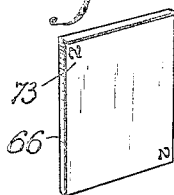


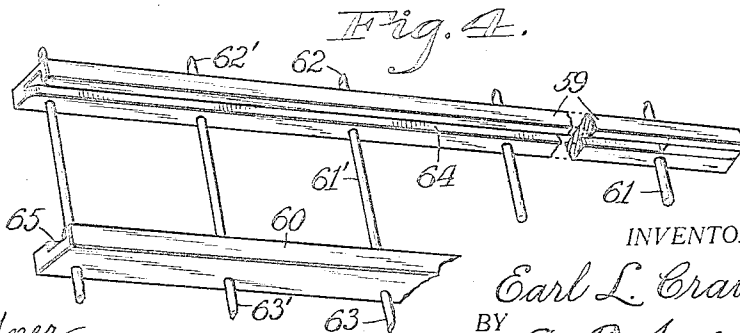
1,159,650.

3 SHEETS—SHEET 1.



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MOVING PICTURE FILM PRINTING MACHINE.
APPLICATION FILED NOV. 19, 1913.

Patented Nov. 9, 1915.
3 SHEETS—SHEET 2.

1,159,650.

Fig. 5.

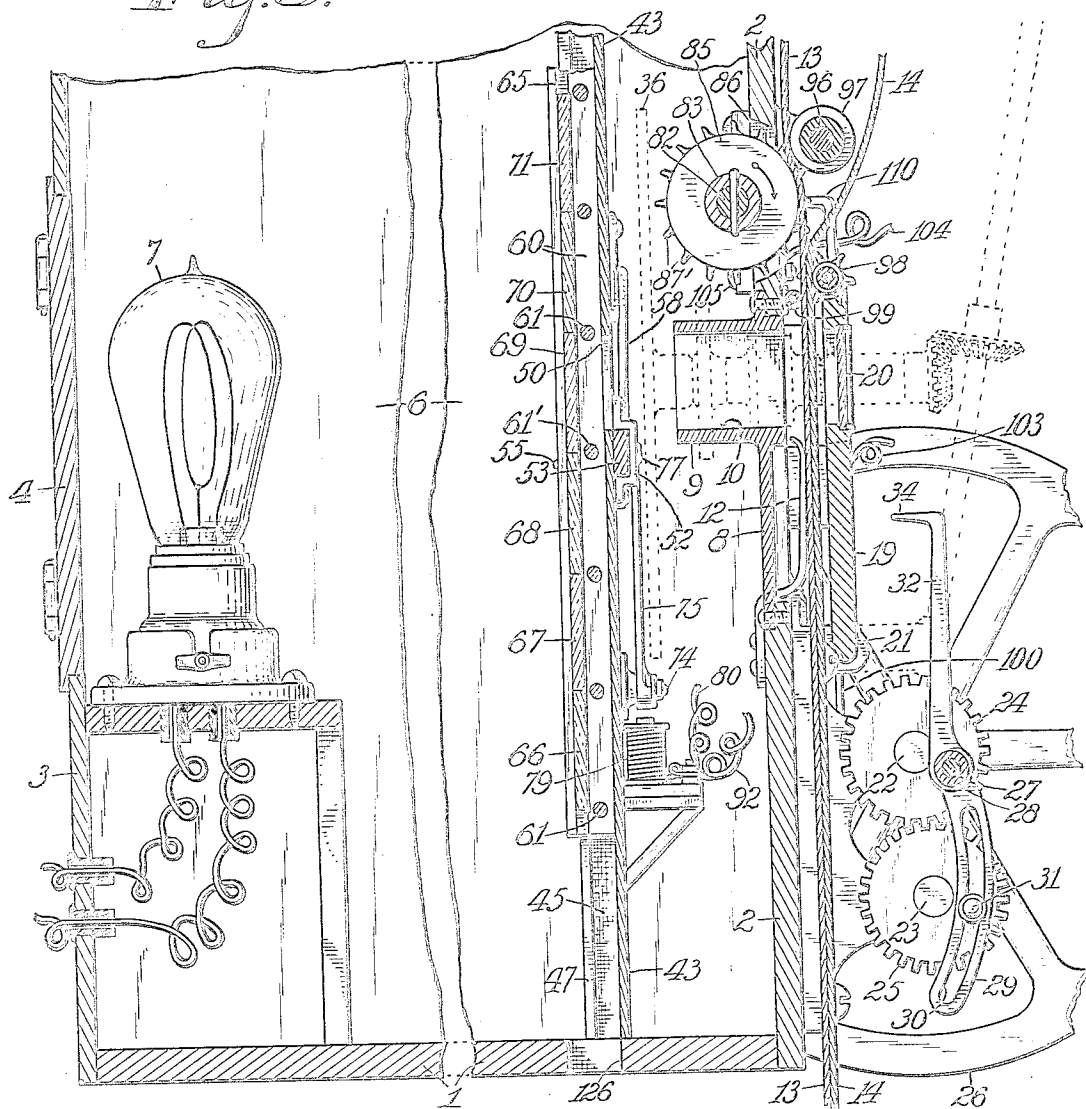
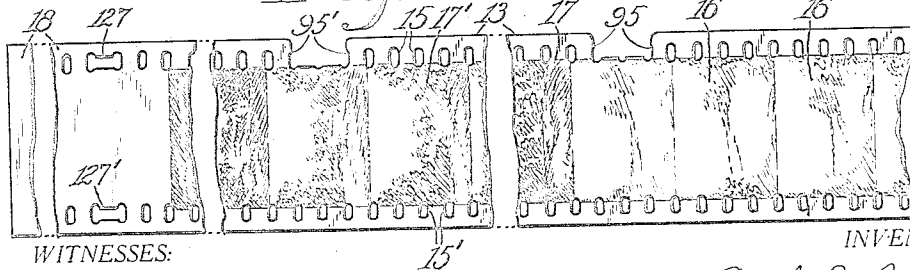


