

Jan. 28, 1947.

V. C. ERNST

2,414,938

PHOTOGRAPHIC REPRODUCTION PROCESS AND APPARATUS

Filed March 6, 1944

3 Sheets-Sheet 1

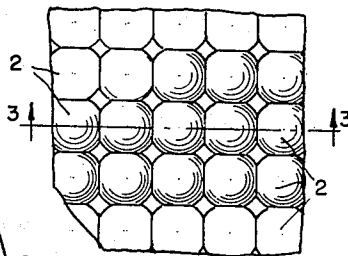
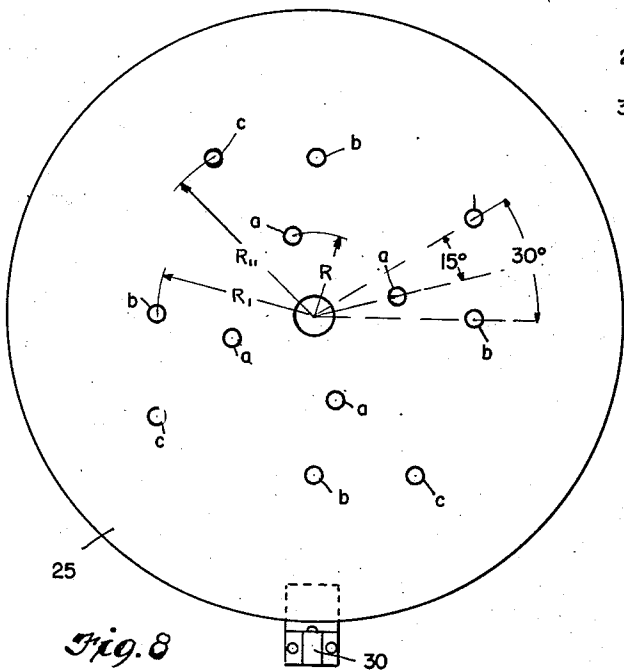


Fig. 2

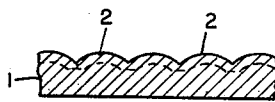
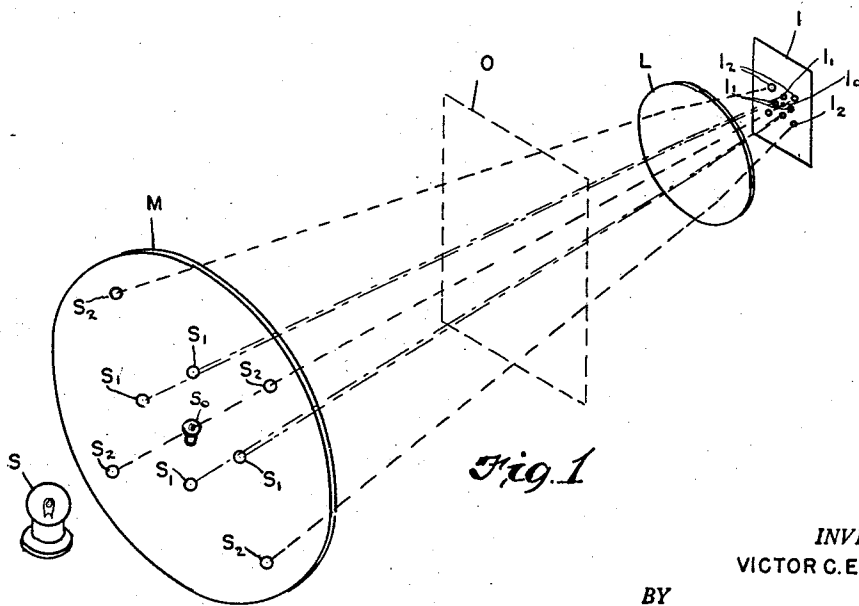


