

Feb. 20, 1934.

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PHOTOGRAPHIC PRINTING MACHINE

Filed May 16, 1932

2 Sheets-Sheet 1

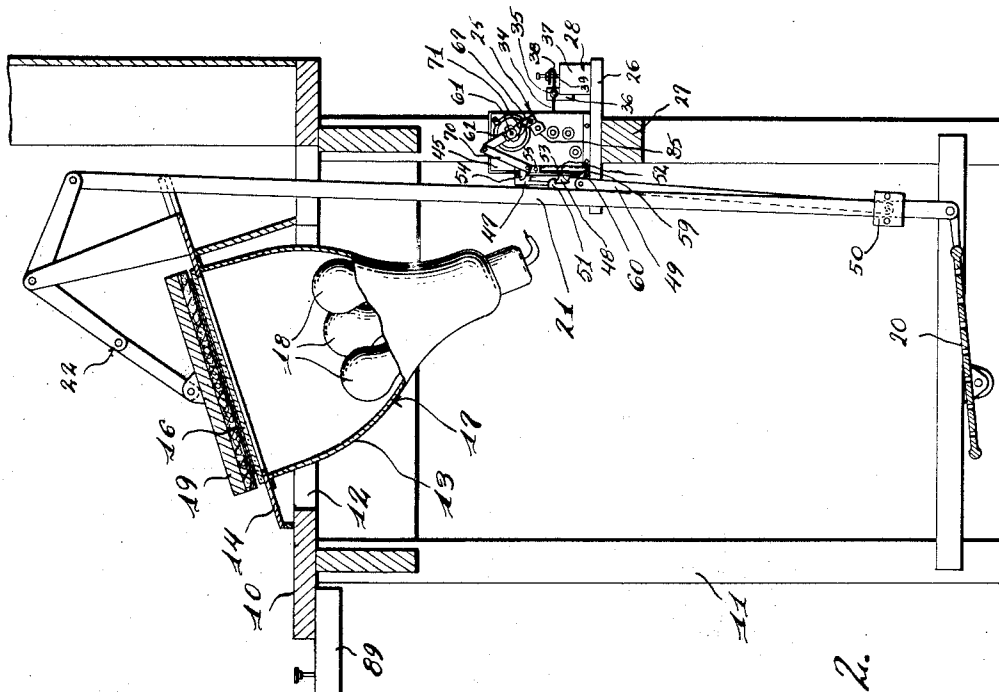


Fig. 2.

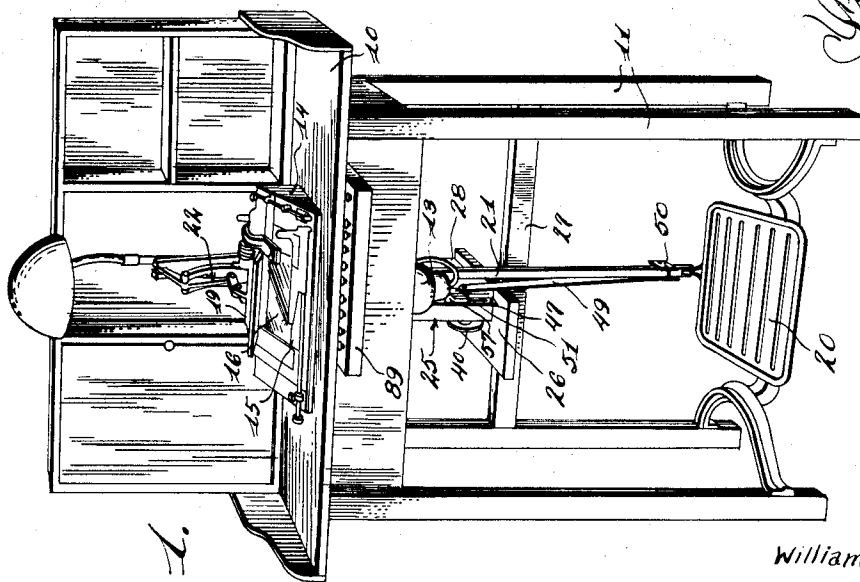


Fig. 1.