Fig. 6.



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Fig. 7.

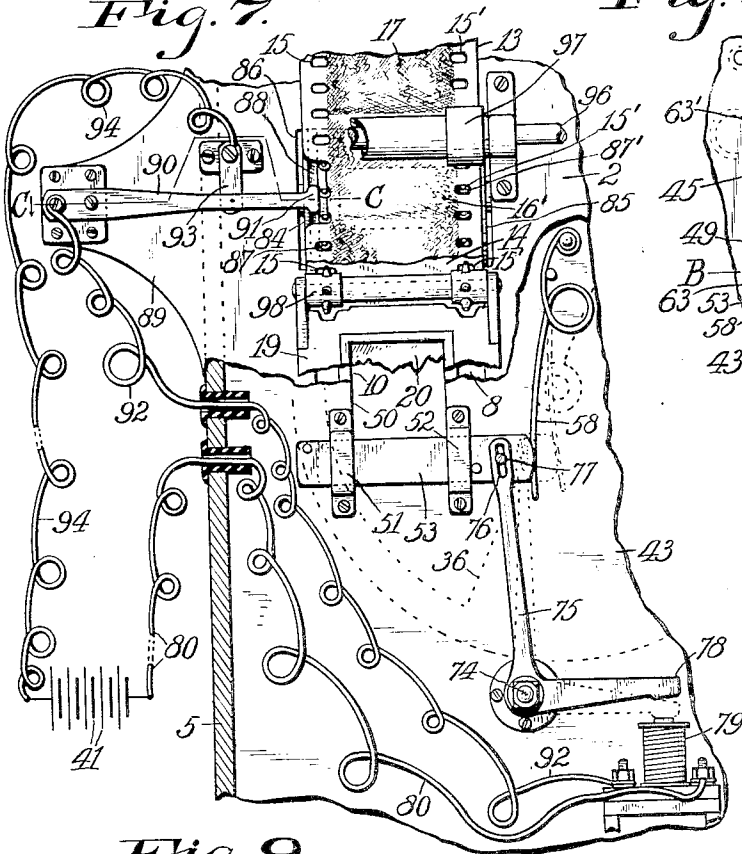


Fig. 8.

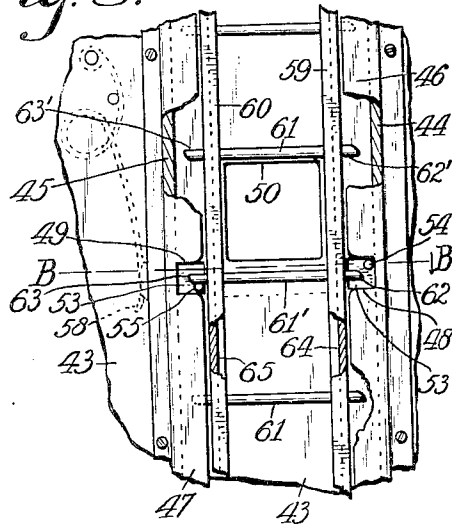


Fig. 9.

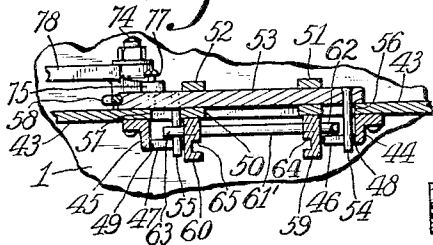


Fig. 10.

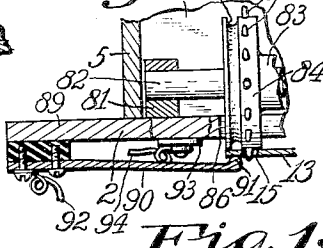
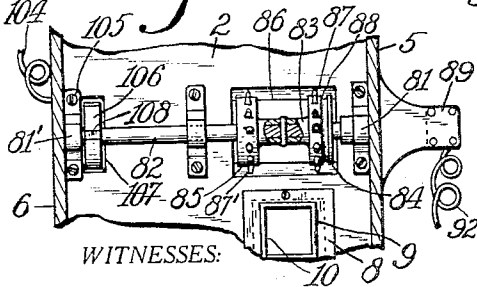


Fig. 12.



WITNESSES:

Fig. 13.