Fig. 3



INVENTOR.
VICTOR C. ERNST

BY

Oberlin, Limbach & Day
ATTORNEYS

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3 Sheets-Sheet 2

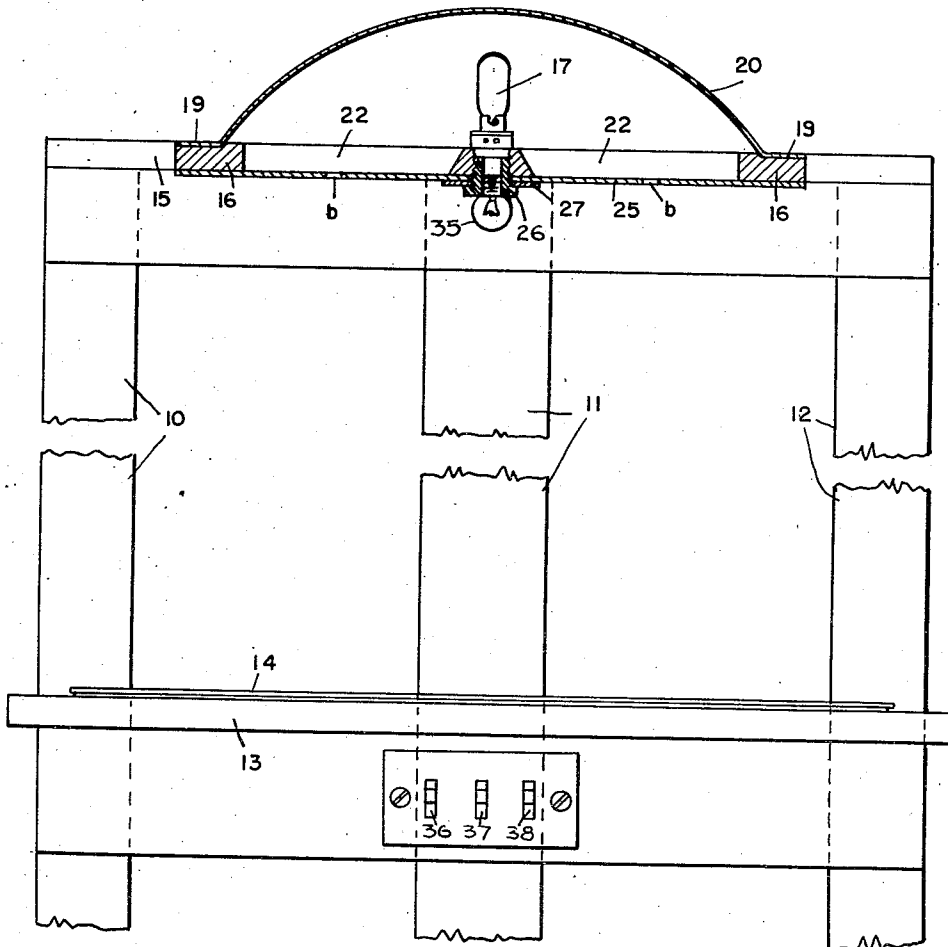


Fig. 4

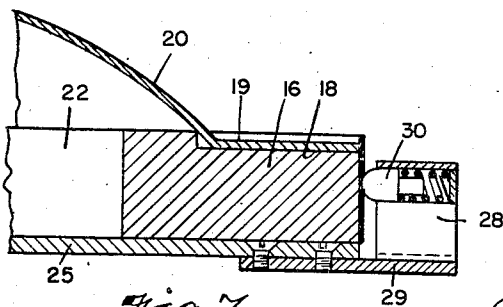


Fig. 7

INVENTOR.
VICTOR C. ERNST

BY

Oberlin, Limbach & Day.
ATTORNEYS

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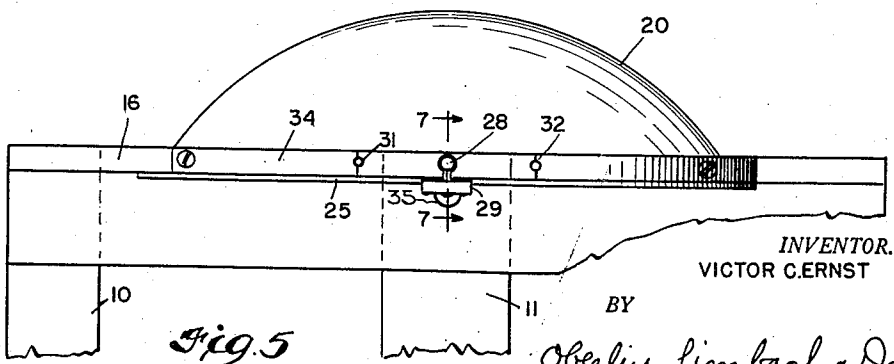
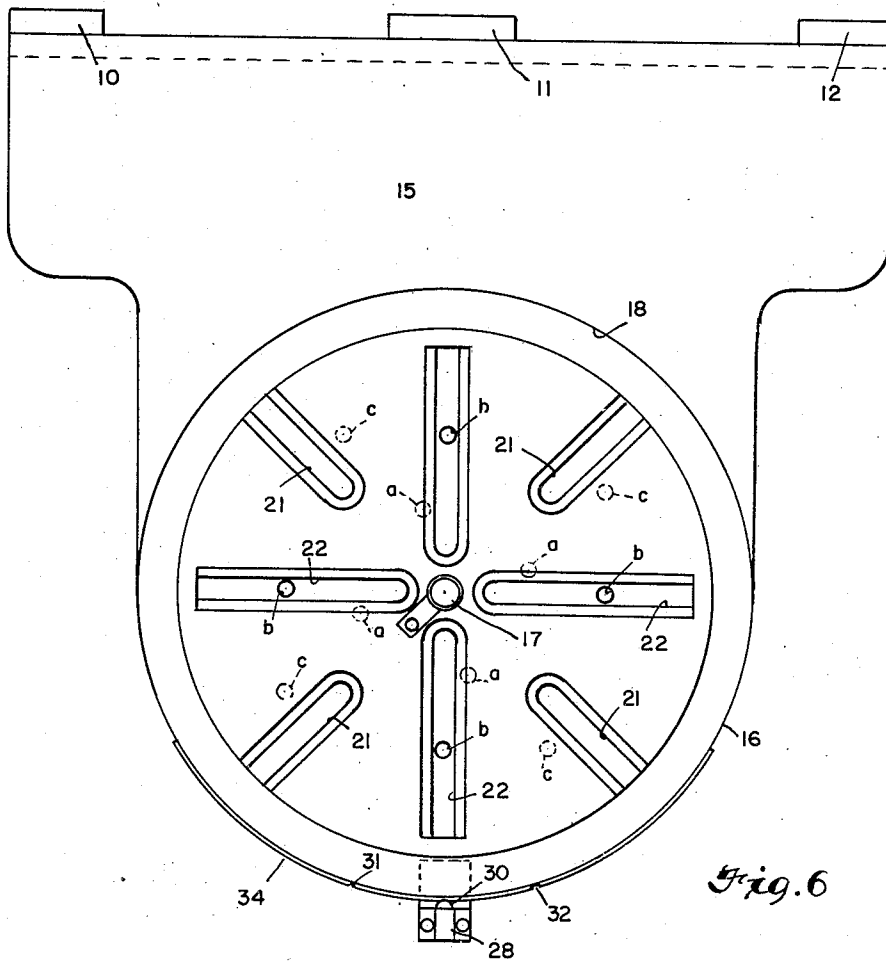
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PHOTOGRAPHIC REPRODUCTION PROCESS AND APPARATUS

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3 Sheets-Sheet 3



INVENTOR.
VICTOR C. ERNST

BY

Oberlin, Limbach & Day.
ATTORNEYS

UNITED STATES PATENT OFFICE

2,414,938

PHOTOGRAPHIC REPRODUCTION PROCESS
AND APPARATUSVictor C. Ernst, Independence, Ohio, assignor to
The Fulton Tone Process Company, Cleveland,
Ohio, a corporation of Ohio

Application March 6, 1944, Serial No. 525,178

10 Claims. (Cl. 95—5)

1

The present invention, relating as indicated to a photographic reproduction process and apparatus, has more particular reference to the art of photographically transforming continuous tone images or "copy" into an interrupted tone or "half-tone" object. My invention is well adapted to the preparation of printing plates in several types of printing processes such as the photolithographic, photoengraving, photogravure and photogelatin processes.

