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CROSS REFERENCE
EXAMINEI

Sept. 11, 1934. C. F. SMITH 1,973,512

PHOTOGRAPHIC PRINTING APPARATUS

Filed Oct. 13, 1932 6 Sheets-Sheet 1

Fig. 1.

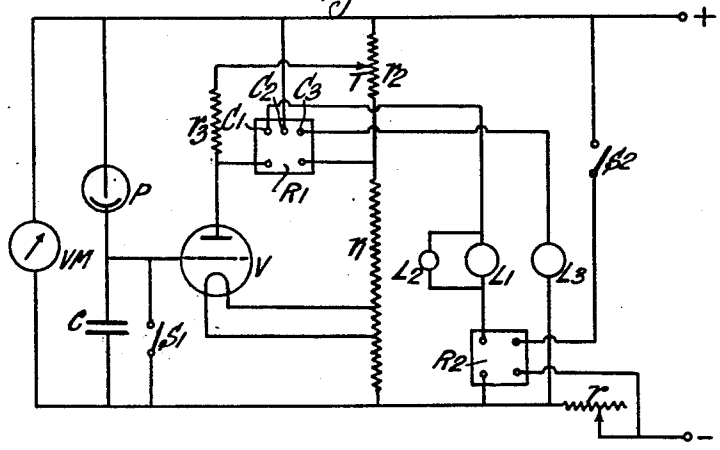
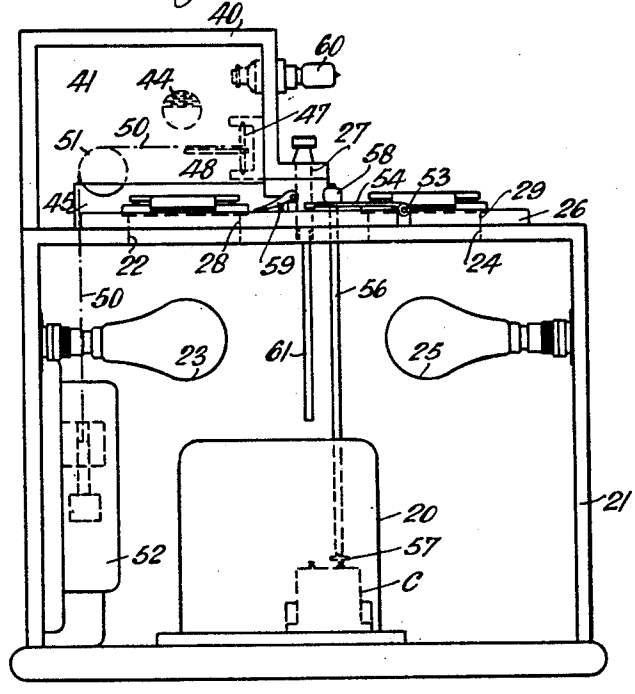


Fig. 2.



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Fig. 3.

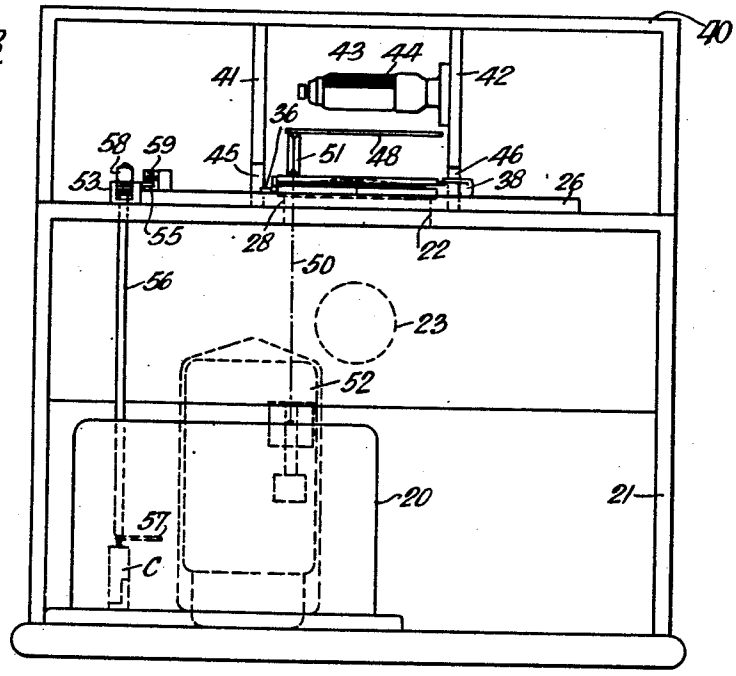
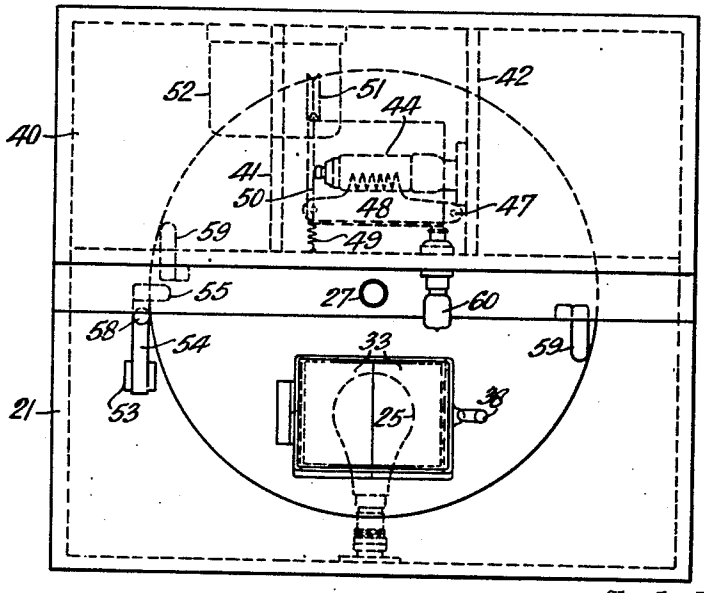


Fig. 4.