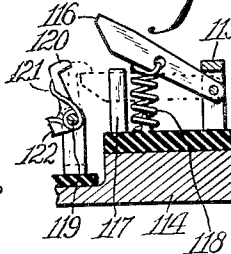
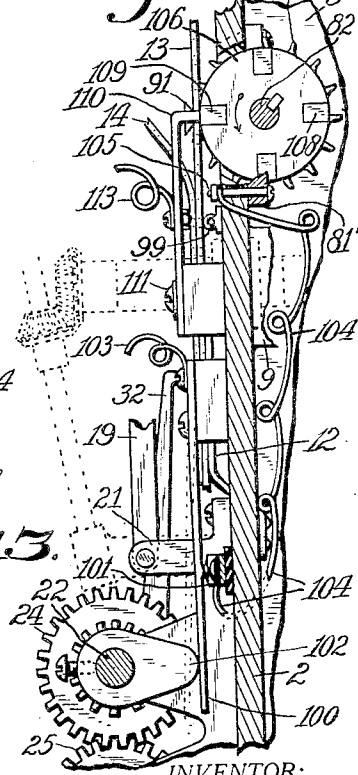


Fig. 11.



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UNITED STATES PATENT OFFICE.

EARL LEON CRABB, OF CHICAGO, ILLINOIS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE BELL & HOWELL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

MOVING-PICTURE-FILM-PRINTING MACHINE.

1,159,650.

Specification of Letters Patent.

Patented Nov. 9, 1915.

Application filed November 10, 1913. Serial No. 801,870.

To all whom it may concern:

Be it known that I, EARL L. CRABB, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Moving-Picture-Film-Printing Machine, of which the following is a specification, reference being had to the accompanying drawings and to the letters and figures of reference marked thereon.

This invention relates to the art of photography, especially with respect to the multiplication of pictures, the invention having reference more particularly to apparatus whereby positive films from negatives are made to be used in moving picture machines.

An object of the invention is to provide an improved photographic printing machine that shall be so constructed as to be enabled to operate automatically in the printing of a relatively large number of pictures on a single web or ribbon form of film in order to avoid the expense of constant attendance of an operator, so that one operator may divide his time with a large number of printing machines.

Another object of the invention is to provide simple and inexpensive means in moving picture film printing machines whereby the light required for printing shall be automatically modified, so as to effect superior printing from negatives of different degrees of density that may be made or assembled on a single strip of film in the preparation of correlated scenes, from which to produce duplicates for distribution to moving picture shows or theaters, the aim being to enable the printing machine to reproduce the pictures or make positive films for displaying purposes that shall be artistically perfect, regardless of the light and other conditions under which the original pictures may have been made.

A further object of the invention is to provide an improvement in film printing machines whereby stoppage of the machine shall be automatically effected in case the machine accidentally begins to print "out of frame" as it is termed in the art, in order to avoid ruin of portions of the film.

A still further object of the invention is to provide an improved web or ribbon type

of picture film that shall be so constructed or formed as to be qualified to control automatic stoppage of the printing machine to prevent printing "out of frame" and also to effect stoppage of the machine at the end of the picture portion of the strip of film.

With the above mentioned and other objects in view, the invention consists in a photographic printing machine comprising mechanism for drawing strips of photographic film past an aperture for admitting light to the films, a plurality of light modifying plates having different degrees of translucency, means for carrying the modifying plates opposite to the aperture, means for automatically controlling the movement of the plates to modify the degree of light to which the films are exposed for printing, and automatically acting means controlled by one of the films for stopping the machine. The invention consists also in the novel parts and in the combinations and arrangements of parts as hereinafter particularly described and further defined in the accompanying claims.

Referring to the drawings, Figure 1 is a side elevation of a moving picture film printing machine constructed substantially in accordance with the invention; Fig. 2, a front elevation of the improved machine; Fig. 3, a perspective view of one of the light modifiers; Fig. 4, a fragmentary perspective view of the light modifier carrier; Fig. 5, a fragmentary section approximately on the line A A in Fig. 2 on an enlarged scale; Fig. 6, a fragmentary plan of the improved negative or original picture film; Fig. 7, a fragmentary front elevation of the improved printing machine partially broken away to expose internal features thereof; Fig. 8, a fragmentary interior elevation looking forward and particularly showing the light modifier carrier; Fig. 9, a section approximately on the line B B in Fig. 8; Fig. 10, a fragmentary section approximately on the line C C in Fig. 7; Fig. 11, a fragmentary section approximately on the line D D in Fig. 2; Fig. 12, a fragmentary interior elevation of the front of the casing of the machine and devices thereon looking forward, and Fig. 13 is a central sectional view of an improved circuit breaker or switch adapted to be automatically actuated to break the electric cir-

cuit of a motor commonly employed for driving the film printing machine.

Similar reference characters in the different figures of the drawings indicate corresponding elements or features of construction herein referred to.

In order that the purpose, structure and mode of operation of the invention may be made clear, it should be understood that web-like films contain different scenes which are photographed under different conditions as to light and shade, so that a portion of the film containing one scene is or may be more dense than other portions containing other scenes, and the denser portions require stronger light for penetrating through them to properly affect the emulsion of the film that is to be printed upon. In the preparation of the original or negative film a great number of strips of film containing different scenes are cemented together so as to appear in succession in the order in which the scenes are designed to be exhibited. It follows, therefore, that after printing one scene, if the speed of the printing machine is not altered it becomes necessary to modify the light before printing the succeeding scene in case of variation in density of the negatives.