In the half-tone reproduction process, the continuous tone of an image, which may be a photograph, a drawing, or a line copy, is broken up, by means of a half-tone screen, into a system of dots which form the high lights, middle tones and shadows on the reproduced object. As a medium for breaking up the continuous tone into a half-tone, in the transmission of light from the object which is to be reproduced to the sensitized surface upon which the image is to be imposed, my invention preferably utilizes the lenticular screen of my prior U. S. Patent No. 1,887,872. The faithfulness of reproduction of such a process is primarily dependent upon the extent of the tonal scale of the number and pattern of the individual dots which go to make up the various high lights, middle tones and shadows. Since the intensity of any given dot reproduced upon the sensitized image-receiving plate is in turn dependent upon the intensity of the light source whose rays are transmitted to the sensitized plate, it is important that uniform light source intensity be maintained, particularly where a multiple light point pattern is employed as the light source, as in the case of my present invention.

The general object and nature of my invention, therefore, is to provide a photographic reproduction process of the nature above-indicated whereby an enlarged tonal scale, i. e., an increased gradation of half-tone dot patterns can be reproduced through the medium of the lenticular screen, and wherein a uniform intensity of multiple light point patterns is maintained.

Another object of my invention is to provide a reproduction apparatus wherein a single source of light is employed together with means for masking such single source into a multiple light point pattern, whereby the intensity of any given light point is no greater than any other, and all light points are in turn dependent for their intensity upon that of the original, single source.

Still another object of my invention is to provide an apparatus wherein the change from one multiple light point source pattern to another

2

may be quickly and easily accommodated by the operator.

Another object of the invention is to provide a removable member having a series of perforations therein forming light point patterns, which member can be conveniently replaced by an equivalent member having different patterns of perforations therein.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a diagrammatic view illustrating the principle of my invention;

Fig. 2 is a plan view of a portion of lenticular screen employed in the practice of my invention;

Fig. 3 is a sectional view taken upon line 3—3 of Fig. 2;

Fig. 4 is a front elevational view (partially broken away and partially in section) of the apparatus embodying my invention and adapted to perform the process thereof;

Fig. 5 is a detailed, front elevational view of the light source canopy or platform of the apparatus shown in Fig. 4;

Fig. 6 is a top plan view of Fig. 5 with the reflector removed;

Fig. 7 is an enlarged, detailed sectional view taken substantially along line 7—7 of Fig. 5; and

Fig. 8 is a detailed, plan view of the removable shutter disc.

The process of my invention is best illustrated by reference to Fig. 1 where S represents a single source of light, such as an incandescent light bulb, the light from which is masked by the opaque masking member M having a plurality of perforations therein, indicated at S₁ and S₂ which form a plurality of light points. The light rays from the light points S₁ for example, are transmitted through the continuous tone object indicated at O, and thence through the lens L of the lenticular screen to be focused upon the sensitized, image-receiving plate I. Thus, the light rays from the sources S₁ will be transmitted to the sensitized plate to form the dots I₁, respectively, such dots being in a pattern similar to that in which the light points S₁ are arranged. For each individual lens L of the lenticular

3

screen, a similar dot pattern will be reproduced on the sensitized plate.

Also shown in Fig. 1 is the light source S_0 located on the opposite side of the masking member M to that of the light source S . Light from the source S_0 is transmitted through the object O and the lens L to form the single dot I_0 on the image-receiving plate I . As will be subsequently pointed out, the purpose of the light source S_0 is to produce a single dot pattern for high lights, as distinguished from the multiple dot patterns for the middle tones and high lights produced by the light sources S_1 and S_2 .