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PHOTOGRAPHIC PRINTING APPARATUS

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Fig. 5

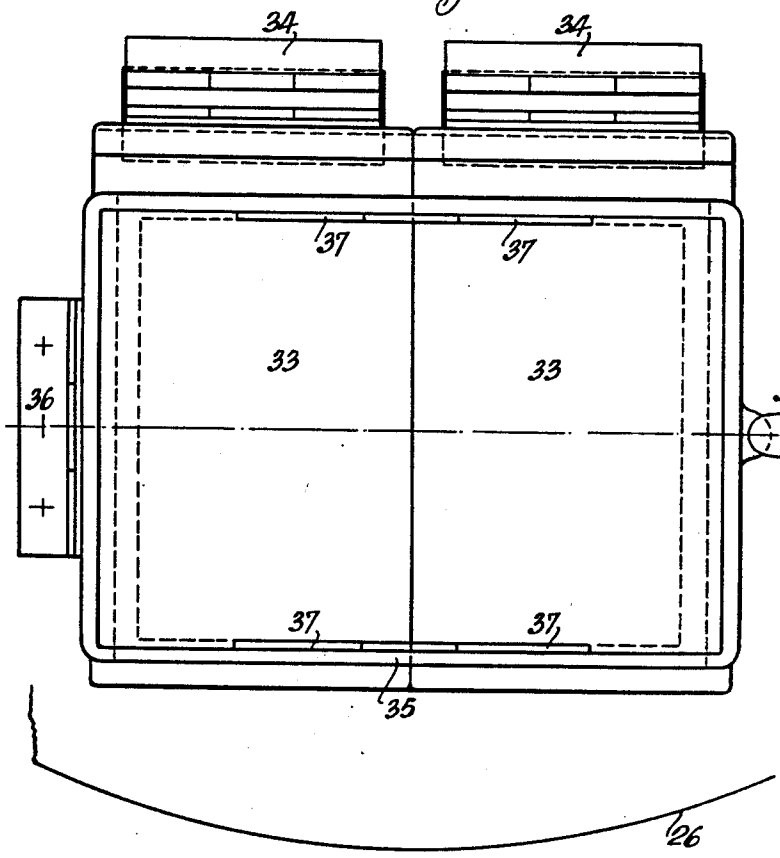


Fig. 6

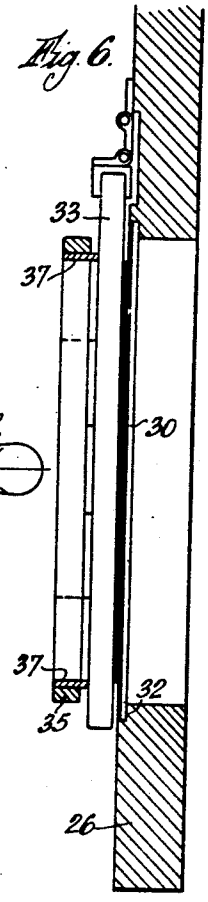
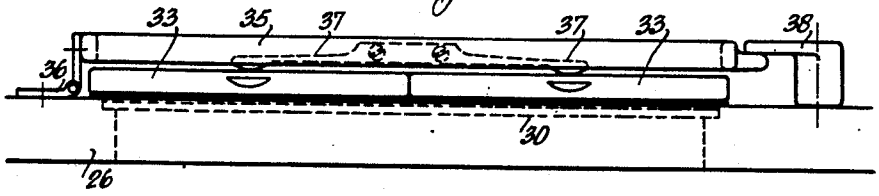


Fig. 7



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Fig. 9.

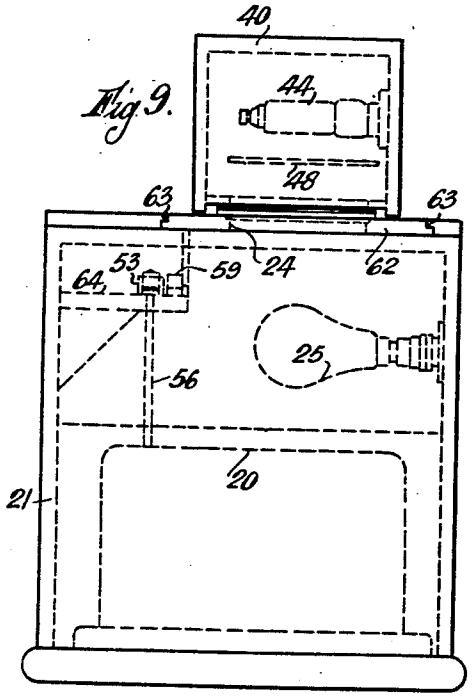


Fig. 10.