For the purpose of illustrating the invention which is adapted to be applied to a well known type of moving picture film printing machine, the principal features of such machine are shown and described and comprise a casing or house composed of a bottom 1, a front 2, a back 3 provided with a door 4, sides 5 and 6 and obviously a suitable top or roof, a suitable electric lamp 7 being mounted in the rear portion of the casing, or obviously natural light for printing may be admitted into the casing if the door 4 be opened. Preferably a portion of the front of the casing is composed of an inserted plate 8 having a frame 9 in which is an aperture 10 for the passage of light from the interior of the casing and through the front. Below the aperture a pair of elastic guides 11 and 12 are supported for guiding the films 13 and 14 past the aperture, each film having a row of perforations 15 near one edge and a row of similar perforations 15' near the opposite edge thereof. The original or negative film 13 has a succession of pictures 16, 16' and other pictures 17 and 17' of a different scene and different density requiring stronger light for printing than the preceding scene. Each web or strip of film usually has a blank end portion 18 following the series of scenes.

The arrangement of reels from which the films are unwound and the mechanism for unwinding them, the latter being shown by broken lines, being well known require no description in detail and in the construction of new machines may be varied.

The front of the casing has a door 19 provided with a window 20 and is hingedly supported in a bearing device 21 mounted on the exterior of the front 2 so as to swing forward, the door being normally fastened in upright position so that the films pass between it and the guides 11 and 12, the window 20 being opposite the aperture 10.

Two shafts 22 and 23 are rotatably mounted on the front 2 of the casing and have gear wheels 24 and 25 fixed thereon respectively, the wheels being in mesh each with the other, one of the shafts having a suitable driving wheel or pulley 26 secured thereto. The wheel 24 is provided with a long crank pin 27 on which a hub 28 is rotatably mounted, the hub having an arm 29 thereon provided with a longitudinal slot 30 into which extends a crank pin 31 with which the wheel 25 is provided. The hub 28 has also an arm 32 thereon, and a similar arm 33 is mounted on the crank pin 27 and suitably connected with the hub so that the arms operate in unison. The arms extend upwardly and have lugs 34 and 35 thereon respectively that enter the perforations in the films and draw the films through the machine, intermittently in the step printing type of machine, the lugs operating through suitable openings in the door 19. A suitable rotary shutter 36, as will be understood, is operated at the inner end of the aperture 10 for intermittently preventing the light from passing through the aperture while the films are moved preparatory to the printing of a succeeding picture.

The film moving mechanism may be driven by various means, preferably by a suitable electric motor 37 having a driving pulley 38 connected with the wheel or pulley 26 by means of a belt 39, the motor being provided with an electric circuit wire 40 connected with a suitable battery or source of electricity 41, another circuit wire 42 being suitably connected with the motor, and for purposes of the present invention is connected with a suitable circuit breaker or switch, as will further appear.

The casing or housing is provided with a partitional wall 43 extending across the interior thereof opposite to the front 2 and relatively close to the front. One side of the wall is provided with vertical guides comprising oppositely facing bars 44 and 45 from which extend bars 46 and 47 respectively that are opposite to the wall and extend each toward the other. The bars 46 and 47 preferably have notches 48 and 49 in the inner edges thereof respectively. The wall 43 has an aperture 50 therein arranged so as to permit the light to pass through the wall and into the aperture 10. The wall is provided with two guides 51 and 52 which movably support a shifting bar 53 in horizontal position below the aper-

ture 50, the bar being provided with two horizontally extending stop pins or fingers 54 and 55 that extend through guide slots 56 and 57 in the wall and preferably extend into or through the notches 48 and 49 respectively, one pin being on a horizontal plane slightly higher than the other. A spring 58 is mounted on the wall so as to be in contact with one end of the bar 53 and normally hold the bar in rest position with the pin 54 seated in the bottom of the notch 48.

A light modifier carrier having escapement-gear control is provided which comprises two side bars 59 and 60 connected together by means of suitable cross-bars 61, 61' which preferably extend through the side bars and conveniently form projections 62, 62' with which the outer side of the bar 59 is provided and similar projections 63 and 63' with which the outer side of the bar 60 is provided, the projections being adapted to be stopped and supported upon the pins or fingers 54 and 55. The inner or opposite sides of the side bars 59 and 60 have vertical grooves 64 and 65 therein respectively that extend from the upper end nearly to the lower end thereof to receive a suitable number of glass plates 66, 67, 68, 69, 70 and 71, one upon another, each plate being adapted to constitute a light modifier by any suitable means so that different plates have different degrees of translucency. The different plates have different numbers, as 72 or 73 thereon, conforming to a suitable index which may be prepared for guidance of the operator to indicate the different modifiers that should be successively placed in the carrier to correspond to the different densities of different portions of the films, such indexes being prepared in advance by a tester on inspection of each scene represented on the complete film, as for instance the first and third scenes on the film may be of the same density and require a No. 1 modifier, while the second and fourth scenes may have different densities each from the other and differ from the first and third so as to require different modifiers. The plates constituting the modifiers may suitably be made of glass having emulsion thereon as required for photographic purposes, and the emulsion is exposed, developed and fixed as in the practice of photography but so that different plates shall have different degrees of translucency, so that those plates that are more nearly transparent shall permit the passage of the stronger light. Preferably one of the plates is transparent so as to not change the character of the light. A suitable number of each of the series of modifiers is prepared so that, for instance, several of the No. 1 or two or more of the No. 2 modifiers may be used if required in the carrier for one strip