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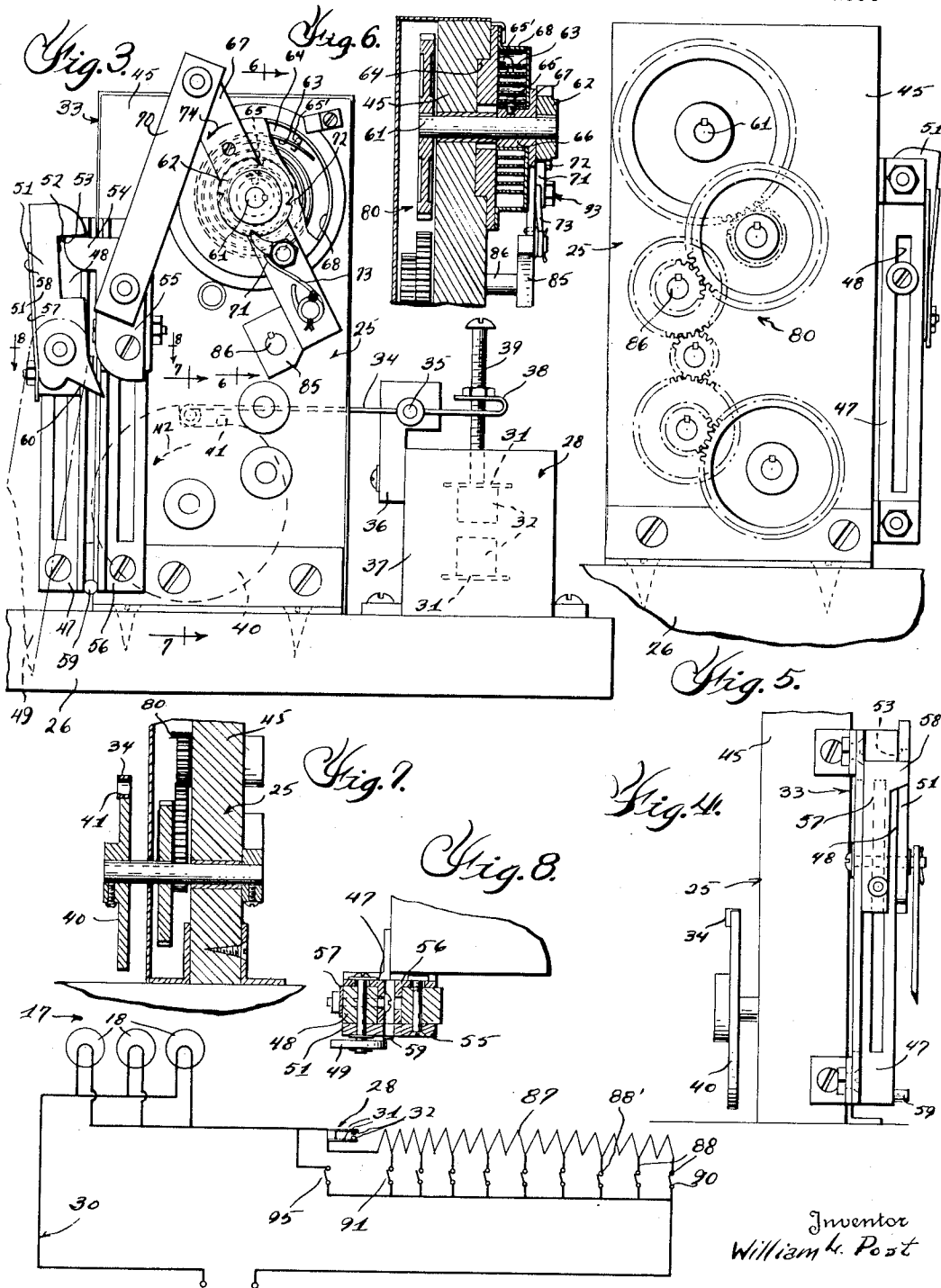
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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PHOTOGRAPHIC PRINTING MACHINE

William L. Post, Detroit, Mich.

Application May 16, 1932. Serial No. 611,654

9 Claims. (Cl. 95—73)

This invention relates generally to photographic equipment and refers more particularly to an improved device applicable to photoprinters for increasing the efficiency of operation of the same.

Printers of the type commercially employed at the present time in the art of photo-finishing are objectionable since they depend upon the operator to regulate the time of exposure in accordance with the density of the negatives printed. Notwithstanding the competency of the operator, considerable loss in production and material has been experienced with the above types of printers owing to the difficulty in constantly noting the elapse of time during the printing operation which is essential in order to obtain uniform prints from a negative.

The present invention provides for obtaining maximum production with the minimum waste of material by associating means with a photoprinter for automatically controlling the time of exposure of the photographic prints without any attention whatsoever on the part of the operator.

Another object of this invention resides in the provision of means of the above type in the form of switch mechanism arranged in the same circuit as the usual electrically operated illuminating device of the printer for completing the circuit to the device upon movement of the printer platen to its operative position and for automatically breaking said circuit at constant predetermined intervals independent of the operation of said platen.

A further advantageous feature of this invention resides in the provision of means for varying the light intensity of the illuminating device in order to provide for printing negatives of different density.

A still further object of the present invention consists in combining the light intensity varying means with the automatic switch mechanism previously set forth in such a manner as to provide a construction wherein negatives of varying density may be efficiently printed by maintaining the time of exposure constant and changing the light intensity in accordance with the varying conditions. With such a construction, it will be apparent that production is greatly increased since the time required to print negatives remains constant irrespective of the density of the latter.

Still another object of this invention resides in the provision of time controlled switch mechanism for accomplishing the foregoing results which is in the form of an attachment capable of being

readily applied to and removed from printers of various designs and sizes.