Thus, where the continuous tone object to be reproduced is in the form of a photographic negative, the light from the points S_1 is transmitted through the object O , lens L to the sensitized plate I and the latter exposed for a sufficient time to produce the basis of a middle tone of the dots I_1 . Then, in order to produce a fuller gradation of half-tone dots, light from the points S_2 is similarly transmitted and the sensitized plate I exposed thereto, to produce the pattern of the dots I_2 , whereby the middle tone scale is further augmented and a basis for shadow values is reproduced. A third exposure of the plate I to yet a different light source pattern and preferably in the form of a single dot complements and enlarges the tonal scale to reproduce high lights. Thus, this third exposure of the plate I in order to produce single dot high lights is accomplished by means of light rays transmitted from the single light source S_0 through the object O , lens L to the sensitized plate I . It will also be appreciated by those skilled in the art, that the above-described process can be equally well adapted to the reproduction of a negative image from a photographic positive continuous tone plate or film.

It will thus be seen that different dot patterns can be reproduced on the sensitized plate, the dots of each pattern being different in arrangement with respect to the dot or dots of another pattern, and each individual lens of the lenticular screen reproducing these pattern groups. An extremely faithful half-tone reproduction is thus enabled to be made, since the number of individual dots which are transmitted through each individual lens are practically unlimited, and the gradation in tonal scale from high lights to shadows is indeed complete. Such gradation varies all the way from a single dot for high lights to a multiple number of dots for each half-tone screen lens area in the middle tones and shadows. Although the individual dots I_0 , I_1 and I_2 are shown as being separate and distinct from each other in Fig. 1, for the purpose of convenience in illustration, it will be understood by those skilled in the art, that in actual reproduction practice, the adjacent dots will partially overlap or merge one with the other in the middle tone and shadow patterns.

It should also be appreciated by those skilled in the art that my above-described process is of particular advantage in the reproduction of copy in the color plate or color gravure printing processes, wherein the different dot patterns can be utilized for reproducing different color value tones upon a series of sensitized plates.

The structure of the lenticular screen employed in the practice of my invention is illustrated in Figs. 2 and 3, and consists of a transparent sheet 1 having a plurality of planoconvex lenses 2 formed on its upper surface. Each one of the lenses 2 functions as the individual lens described

4

in connection with Fig. 1. Thus, for example, where there are 150 of the lenses 2 per inch in the lenticular screen (corresponding to "150 lines" per inch of the mechanical or ruled screen), it is possible to reproduce upon the sensitized plate a multiple number of dots (viz: four of the dots I_1 and four of the dots I_2) per individual lens 2 of the lenticular screen, thereby obtaining a highly flexible, or multiple tone effect from one and the same lenticular screen.

Now directing attention to Figs. 4-8, incl., the apparatus of my invention is seen to comprise the vertical supporting frame members 10, 11 and 12 which carry a horizontal table 13, located at convenient waist height of the operator. A vacuum frame 14 is mounted in the table 13 for holding the lenticular screen, continuous tone copy or image and the sensitized plate. Mounted upon the top of the supporting frame is the light canopy platform 15 which extends horizontally parallel to the table 13 and merges into the semi-circular portion 16.

The single light source, such as an incandescent bulb 17 is located at the center of the portion 16. A circular groove or channel 18 is provided on the top of the platform 15 for reception of the flange 19 of the bowl shaped reflector 20.

Radial slots, having tapered or beveled sides, are formed in the platform 15 and emanate from a center which is in vertical alignment with the light source 17. It will be noted that the shorter slots 21 are each of the same length and are each located at the same arcuate angle with respect to each other, viz., 90°, and that the same relationship maintains for the arcuate slots 22.