or reel of film. The modifier carrier as illustrated is arranged to descend by gravity and bring the modifiers in succession opposite to the aperture 50 and is started and stopped by means of the stop or shifting bar 53 which is operated so as to permit the descent of the carrier by suitable means, a pivot 74 being supported by the wall 43 and supporting an arm 75 which has a slot 76 therein receiving a wrist pin 11 with which the bar 53 is provided, the arm 75 preferably having another arm 78 thereon that extends opposite and adjacent to an electro magnet 79 with which a circuit wire 80 is connected, the wire being connected also with the battery 41. When the electro magnet is energized, so as to draw the arm 78 thereto, the arm 75 moves the bar 53 in opposition to the pressure of the spring 58, the spring retracting the bar when the magnet is demagnetized, suitable provision being made for completing a circuit between the battery and the electro magnet, as will further appear.

The means preferably employed for controlling the operations of the stop bar 53, so as to effect the changing of the light modifiers, comprise means controlled by the original or negative film. A practical embodiment of the preferred construction comprises journal boxes 81 and 81' secured to the inner side of the front 2 of the casing somewhat higher than the aperture 10, the boxes rotatably supporting a shaft 82 to which is secured a suitable sprocket wheel adapted to be rotated by the passing film 13, the wheel preferably comprising a hub 83 secured to the shaft and having two flanges or wheels 84 and 85 thereon spaced apart, the wheels operating in an aperture formed in the front 2 and having sprocket teeth 87 and 87' thereon, respectively suitably spaced apart so as to enter the perforations 15 and 15', respectively. The wheel 84 is provided with a peripheral groove which constitutes a clearance recess extending circumferentially about the wheel. The front 2 preferably is provided with an arm or extension 89 on the front of which an electrical connector 90 is secured so as to extend to the wheel 84, and it has a head 91 thereon that normally is in contact with the film 13 and is adapted to enter the groove 88, being carried into the groove by the connector 90, which is elastic, to permit the connector to have contact with a contact device 93 mounted on the front 2 and in connection with a circuit wire 94 that is in connection with the battery 41, to complete the circuit for the electromagnet 79, the circuit being broken when the head 91 is in contact with the film which prevents the head from entering the groove. The original or negative film 13 has a suitable number of notches or openings 95, 95' in one

edge portion thereof to permit the head 91 to be moved into the groove 88 in order to permit the closing of the electrical circuit. The notches or openings 95, 95' are made in the strip of film after determining by inspection or test the density of the series of pictures of the different scenes, and they are so spaced as to cause the required change of light modifier at the proper periods.

10 Preferably a shaft 96 is supported on the front 2 of the casing and rotatably supports a roller 97 adjacent to the wheels 84 and 85 for guiding the negative film into connection with the wheels, another guide roller 15 98 being suitably supported, as upon the top of the door 19 for guiding the blank positive film 14 into contact with the negative film 13, the latter preferably passing over a bearing roller 99 mounted adjacent to the roller 98 on the front 2.

In case the films drag so that the lugs 34 and 35 do not reach to the perforations in the films necessary to move the films the required distance, the printing is done "out of frame" until stopped by the attendant, or automatically, the present invention including means for immediately stopping the machine so as to avoid serious loss of film. In the practical attainment of the object a vibratory elastic arm 100 is supported at one end on the front 2 and constitutes a circuit connector extending opposite to a contact device 101 mounted also on the front 2, the arm normally being at a slight distance from the contact device and is moved to the device periodically by means of a cam 102 which is secured to the shaft 22. A circuit wire 103 is connected with the arm 100 and also with the battery 41. A circuit wire 104 is connected with the device 101 and also with a bolt or binding screw 105 which is conveniently employed in securing the journal box 81' to the front 2, so that a circuit is formed through the box and the shaft 82 with a cylinder 106 which is secured to the shaft and extends through an opening 107 formed in the front 2, the cylinder having a suitable number of non-conducting blocks 108, 109 set into the periphery thereof. An elastic electrical brush 110 is adjustably secured by means of a screw 111 to a suitable support on the front 2, the screw extending through a slot 112 in the shank of the brush which is adjusted so that when the film is at rest the brush shall be in contact with one of the non-conducting blocks if the machine is operating normally so as to print "in frame". A circuit wire 113 is connected to the brush 110 for conducting a current in case the cylinder 106 stops with the brush in contact therewith. A suitable switch base 114 is provided which has a suitable pivot stand 115 thereon to which a switch bar constituting a self-acting circuit breaker

116 is pivoted so as to move into connection with or away from a contact plate 117, being forced away from the plate by means of a spring 118. The base 114 is provided with a pivot 119 on which is mounted a hook 120 adapted to engage the end of the bar 116 and hold the bar in contact with the plate 117, the hook being normally held in connection with the bar by means of a suitable spring 121, and the hook has a finger 122 thereon for withdrawing the hook from the bar 116. The circuit wire 42 is connected with the plate 117 and another circuit wire 123 is connected with the stand 115 and also with the battery 41, so that the motor circuit is interrupted or broken when the switch bar 116 is moved away from the plate 117. An electro-magnet 124 is mounted on the base 114 under the finger 122 and is connected with the circuit wire 113 and also with another wire 125 that is connected with the battery 41, so that when the electro-magnet is energized it draws the finger 122 thereto and thus moves the hook 120 so as to release the switch bar 116.