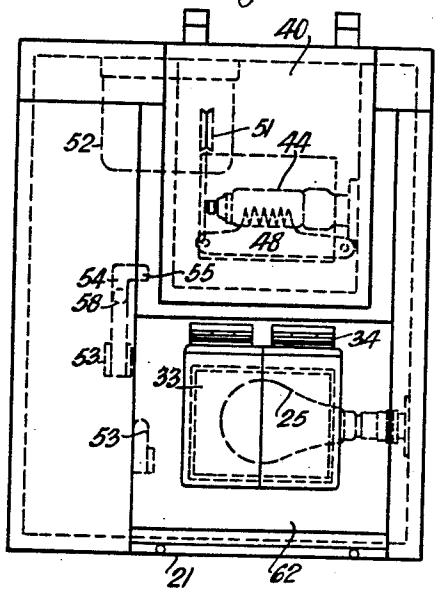
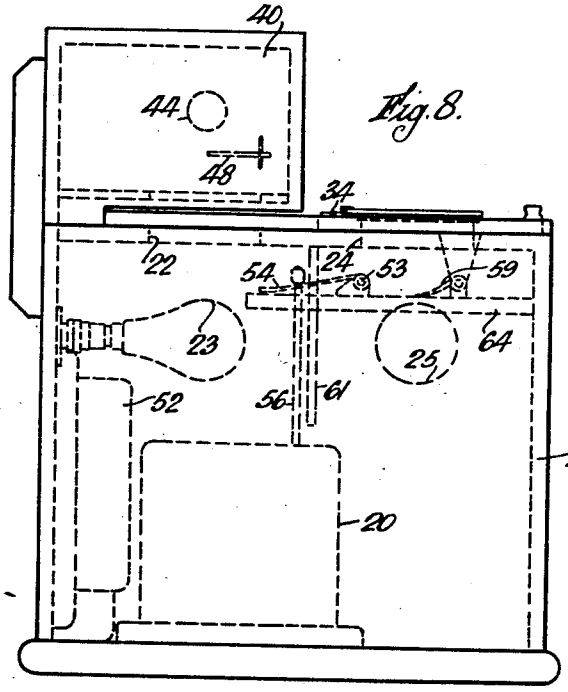


Fig. 8.



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PHOTOGRAPHIC PRINTING APPARATUS

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Fig. 13.

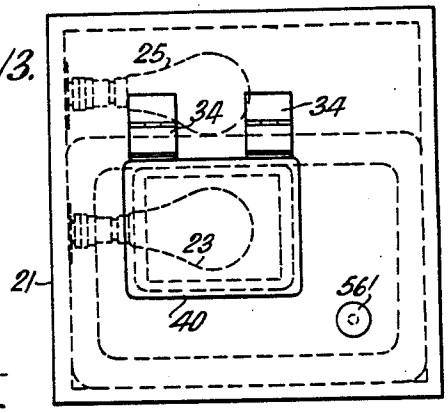


Fig. 14.

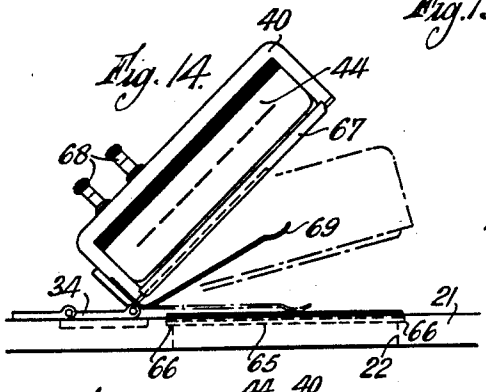


Fig. 11.

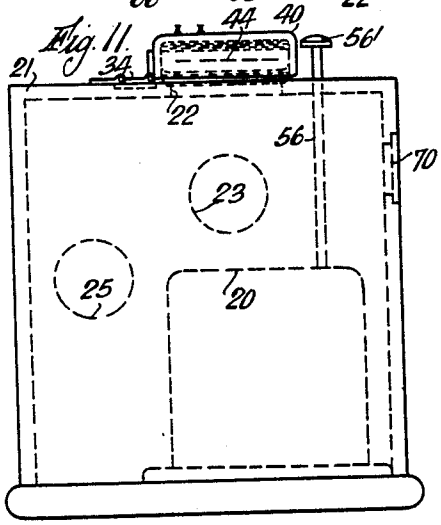


Fig. 12.

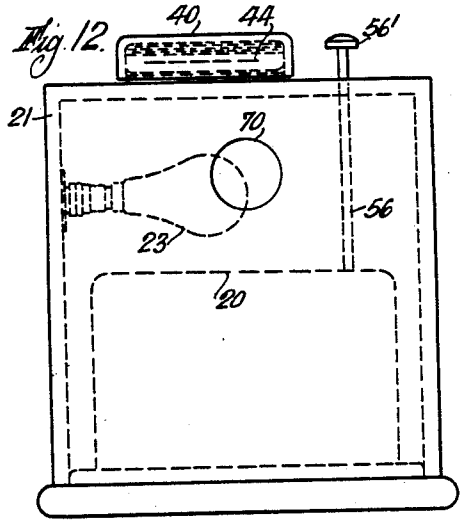


Fig. 15.

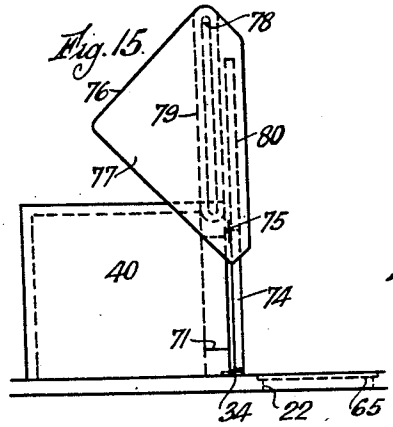
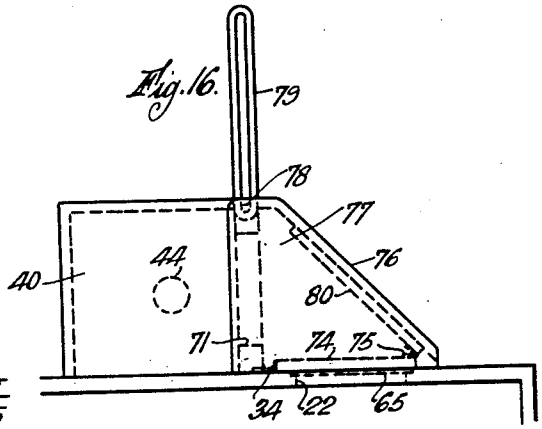


Fig. 16.



