized surface through a screen having numerous transparent angular units

arranged around a common center while the remainder of the sensitized surface is protected against light, and thereafter rotating said screen and exposing portions of the sensitized surface which were previously protected, while protecting the portions which were previously exposed, substantially as set forth.

2. In color photography, the herein described method which consists in producing upon a sensitized surface a color record by photographing the object through a screen composed of angular units of different colors, said screen exposing the units of one color while the units of different color are protected against light, substantially as set forth.

3. In color photography, the herein described method which consists in producing a color record photographically and then printing said record upon a sensitized multicolor base having its area composed of numerous angular units of different color by exposing the units of one color at a time while protecting the units of different color against light, substantially as set forth.

4. In color photography, the herein described method which consists in producing upon a sensitized surface a color record by photographing the object through a screen composed of angular units of different colors, said screen exposing the units of one color while the units of different color are protected against light, and printing said record upon a sensitized multicolor base having its area composed of numerous angular units of different color and exposing the units of one color at a time while protecting the units of different color against light, substantially as set forth.

Witness my hand, this 13th day of May, 1911.

WILLIAM C. HUEBNER.

Witnesses:
EDWARD WILHELM,
C. B. HORNBECK.