In some cases an aperture 126 is formed in the bottom 1 of the casing to permit the modifier carrier to descend through the bottom, and similar provision may be made to permit the carrier to be inserted through the top of the casing.

The end portion 18 of the film 13 is provided with slots 127 and 127' to enable the negative film to effect the stoppage of the machine when the printing of a reel of film is completed.

It should be understood that in the construction of entirely new photographic printing machines the different elements thereof may be variously modified and arranged in the interest of economy, relative efficiency, or durability in use, within the scope of the accompanying claims.

In practical use, the operator or attendant will thread the machine as is customary, and after consulting the previously prepared catalogue or index will select the required modifier plates and place them in succession in the modifier carrier so that they shall be arranged according to their designating numbers or characters in the successive order in which they may be required by the condition of the various portions of the negative film, after which the switch bar 116 is set in normal position so that the motor is started after which the machine may be left to operate automatically while the attendant gives his attention to other similar machines. The light passing through the aperture 10 is, or may be, modified by the plate interposed between the aperture and the light, and after a series of scenes have been printed and it becomes necessary to modify the light for

printing the succeeding series of scenes, the negative film 13 permits the head 91 to enter the groove 88 through an opening 95 or 95' in the film, thus permitting the connector 90 to make contact with the device 93 which completes the electrical circuit so that the electro-magnet 79 operates the arm 78, the bar 53 consequently being moved so that the pin 55 is moved from beneath the projection 63, the pin 54 at the same time being brought under the projection 62', the carrier thus being released and permitted to descend by gravity until the projection 62' comes in contact with the pin 54 or in case the bar 63 is instantly retracted, after releasing the carrier, the projection 63' is stopped upon the pin 55. If the projection 62' is stopped upon the pin 54 the stop bar 63 is immediately retracted so as to carry the pin 54 from beneath the projection 62' and carry the pin 55 under the projection 63', the latter projection being carried slightly farther down until stopped by the pin 55. The shifting is automatically repeated as may be required according to design.

In the normal operation of the machine the negative film rotates the wheels 84 and 85 and consequently the shaft 82 which turns the cylinder 106, and when the momentary stoppage occurs for the exposure of the films to the light the brush 110 rests on one of the non-conducting blocks in the cylinder. In case the draw-lugs miss connection and enter the perforations in the film adjacent to those in which they should enter, it will be clear that the cylinder will be turned either too far or not sufficiently far, according to circumstances, and the brush will rest on the cylinder instead of being in contact with the non-conducting block, the arm 100 being at about the same time moved into connection with the device 101 so that an electrical circuit is completed which energizes the electro-magnet 124 with the result that the switch bar 116 is released and breaks the motor circuit so that the stoppage of the machine results. The operator when at leisure may again properly start the machine.

On the completion of the printing of the reel of film the lugs 34 and 35 enter the slots 127 and 127' and move idly therein until they take hold of the film and move it, but a lesser distance than normally, so that the brush 110 remains in contact with the cylinder 106 and establishes electrical connection which throws the switch as above explained and effects the stoppage of the machine without liability of damaging the films.

Having thus described the invention, what is claimed as new is—

1. A photographic printing machine in-

cluding a series of plates having different degrees of translucency respectively, and a slidable carrier holding the plates in relative edge to edge arrangement for control of the plates, the carrier being movably guided for guiding all the plates on one and the same plane.

2. A photographic printing machine including a series of light-modifying plates having different degrees of translucency and also different characters indicating the different degrees of translucency, and a slidable carrier holding the plates in a row on one and the same plane; the carrier being movably guided longitudinally of the row for control of the plates.

3. A photographic printing machine including a slidable carrier, and a plurality of rectangular glass plates collocated edge to edge on the carrier and movably supported thereby, the plates having different degrees of translucency respectively.

4. A photographic printing machine including a casing having a straight guide, a carrier longitudinally movable through the casing and guided by the guide, and a plurality of glass plates supported by the carrier and having different degrees of translucency respectively.

5. A photographic printing machine including a casing having an aperture in its bottom and also an aperture in its top, a carrier guided to move longitudinally through the apertures, and a plurality of light modifying plates supported by the carrier and differing in degree of translucency.

6. A photographic printing machine including a light-modifier carrier, means for slidably guiding the carrier longitudinally, means including escapement gearing for controlling the sliding movement of the carrier, and emulsion-coated light modifying plates mounted on the carrier in a straight row arrangement, the different plates having different degrees of translucency.