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PHOTOGRAPHIC PRINTING APPARATUS

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Fig. 17.

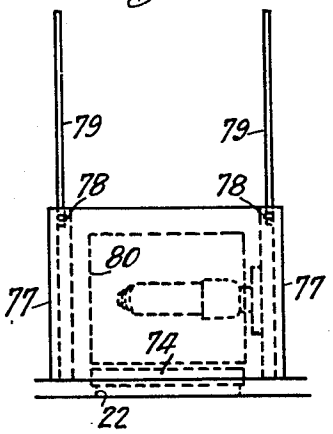


Fig. 11a.

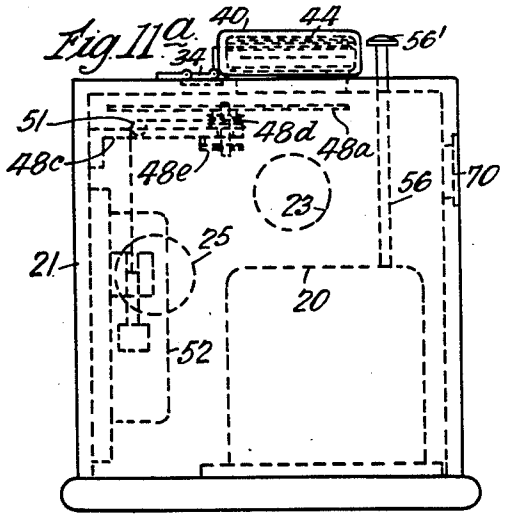


Fig. 18.

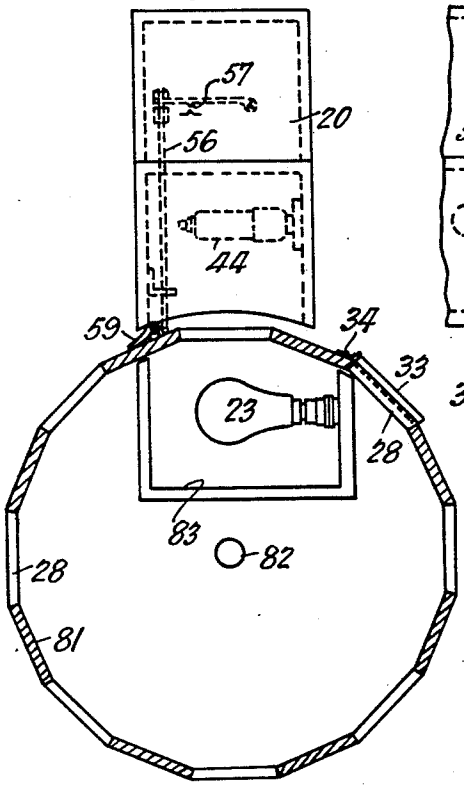
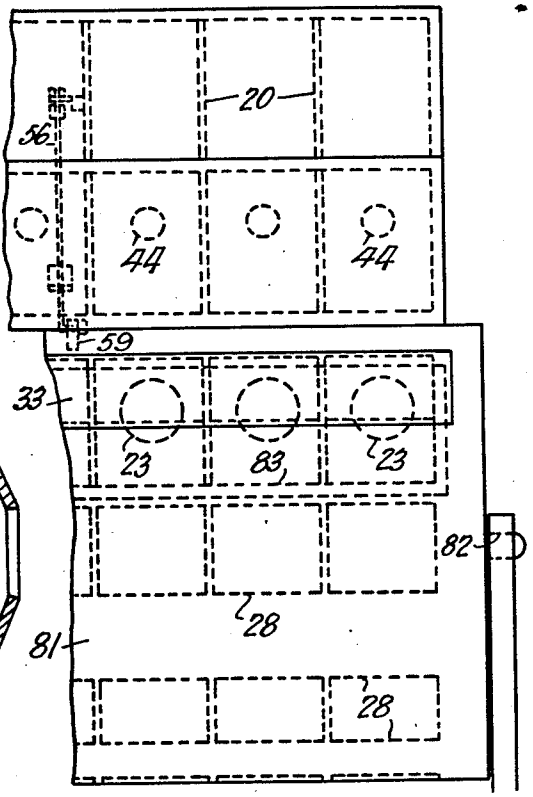


Fig. 19.



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Patented Sept. 11, 1934 1,973,512

UNITED STATES PATENT OFFICE

1,973,512

PHOTOGRAPHIC PRINTING APPARATUS

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Application October 13, 1932, Serial No. 637,587
In Great Britain October 27, 1931

10 Claims. (Cl. 95—73)

The present invention relates to photographic printing apparatus, and more particularly to photographic printing apparatus having automatic means for regulating the quantum of light (i. e. product of intensity of illumination and time of exposure) falling on the printing surface for the purpose of securing uniform printing.

In U. S. Patent No. 1,939,243, issued December 12, 1933 to Frank Twyman there is described automatic exposure determining means comprising a light sensitive device (e. g. a photo-electric cell) exposed to the influence of light transmitted through the negative, an electric storage device (e. g. a condenser) adapted to be charged by current under control of the light sensitive device, and an electric relay adapted to be operated to terminate the exposure when the storage device has been charged to a certain point. In the particular embodiments described and illustrated in the drawings in the said patent to Twyman, the prints (which if desired may be enlargements) are made by projecting the negative image on the printing surface. The present invention, however, is concerned with contact printing.

According to the present invention in apparatus for the automatic control of exposure in photographic printing, which comprises a light sensitive device exposed to light of an intensity bearing a predetermined relation to the intensity of illumination of the printing surface, means for integrating the response of said device with respect to time. and means for cutting off the printing light when the integrated response has reached a predetermined value, the light sensitive device is positioned to receive light transmitted through the printing medium whereby contact printing may be effected.