An opaque masking member or shutter disc 25 is mounted on the bottom of the platform 15 by means of the threaded bushing 26 bearing against the washer 27 and passing through a hole in the center of the disc 25. The disc 25 has a plurality of groups of holes or perforations a , b and c therethrough. By reference to Fig. 8, it will be seen that the holes a , for example, are equally radially spaced the distance R from the center of the disc 25 and are equally arcuately spaced, viz., 90°, from each other; that the groups of holes b and c are equally radially spaced the distance R' and R'' , respectively, from the center of the disc 25 and equally arcuately spaced from each other, but that each group is located on radial lines which are angularly offset from the radial lines of another group of holes.

A bracket 28 is attached by means of the plate 29 to the bottom of the disc 25. The bracket 28 carries a spring loaded detent 30 which is adapted to engage in depressions in the metallic rim 34 fastened to the front edge of the platform 15. These depressions are indicated at 31 and 32, and one is also located at the position of the detent 30 as shown in Figs. 5 and 6.

These depressions are located at points 15° removed from each other with respect to the center of the disc 25. Thus, when the detent 30 engages with the particular depression in the rim 34 as shown in Fig. 6, the holes b are in alignment with the radial slots 22, thus producing a multiple light point pattern emanating from the disc 25 which comprises the light passing through the slots 22 and the holes b . Similarly when the bracket 28 and disc 25 are moved to the position where the detent 30 engages with the depressions 31, thus aligning the slots 21 with the holes c , multiple light point patterns corresponding to that of the holes c are formed and transmitted from the single light source 17. Movement of

5

the disc 25 to the position where detent 30 engages depression 32 aligns slots 22 with holes a, and transmits light according to the pattern of that particular group of holes. In each respective position, the light is masked with respect to the groups of holes a, b or c, other than the particular one group which at the time is in alignment with the radial slots 21 or 22.

It will thus be seen, that the operator can simply and quickly change from one light source pattern to another by merely shifting the position of the bracket 23. If different patterns or sizes of light source holes are desired, another disc, similar to the disc 25, can be easily put in place thereof, and by the simple expedient of unfastening the bushing 26.

The bushing 26 also functions as a mounting socket for the light bulb 35 which in turn functions as the single light source S₀, previously described in connection with Fig. 1. A switch panel is shown on the front face of the table 13 and contains the electric switches 36, 37 and 38 for convenient operation of the vacuum frame 14, and the lights 17 and 35, respectively.

Other modes of applying the principle of my invention may be employed, instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:

1. Photographic reproduction apparatus comprising a photographic plate supporting frame, a single light source spaced from said frame, an opaque member positioned between said light source and said frame, a second opaque member superimposed on said opaque member, both of said opaque members having a plurality of spaced openings therein, and means for rotating said opaque members with respect to each other whereby the openings therein are placed in alignment.

2. Photographic reproduction apparatus comprising a photographic plate supporting frame, a single light source spaced from said frame, an opaque wall member located between said light source and said frame, a plurality of radially positioned openings in said wall member emanating centrally outwardly from said light source, and a rotatable circular shutter member overlying said wall member, said shutter member having its center in alignment with said light source, and also having perforations adapted to register selectively with said openings in said wall member at different rotative positions of said shutter member.

3. Photographic reproduction apparatus comprising a photographic plate supporting frame, a single light source spaced from said frame, an opaque wall member having a plurality of radial slots emanating centrally outwardly from said light source, said wall member being located between said light source and said frame, and a rotatable circular shutter member overlying said wall member, said shutter member having a plurality of groups of radially and arcuately spaced perforations, the perforations of one group being equally arcuately spaced with respect to each other and at the same arcuate angle as that of said radial openings but arcuately offset with respect to the perforations of another group, whereby rotation of said shutter member places said openings in alignment with different groups of said perforations.