7. A photographic printing apparatus including longitudinally-movable films, a carrier guided for longitudinal movement with the films, a plurality of rectangular light-modifiers collocated on the carrier in a straight row on the plane of movement of the carrier in proximity to the films, and means for controlling the movement of the carrier.

8. A photographic printing machine including a carrier comprising two connected side bars having two longitudinal grooves in their two adjacent sides respectively, and a plurality of light modifying plates removably supported one upon another in the two grooves, the different plates having different degrees of translucency.

9. A photographic printing machine provided with movable light modifying appli-

ances, controlling means including a movable electrical circuit connector for controlling the movement of the modifying appliances, and a movable photographic film adapted to automatically control the action of the connector for governing the controlling means.

10. Moving picture film printing means including a wall having an aperture therein, a photographic film longitudinally movable opposite to the aperture, a carrier guided for movement adjacent to the wall longitudinally with the film, a plurality of light-modifying plates supported by the carrier to be moved thereby in succession opposite to the aperture, a movably supported stop device for engaging and stopping the carrier, and means for actuating the stop device controlled by the film.

20 11. Moving picture film printing means including a wall having an aperture therein, a photographic film having sections and movable opposite to the aperture, a carrier guided for movement adjacent to the wall and with the film, and a plurality of light-modifying glass plates corresponding respectively to the sections of the film in face size and supported in a straight row on the carrier to be moved thereby opposite to the aperture in succession, the different plates having different degrees of translucency.

30 12. A photographic printing machine including a light-modifier carrier having a plurality of stop projections successively arranged thereon, a plurality of light-modifiers supported in a straight row by the carrier, means for guiding the carrier for longitudinal movement to carry the row of light-modifiers longitudinally, and a movably supported escapement device for separately engaging the stop projections intermittently and successively to control the movement of the carrier.

45 13. A photographic printing apparatus including a movable carrier provided with escapement gearing for controlling the movement of the carrier, a plurality of light-modifying plates mounted on the carrier, an electro-magnet for controlling the operation of the escapement gearing and having an electrical circuit, a movable electrical circuit connector for the circuit, and a movable photographic film constructed for automatically controlling the action of the connector for governing the escapement gearing.

60 14. A photographic printing apparatus including a series of rectangular light-modifying plates, the different plates of the series having different degrees of translucency, an automatically-moving carrier supporting the plates one upon another, controlling means including an automatically-acting electrical connector and escapement gearing

for periodically stopping and controlling the movement of the carrier and the plates, and a movable photographic film constructed for automatically controlling the action of the connector for governing the controlling means.

70 15. In a photographic printing machine, an upright wall having an aperture therein, a stop bar movably supported horizontally on the wall and having a lateral horizontal stop pin thereon, two guides secured to the wall on opposite sides respectively of the aperture, an arm pivoted on the wall and connected with the bar for moving the bar in one direction, and a device for moving the bar in the opposite direction, in combination with a carrier guided by the two guides and provided with projections adapted for engagement with the stop pin for support, and light modifying plates mounted in the carrier.

85 16. In a photographic printing machine, a light modifier carrier comprising two side bars vertically guided, and a plurality of cross-bars extending through and secured to the side bars, the ends of the cross-bars constituting stop projections on the outer sides of the side bars, the inner side of each side bar having a groove therein extending from the upper end toward but not to the lower end thereof, in combination with a movable escapement device adapted to separately engage the projections and support the carrier.

100 17. In a photographic printing machine, a pair of vertical guides, and a carrier movably guided by the guides and comprising two side bars and a plurality of cross-bars secured to the side bars, each side bar having a plurality of supporting projections thereon and having also a longitudinal groove in the inner side thereof to receive light modifying plates, in combination with a stop bar movably supported and adapted for alternately engaging and supporting the projections of the two side bars to control the descent of the carrier.

110 18. In a photographic printing machine, the combination with a wall having an aperture therein, and vertically supported guides, of a carrier movably guided by the guides, means for controlling the movement of the carrier, and a series of light modifying plates superimposed on edge and mounted on the carrier, the different plates of the series having different degrees of translucency and also different characters indicating the different degrees of translucency.

115 19. In a photographic printing machine, a wall having an aperture therein, a carrier guided to move downward on the wall, a plurality of light modifying plates supported in the carrier to be moved thereby in succession opposite to the aperture, a stop

bar movably mounted on the wall for controlling and intermittently stopping the movement of the carrier, a photographic film movable opposite to the aperture, and means for actuating the stop bar controlled by the film.

20. In a photographic printing machine, a film having longitudinal slots and also perforations therein, operating means for moving the film including movably carried lugs for entering the perforations to move the film or entering and slipping in the slots and subsequently moving the film to a lesser extent, and means automatically acting to effect stoppage of the operating means on movement of the film to the lesser extent.

21. In a photographic printing machine, the combination of a carrier having grooves therein, a plurality of glass plates superimposed on edge in the grooves and removable therefrom, the different plates being adapted to permit the passage of different degrees of light respectively, means for movably guiding the carrier, and means for automatically controlling the movement of the carrier.