In the preferred method of carrying out the invention, the combination of a photo-electric cell, a condenser adapted to be charged by the output of said cell and a thermionic valve whose grid-cathode space is connected across said condenser is utilized in a manner generally similar to that set forth in the Twyman patent.

In the Twyman patent it has further been shown that for correct exposure the quantum of light required is not constant for negatives of varying density and various arrangements have been described in the said specification whereby this departure from what is known as Bunsen's reciprocity law (viz. that to produce a given density the intensity of illumination multiplied by time of exposure must be constant) may be compensated for. Any of these arrangements may be utilized in carrying out the present invention, but it is preferred progressively to screen the light-sensitive device during the time of the exposure so as gradually to reduce the amount of light falling thereon, whereby in the case of denser negatives the time of exposure is increased to a greater extent than would otherwise be the case.

The invention is illustrated in the accompanying drawings which show diagrammatically various forms of contact printing apparatus in accordance with the said invention.

In the drawings, Figure 1 is a circuit diagram showing the connections of the various elements in a preferred exposure determining device applicable to any of the constructions to be described. Figures 2, 3 and 4 respectively are side, front and plan views of one form of contact printer. Figures 5, 6 and 7 are respectively a plan and side and front elevation to an enlarged scale of the printing frame employed in the apparatus shown in Figures 1, 2 and 3. Figures 8, 9 and 10 are respectively side, front and plan views of a modified form of contact printer and figures 11, 12 and 13 are similar views of a further modification, Figure 14 being a detail view to an enlarged scale of the combined printing frame and photo-electric cell structure shown in Figures 11, 12 and 13. Fig. 11*a* shows the printer of Fig. 11 provided with a light modifying device for varying the response of the light cell. Figures 15, 16 and 17 show an alternative form of printing frame while Figures 18 and 19 show diagrammatically an arrangement whereby a number of prints may be made simultaneously.

Referring to Figure 1, which shows a modification of the circuit arrangement of the exposure determining device described in the above Twyman patent a photo-electric cell P, adapted to receive light passing through a negative and the printing medium in contact therewith, is connected as shown in series with a condenser *c* and a variable resistance *r* to a suitable source of direct current potential, the junction point of the cathode of the cell and the condenser being connected to the grid of a thermionic valve V, suitable anode, filament and grid bias potential for said valve being obtained from tappings upon a potential dividing resistance *r*1. The actuating winding of an electromagnetic relay R1 is connected in the anode circuit of the valve V and an adjustable tapping T on a resistance *r*2 in series with resistance *r*1 is connected through a resistance *r*3 to the valve anode to provide a

convenient means of adjustment of the value of anode current at which the relay R1 is set to "trip". A switch S1 is connected in parallel with the condenser c.

The relay R1 comprises three contacts C1, C2, C3. When the valve anode current flowing through the relay R1 is below a predetermined value, a circuit is completed between the contacts C1 and C2, and when the anode current rises above the said predetermined value, the contacts C1 and C2 are open-circuited and a circuit is simultaneously completed between contacts C2 and C3. It will be seen, therefore, that the relay acts as a single pole change-over switch. Contacts C1, C2 are in series with a lamp L1 for supplying the printing light in parallel with which is a signal lamp L2. Contacts C2, C3 are in series with a third lamp L3. Th lamp L3 may be employed as a "masking" lamp in a manner to be described later, and is adapted to replace the load which is thrown off when the lamps L1 L2 are extinguished by the tripping of relay R1. The lamp L2 may be of the "neon" type whose load is negligible, in which case the lamps L1 and L3 may be of similar rating. If a separate masking lamp which is permanently illuminated be employed, the lamp L3 may be replaced by a "ballast" resistance of appropriate value. In series with the lamp L1 is a time delay relay R2 adapted to be "set" by means of a switch S2 connected across the source of supply and the purpose of which will be described later.

A voltmeter VM is connected between the resistance r and the positive terminal of the source of supply, the voltage being maintained constant while the apparatus is in use by adjustment of the value of r.

In operation, an exposure is started by momentarily closing switches S1 and S2, condenser c thus being negatively charged by an amount depending upon the potential difference between the negative end of the filament of valve V and the low potential end of resistance r1 and a circuit being simultaneously completed through relay R2. The charge on condenser c reduces the potential of the grid of valve V and the anode current drops to a low value such that a circuit is completed between the contacts C1, C2 of relay R1 and the printing lamp L1 and the signal lamp L2 are illuminated. Current immediately starts to flow through the photo-electric cell P, due to the light passing through the negative and the printing medium, thus gradually reducing the charge on the condenser c, the grid of the valve V meanwhile becoming gradually more positive. When the anode current rises above a value determined by the setting of relay R1, the said relay trips and terminates the exposure. The relay R2 is set to "trip" (i. e. to open the printing lamp circuit) after a time delay of about one minute, in order to terminate the exposure at the end of that time in cases where exceptionally dense negatives are being printed, and which would normally require an exposure of greater length than one minute. Such negatives are more economically printed by hand in the normal manner.

Referring now to Figures 2, 3 and 4, the essential elements of the exposure determining device with the exception of the photo-electric cell are arranged as a unit and are contained in a box 20. The box 20 is located in an enclosing cabinet 21. An aperture 22 (herein termed "the printing aperture") somewhat larger than the overall dimensions of the negatives to be printed, is formed in the top of the cabinet directly over a printing lamp 23. A similar aperture 24 (herein termed "the masking aperture") is located directly over a second lamp 25. Rotatably mounted in close contact with the top of the cabinet is a turntable 26 adapted to rotate about a spindle 27 and having two diametrically opposed apertures 28 and 29 similar to and adapted to coincide with the apertures 22 and 24 when the turntable 26 is in the position shown in the drawings.