6

4. Photographic reproduction apparatus comprising a photographic plate supporting frame, a single light source spaced from said frame, a bowl shaped reflector surrounding said light source on the side thereof opposite to said frame, an opaque wall enclosing said light source within said reflector and located on the side thereof toward said frame, a movable opaque wall superimposed on said first-named wall, both of said opaque walls having spaced openings therein, and means for rotating said opaque members with respect to each other whereby the openings therein are placed in alignment.

5. Photographic reproduction apparatus comprising a photographic plate supporting table, a light supporting platform mounted above said table, a light source on the top and center of said platform, a plurality of radially extending slots in said platform emanating outwardly from said light source, an opaque disc rotatably mounted against said platform, the center of said disc being in alignment with the center of said radial slots, said disc having a plurality of radially and arcuately spaced holes, and means accessible to the operator for rotating said disc to different positions, whereby different groups of said holes are moved into registry with said radial slots.

6. Photographic reproduction apparatus comprising a photographic plate supporting table, a light supporting platform mounted above said table, a light source on the top and center of said platform, a plurality of radially extending slots in said platform emanating outwardly from said light source, an opaque disc rotatably mounted against said platform, the center of said disc being in alignment with the center of said radial slots, said disc having a plurality of radially and arcuately spaced holes, means accessible to the operator for rotating said disc to different positions, whereby different groups of said holes are moved into registry with said radial slots and a second light source mounted below and centrally of said platform.

7. Photographic reproduction apparatus comprising a photographic plate supporting table, a light supporting platform mounted above said table, a light source mounted above and centrally of said platform, a plurality of radially extending slots in said platform emanating outwardly from said light source, an opaque disc rotatably mounted against said platform, the center of said disc being in alignment with the center of said radial slots, said disc having a plurality of radially and arcuately spaced holes, means accessible to the operator for rotating said disc to different positions, whereby different groups of said holes are moved into registry with said radial slots, means for removably attaching said disc to said platform, and means for independently controlling both of said light sources.

8. Photographic reproduction apparatus comprising a photographic plate supporting table, a light supporting platform mounted above said table, a light source mounted above and centrally of said platform, a plurality of radially extending slots in said platform emanating outwardly from said light source, an opaque disc rotatably mounted against said platform, the center of said disc being in alignment with the center of said radial slots, said disc having a plurality of radially and arcuately spaced holes, means accessible to the operator for rotating said disc to different positions, whereby different groups of said holes are moved into registry with said

7

radial slots, and means for removably attaching said disc to said platform.

9. Photographic reproduction apparatus comprising a photographic plate supporting table, a light supporting platform mounted above said table, a light source mounted above and centrally of said platform, a bowl shaped reflector on top of said platform and enclosing said light source, a plurality of radially extending slots in said platform emanating outwardly from said light source, an opaque disc rotatably mounted against the bottom of said platform, the center of said disc being in alignment with the center of said radial slots, said disc having a plurality of radially and arcuately spaced holes, means accessible to the operator for rotating said disc to different positions whereby different groups of said holes are moved into registry with said radial

8

slots, a detent for holding said disc in selected rotative position, and means for removably attaching said disc to said platform.

10. The method of photographically transforming a continuous tone object into an interrupted tone image thereof on a light sensitive plate with a single source of light and an interposed half-tone screen, comprising acting upon the sensitive plate by the light projected through such object and screen by masking the light from said source into a predetermined pattern of a plurality of dots, maintaining the said light source, object, screen and plate in unchanged position, and acting upon the light sensitive plate with the light projected through the object and screen masked into a different pattern of dots.

VICTOR C. ERNST.

Certificate of Correction

Patent No. 2,414,938.

January 28, 1947.

VICTOR C. ERNST

It is hereby certified that the name of the assignee in the above numbered patent was erroneously described and specified as "The Fulton Tone Process Company" whereas said name should have been described and specified as *The Full Tone Process Company*, as shown by the record of assignments in this Office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 15th day of April, A. D. 1947.

[SEAL]

LESLIE FRAZER,

First Assistant Commissioner of Patents.

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[SEAL]

LESLIE FRAZER,

First Assistant Commissioner of Patents.