22. In a photographic printing apparatus, a plurality of films having perforations therein, operating means for moving the films including movably carried lugs for entering the perforations to move the films, a motor operatively connected with the operating means, an electrical circuit connected with the motor and provided with a self-acting circuit breaker, an open electrical breaker-controlling circuit, an electro-magnet connected with the breaker-controlling circuit, a latch movably supported for restraining the action of the self-acting circuit breaker and actuated by the electro-magnet to release the circuit breaker, and means enabling one of the films on abnormal movement to control the closing of the open circuit to energize the electro-magnet, for automatically stopping the motor on faulty action of the operating means.

23. In a photographic printing machine, a pair of vertical guides, a carrier provided with projections and movably guided by the guides, the carrier descending by the force of gravity, and a movable escapement device adapted to separately engage the projections and momentarily arrest the descent of the carrier.

24. In a moving picture film printing apparatus, a plurality of translucent rectangular glass plates varying respectively in degree of translucency, a carrier constructed for holding the plates edge to edge in a straight row and moving the plates on the line of the row, and a straight guide for the carrier.

25. In a photographic printing machine,

the combination of a carrier, a plurality of translucent glass plates superimposed on edge in the carrier, the plates varying respectively in degree of translucency, means for movably guiding the carrier, and means for controlling the movement of the carrier.

26. In a photographic printing machine, a supported electrical contact device, a photographic film movably guided and having a plurality of notches in the edge portion thereof, a wheel rotatably supported and rotated by the film and having a circumferentially extending groove therein, the film extending opposite the groove, and an elastic connector arm adapted for automatic contact with the contact device and having a head portion normally in contact with the film and thereby restraining the arm from contacting with the device, the head portion being adapted to enter the groove through the notches in succession to permit contact of the arm with the device, the head portion being adapted to be forced by the film from the groove onto the film.

27. In a photographic printing machine, a film movably guided, a rotatably supported shaft, a wheel and a conducting cylinder fixedly secured to the shaft, the wheel being rotated by the film to rotate the shaft, the cylinder having a plurality of non-conducting blocks therein, a circuit wire in electrical connection with the cylinder, an electrical brush supported in contact with the cylinder to complete a circuit and adapted to rest on the block to break the circuit, and a circuit wire electrically connected with the brush.

28. In a photographic printing machine, a movably guided film, mechanism including a rotatable shaft for moving the film, a supported electrical contact device, a vibratory circuit connecting arm extending opposite the device to be moved into contact therewith, a cam secured to the shaft and periodically contacting with and moving the arm into contact with the device, a circuit wire connected with the contact device, and a circuit wire connected with the arm.

29. In a photographic printing machine, a plurality of moving picture films, mechanism for normally moving the films, a motor connected with the mechanism, a battery, an electrical circuit connected with the motor and the battery and provided with a self-acting circuit breaker, an electrical breaker-controlling circuit connected with the battery and provided with two circuit closers normally interrupting the circuit, means enabling the mechanism to periodically operate one of the circuit closers to close the circuit, means enabling one of the films on abnormal movement to operate the remaining one of the circuit closers to close the circuit, an electro-magnet connected with

the breaker-controlling circuit, and a latch movably supported for restraining the action of the self-acting circuit breaker and actuated by the electro-magnet to release the circuit breaker, for automatically stopping the motor on faulty action of the moving mechanism.

30. In a photographic printing machine, a wall having an opening therein, a carrier guided on the wall for intermittent movement and provided with projections, a plurality of light modifiers removably inserted in the carrier to be moved thereby in succession to the opening, a stop bar movably supported and adapted to engage the projections for stopping the movement of the carrier, a movably supported device acting to move the stop bar in one direction, an electro-magnet supported adjacent to the device for actuating the device, a battery, an electrical circuit connected with the battery and the electro-magnet and provided with a self-acting circuit closer, and a film movably guided opposite the opening and preventing action of the circuit closer, the film being adapted to periodically permit action of the circuit closer.

31. In a moving picture film printing apparatus, a plurality of emulsion-coated glass plates for modifying the degree of light that may be passing therethrough, and self-acting means for movably supporting and guiding the plates on a straight line.

32. In a moving picture film printing apparatus, an oblong carrier having a straight guide extending longitudinally thereof, a

plurality of light-modifying plates arranged in a row in the guide, and means for longitudinally guiding the carrier.

33. In a moving picture film printing apparatus, a guided self-moving carrier, a plurality of light-modifying plates mounted edge to edge on the carrier, an electro-magnet, a battery, a circuit connected with the electro-magnet and the battery and provided with a self-acting closer normally closing the circuit, escapement gearing automatically acting to stop the carrier and controlled by the electro-magnet for controlling the movement of the carrier, and a movable film normally engaging the circuit closer and preventing action thereof, the film being adapted to periodically release the closer to permit action thereof.

34. In a photographic printing machine, the combination with a wall having an aperture therein, and a straight guide supported adjacent to the wall, of a self-moving carrier guided by the guides, a series of light modifying plates mounted on the carrier to be moved successively opposite to the aperture, the different plates of the series having different degrees of translucency, self-acting means for stopping the movement of the carrier, and means for controlling the action of the self-acting means.

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

EARL LEON CRABB.

Witnesses:

E. B. COWELL,
G. CRABB.