A transparent backed printing frame (shown in greater detail in Figures 5, 6 and 7) is arranged over each of the apertures 28, 29 and comprises a sheet of glass 30 let into a recess 32 so as to lie flush with the upper surface of the turntable and a transparent back consisting of two pieces of plate glass 33 hinged to the upper surface by means of double hinges 34 to enable the glass backing pieces 33 to make uniform contact with the printing paper which is placed together with the negative to be printed and a suitable mask between the glasses 30 and 33. A metal frame 35 is hinged at 36 to the top of the turntable and is provided with spring arms 37 adapted to engage the back of the glass pieces 33 to clamp the latter in position when the frame is loaded, the frame 35 being held down by means of a catch 38.

Referring again to Figures 2, 3 and 4, a cover 40 is arranged over the printing aperture 22, said cover being provided with partitions 41, 42 to form a substantially light-tight chamber 43 adapted to contain a photo-electric cell 44. The partitions 41, 42 are cut away as shown at 45, 46 to provide sufficient clearance for the turntable. Mounted on a pivot 47 within the cover 40 is a comb-like member 48 having wedge-shaped teeth. The "comb" 48 is adapted to be moved against the tension of a spring 49 progressively to intercept the light reaching the photo-electric cell through the printing frame over the aperture 22 in the course of an exposure by means of a cord or cable 50 passing over a guide pulley 51. The cord 50 is actuated by means of the time delay mechanism of a time relay 52 (to be described later).

Pivoted to the top of the cabinet at 53 is an arm 54 having a tongue 55 positioned over the edge of the turntable 26. Passing through a hole in the arm 54 is a rod 56 which rests on and is resiliently supported by a spring contact 57 which in conjunction with one terminal of the condenser c constitutes the switch S1. A collar 58 is provided on the upper end of the rod 56 and a pair of pawls 59 is pivoted to the turntable near the edge thereof in diametrically opposite positions such that shortly before a printing frame comes into position over the printing aperture when the turntable is rotated clockwise, one of said pawls will slide under the tongue 55 on the arm 54 and will raise the latter together with the rod 56 and will then allow the arm and rod to drop suddenly. The resilience of the spring contact 57 is so adjusted that when the rod 56 is suddenly dropped as described the contact 57 makes a momentary connection with the terminal of the condenser c, thus setting the exposure timing circuit.

The time delay relay 52 is of a type well known per se and comprises a clockwork escapement mechanism driven by a weight which forms the core of a solenoid. If the solenoid is momentarily energized, the solenoid is drawn up and then descends slowly as it drives the escapement. The cord 50 is attached to this weight, so that

the "comb" 48 is slowly moved between the photo-electric cell 44 and the printing frame over the printing aperture as the weight descends. At or near the end of the downward travel of the weight, the relay operates to switch off the printing lamp 23. This control is in addition to that provided by the exposure determining device and is adapted to set a predetermined maximum to the exposure to be given in the case of exceptionally dense negatives. The relay 52 is preferably set to trip at the end of an exposure of about one minute, thereby cutting off the light, whether or not the exposure determining device has tripped. This relay corresponds to the relay R2 in Figure 1.

The solenoid of the time relay 52 may be energized to set the relay prior to the commencement of an exposure by means of any convenient contact device actuated by the turntable when the latter is moved to bring a printing frame into printing position. For example, a mercury switch S2 may be mounted on the arm 54 this switch being rocked momentarily to close the solenoid circuit when a pawl 59 passes under the tongue 55. It will be seen that if the turntable is rotated in a counter-clockwise direction, the pawls 59 will ride over the tongue 55 and no exposure will take place.

A screen 61 is provided to prevent light from the printing lamp reaching the masking aperture 24.

A signal lamp 60 is provided to indicate when an exposure is being made, this lamp being connected, for example, in parallel with the printing lamp 23 so as to be switched on and off with the printing lamp.

In operation the printing frame lying over the masking aperture 24 is loaded with a negative and printing paper, correct positioning and masking being facilitated by the lamp 25 which is preferably of the "neon" type emitting substantially non-actinic light. The turntable is then rotated to bring the loaded printing frame over the printing aperture 22, the exposure timing device being automatically set by means of one of the pawls, 59. While the exposure is in progress, the second printing frame may be loaded, and upon completion of the exposure as indicated by the indicating lamp 60, the turntable is again rotated to bring the second printing frame into the printing position.

The arrangement shown in Figures 8, 9 and 10 differs only in detail from that in Figures 2, 3 and 4, similar reference numerals being used for corresponding parts. It will be seen that the overall width of the cabinet has been considerably reduced by reason of the fact that for the turntable arrangement a single sliding printing frame has been substituted. The printing frame proper is substantially the same as that shown in Figures 5, 6 and 7, but it has been mounted in a sliding panel 62 adapted to slide in guides 63 so as to bring the printing frame over the printing aperture 22 or the masking aperture 24 as desired. The width of the cover 40 has also been reduced and is arranged as shown to overhang the printing aperture with sufficient clearance to admit the sliding printing frame.

A single pawl 59 is pivoted to a bracket attached to the lower side of the panel 62 and engages as before a tongue 55 on an arm 54 which in the construction now under consideration is mounted on a pivot 53 attached to a shelf 64 within the cabinet and through which the rod 56 passes. It is believed that the construction and operation of this modification will be obvious without further explanation.

In the modification illustrated in Figures 11 to 14, the construction has been greatly simplified and the overall dimensions reduced to a minimum. In this arrangement the photo-electric cell and the compartment therefor and the printing frame have been combined in a single unit. The printing aperture 22 in the top of the cabinet is closed by a sheet of glass 65 let into a recess 66 so as to lie flush with the top of the cabinet. The back of the printing frame consists of a single sheet of glass 67 forming the lower side of the cover 40, the photo-electric cell 44 being of special construction to conform closely to the internal dimensions of the cover. The electrodes of the photo-electric cell are connected to terminals 68 on the top of the cover 40, and are coupled by flexible leads to the timing device. The cover 40 is hinged to the top of the cabinet by a double hinge 34 and a light spring 69 is attached to the cover to make contact with the back of a piece of printing paper in the printing frame when in the position shown by the dotted lines to hold said paper before it is released by the fingers after placing it in position and before the cover 40 has been completely closed down. The masking lamp 25 in this construction is adapted to emit substantially non-actinic light only and may be of the "neon" type.

In operation the exposure is started by momentarily depressing by hand the knob 56' provided on the end of rod 56. A window 70 is provided in the cabinet to enable the operator to see when the exposure has been completed. In this construction compensation for Bunsen's reciprocity law may be effected by utilizing the time relay device utilized in the previously described construction to traverse a "density wedge" in front of the printing lamp during an exposure, said density wedge comprising for example a rotatably mounted circular screen of a blue colour and of gradually increasing opacity adapted gradually to reduce the amount of red light reaching the photoelectric cell (which is preferably sensitive to the visible spectrum) without materially affecting the blue printing light, thus extending the exposure to compensate for the failure of Bunsen's reciprocity law.

Such an alternative arrangement is shown schematically in Figure 11*a* wherein the density wedge is shown at 48*a* mounted upon a vertical spindle 48*b* rotatable in a bearing bracket 48*c*. The density wedge is rotated by a pulley 48*d* about which is wrapped a cord 50 which passes over a guide pulley 51 and is connected to the plunger of the time delay relay device 52. The density wedge is urged to a normal position by means of a light spiral spring 48*e* anchored at one end to the spindle 48*b* and at the other end to the bracket member 48*c*.

An alternative printing frame and photoelectric cell arrangement utilizing a cell of usual construction is shown in Figures 15, 16 and 17. In this arrangement the cover 40, containing the photoelectric cell 44, is located not over the printing aperture 22 but to one side thereof. The cover 40 is provided with an aperture 71 of substantially the same dimensions as the printing aperture 22. The printing aperture is provided as in the previously described construction with a glass sheet 65 upon which the negative to be printed is placed. The back of the printing frame is formed by a glass sheet 74 attached at one edge by a double hinge 34 to the top of the cabinet and at the op-

posite edge by a hinge 75 to a hood 76 which in the position shown in Figure 16 covers both the printing aperture and the aperture 71. The side walls 77 of the hood are arranged to embrace the sides of the cover 40 and the printing frame back 74 and thus the hood, when in the closed position excludes extraneous light from the photoelectric cell 44. Inwardly projecting from the walls 77 of the hood are pins 78 adapted to slide in slots in upstanding guides 79 mounted on the cover 40. It will be seen that if the hood is raised the glass backing piece 74 will fold up against the aperture 71, the pins 78 sliding up the slotted guides 79. When the hood is in this position, a negative and a piece of printing paper may be placed over the printing aperture. When the hood is lowered, the glass backing 74 folds down over the negative and printing paper, as shown in Figure 16. A mirror 80 is secured to the inside of the sloping front of the hood, said mirror being adapted to reflect light passing through the printing paper from the printing lamp on to the photoelectric cell when the hood is closed and printing is in progress.

It has been proposed and it is anticipated that in the future it may become the standard practice to provide roll film as commonly used in ordinary roll film cameras at the present time with marginal perforations after the manner of motion picture films, the purpose of the proposed perforations being that cameras utilizing such film may then be provided with a film traversing mechanism which shall be capable of traversing the film by a predetermined fixed amount between each picture, whereby the pictures may be accurately and uniformly spaced upon the film. One of the advantages obtainable from such an arrangement is that a complete film of (say) eight exposures can be "masked' by a single mask having eight uniformly spaced apertures of appropriate dimensions, thus enabling the complete film to be printed at one time.

A multiple printing machine in accordance with the present invention and adapted to print a complete film of the kind above set forth at one time is illustrated diagrammatically in Figures 18 and 19. This machine comprises a series of units arranged side by side and corresponding in number to the number of pictures on a complete film. Each unit comprises a photo-electric cell 44 arranged above a printing aperture 22 and an exposure determining device arranged in a compartment 20. The "printing frame" comprises a hollow drum 81 of polygonal section and rotatably mounted upon a shaft 82, a series of glazed apertures 28 being formed in alternate faces of the drum. Hinged glass covers 33 are provided over each aperture 28 for the purpose of clamping the film and printing medium in position. The exposure timing circuits of all the units are set by means of a single switch contact 57 by means of a rod 56 which is raised and then dropped by a pawl 59 engaging the lower end thereof upon rotation of the drum 81 in a manner similar to that described in connection with the embodiments illustrated in Figures 2, 3, 4 and 8, 9, 10. A series of printing lamps 23, each controlled by the appropriate timing unit, is mounted within the hollow drum 81 each lamp being enclosed in a compartment 83 as shown. It will be seen that the printing frames may be loaded on one side of the machine (masking being facilitated by means of a masking lamp 25 located within the drum) and unloaded on the other side. A single time relay common to all the timing units may be provided for cutting off the exposure at the end of, say, one minute, whether or not the timing units have tripped.

What I claim is:—

1. Apparatus for the automatic control of exposure in photographic contact printing and comprising a substantially light-tight chamber a printing light within said chamber, an aperture in said chamber positioned to be illuminated by the printing light therein, means transparent to light for clamping a negative together with a piece of printing paper in position over said aperture, a photoelectric cell external to said chamber and positioned to receive light transmitted through the printing paper a condenser in series with said cell, a thermionic valve whose grid and cathode are connected across the terminals of said condenser, a relay controlled by the output current of said valve for cutting off said printing light and screening means movably mounted over the said aperture in the light-tight chamber and means for gradually and progressively interposing said screening means between the printing medium and the photoelectric cell during the exposure.

2. Apparatus for the automatic control of exposure in photographic contact printing and comprising a substantially light-tight chamber a printing light within said chamber, an aperture in said chamber positioned to be illuminated by the printing light therein means transparent to light for clamping a negative together with a piece of printing paper in position over said aperture, a photoelectric cell external to said chamber and positioned to receive light transmitted through the printing paper a condenser in series with said cell, a thermionic valve whose grid and cathode are connected across the terminals of said condenser, a relay controlled by the output current of said valve for cutting off said printing light, and a time delay relay adapted to be set at the commencement of an exposure for controlling the maximum length of exposure.

3. Apparatus for the automatic control of exposure in photographic contact printing and comprising a substantially light-tight chamber a printing light within said chamber, an aperture in said chamber positioned to be illuminated by the printing light therein, means transparent to light for clamping a negative together with a piece of printing paper in position over said aperture, a photoelectric cell external to said chamber and positioned to receive light transmitted through the printing paper a condenser in series with said cell, a thermionic valve whose grid and cathode are connected across the terminals of said condenser, a relay controlled by the output current of said valve for cutting off said printing light, screening means movably mounted over said printing aperture and a time delay relay for controlling the maximum length of exposure said relay including a clock-work mechanism operatively associated with said screening means whereby said screening means is gradually and progressively interposed between the printing medium and the photoelectric cell during the exposure.

4. Apparatus for the automatic control of exposure in photographic contact printing and comprising a substantially light-tight chamber, a printing light within said chamber, an aperture in said chamber positioned to be illuminated by the printing light therein means transparent to light for clamping a negative together with a piece of printing paper in position over said aperture, a

photoelectric cell external to said chamber and mounted upon the back of said transparent clamping means, a light-tight cover over said cell, said clamping means, cell and cover forming a unit hingedly mounted upon the light-tight chamber adjacent the printing aperture, a condenser in series with said cell, a thermionic valve whose grid and cathode are connected across the terminals of said condenser and a relay controlled by the output current of said valve for cutting off said printing light.

5. Apparatus for the automatic control of exposure in photographic contact printing and comprising a substantially light-tight chamber a printing light within said chamber, an aperture in said chamber positioned to be illuminated by the printing light therein, means transparent to light for clamping a negative together with a piece of printing paper in position over said aperture, a photoelectric cell external to said chamber and mounted upon the back of said transparent clamping means, a light-tight cover over said cell, said clamping means, cell and cover forming a unit hingedly mounted upon the light-tight chamber adjacent the printing aperture, a condenser in series with said cell, means for progressively varying during printing the intensity of the light activating said cell, a thermionic valve whose grid and cathode are connected across the terminals of said condenser and a relay controlled by the output current of said valve for cutting off said printing light.

6. Apparatus as claimed in claim 4 in which a photoelectric cell sensitive to the visible spectrum is employed and comprising a density wedge, of colour adapted to pass actinic light and of progressively increasing opacity to non-actinic light and means for gradually traversing said density wedge between the printing light and the negative during an exposure for compensaton of Bunsen's reciprocity law.

7. Apparatus for the automatic control of exposure in photographic contact printing and comprising a substantially light-tight chamber a printing light within said chamber, an aperture in said chamber positioned to be illuminated by the printing light therein, means transparent to light for clamping a negative together with a piece of printing paper in position over said aperture, a photoelectric cell external to said chamber and located to one side of the printing aperture, a hinged glass cover adapted to clamp the negative and printing paper in position over the printing aperture, screening means associated with said glass cover and adapted when printing is in progress to exclude extraneous light from the photo-electric cell, means for reflecting light passing through the printing medium on to said cell, a condenser in series with said cell, a thermionic valve whose grid and cathode are connected across the terminals of said condenser and a relay controlled by the output current of said valve for cutting off said printing light.

8. Apparatus as claimed in claim 7 and comprising a fixed screening cover adapted to enclose the photo-electric cell and having an aperture at the side adjacent the printing aperture, and a hood member hinged to the glass clamping cover and adapted to exclude extraneous light from the photo-electric cell, and a reflecting surface within said hood for directing light passing through the printing medium on to said cell.

9. Apparatus for the automatic control of exposure in photographic contact printing and adapted to print a number of negatives uniformly spaced upon a continuous strip of film simultaneously said apparatus comprising a plurality of exposure determining units arranged side by side and each including a photoelectric cell in a separate compartment having an aperture in one wall thereof, means for positioning said continuous strip of film together with a continuous strip of printing material in contact therewith so that each negative on said film comes opposite a separate aperture, independent means for illuminating each negative, each exposure determining unit including further a condenser in series with the photoelectric cell, a thermionic valve whose grid and cathode are connected across the terminals of said condenser and a relay actuated by the anode current of said valve for cutting off the appropriate source of printing illumination when the appropriate condenser has been charged to a predetermined extent.

10. Apparatus as claimed in claim 9 and comprising a hollow drum of polygonal cross section, a series of printing apertures corresponding to the apertures in the photoelectric cell, compartments in each alternate face of the drum, means transparent to light for clamping a continuous strip of film and printing paper or the like over said apertures, said drum being rotatably mounted whereby each series of printing apertures may be brought opposite said apertures in the said photoelectric cell compartments.

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