In addition to the foregoing, the present invention contemplates an arrangement of the character specified above which is extremely simple in construction and is capable of being manufactured at a relatively low cost.

The foregoing as well as other objects will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a perspective view of a printer equipped in accordance with the present invention;

Figure 2 is a longitudinal sectional view through the construction shown in Figure 1;

Figure 3 is an enlarged side elevational view of the time controlled switch mechanism illustrated in Figure 2;

Figure 4 is an end elevational view of the construction shown in Figure 3;

Figure 5 is a rear side elevational view of the construction shown in Figure 3;

Figures 6, 7 and 8 are respectively sectional views taken substantially on the lines 6—6, 7—7 and 8—8 of Figure 3;

Figure 9 is a diagram of the system employed in the printer shown in Figure 1.

Although the present invention about to be described is capable for use in connection with various types of photographic printers, nevertheless, I have shown the same herein for the purpose of illustration as utilized in association with a conventional and well known type of printer. Briefly described, the printer selected herein for the purpose of illustration comprises a table portion 10 supported at a convenient elevation by means of the legs 11 and having an opening 12 therein for receiving a suitable deflector 13 secured at its periphery to an upwardly inclined support 14. Mounted upon the support 14 for adjustment relative thereto are the usual masts 15 for positioning the negatives to be printed upon the upper surface of a diffusion screen 16 carried by the support 14 and extending over the open upper end of the deflector 13. Suitable illuminating means designated generally herein by the reference character 17 is located within the deflector 13 for producing the light necessary to accomplish the printing function. The illuminating means in the present instance differs from standard practice in that it comprises a plurality of electric light bulbs 18 instead of the single bulb heretofore employed in commercial printers. The use of a plurality of bulbs provides for ob-

taining maximum light intensity with the minimum amount of preglow and afterglow and is desirable in the present instance since the control means for the bulbs about to be described permits employing greater light intensity than has heretofore been considered practical in printers of the type briefly outlined above.

The illuminating means 17 is operated indirectly by means of a platen 19 mounted for movement into and out of engagement with the negatives supported upon the upper surface of the screen 16. In detail, the platen is actuated by means of a treadle 20 rockably supported in any suitable manner by the legs 11 of the table in a position to be conveniently manipulated by the operator and connected at the rear end to a reciprocating actuating lever 21. The upper end portion of the actuating lever 21 extends through the table top portion 10 and is connected to the platen for operating the latter through the intermediary of the toggle linkage 22.

Heretofore in the construction of printers of the general type briefly outlined above, suitable switch mechanism was arranged in the circuit to the illuminating means 17 and associated with the platen 19 in such a manner as to automatically break the circuit to the illuminating means upon upward movement of the platen and to make the aforesaid circuit upon downward movement of the platen to its operative position. With such an arrangement, the operator is depended upon to vary the duration of exposure in accordance with the density of the negatives to be printed, and, as a consequence, the operator is required to pay strict attention to the time of exposure. Owing to the difficulty in accurately keeping track of the time during each printing operation, considerable difficulty has been experienced in obtaining uniform prints from a negative, and waste of material as well as loss in production results from repeated attempts to maintain a certain standard of quality. Moreover, in systems where variations in density of negatives are compensated for by changing the duration of exposure, production is naturally sacrificed to a certain extent owing to the fact that some negatives require more time than others. While the variation in time of exposure of different negatives may be relatively slight, nevertheless, in a day's production becomes an appreciable factor and materially effects the output of the printer.

The present invention contemplates eliminating the foregoing objections by providing a printer with means for varying the light intensity of the illuminating means 17 to compensate for negatives of different density and with means for maintaining the time of exposure constant irrespective of the condition of the negatives. The duration of the exposure is maintained constant herein by providing a mechanical unitary device 25 readily attachable to the printer previously set forth and responsive to the operation of the treadle 20 for automatically making and breaking the circuit to the illuminating means 17. In detail, the device or attachment 25 comprises a base 26 capable of being readily secured to a cross brace 27 for the rear legs 11 of the table and forming a support for a suitable switch 28. As shown in Figure 9, the switch 28 is connected in series with the circuit 30 to the illuminating means 17 and is preferably of the carbon type. With reference to Figure 3, it will be noted that the switch 28 comprises a pair of superimposed flexible bars 31 having adjacent ends suitably fixed and having carbon contacts

32 at the free ends normally maintained in spaced relation by the inherent resiliency of the bars.

The carbon contacts 32 are automatically moved into and out of engagement by the treadle 20 of the printer through the intermediary of the time controlled mechanism designated generally by the reference character 33 and also fixed to the base 26. The upper bar 31 of the switch 28 is connected to the mechanism 33 by means of a rocker arm 34 pivotally connected intermediate the ends thereof as at 35 to a suitable bracket 36 which in turn is fixed to the switch casing 37. One end of the rocker arm 34 is return-bent as at 38 to provide an efficient anchor for an adjustable element 39. The latter extends transversely of the rocker arm and the lower end portions thereof extend through the switch casing 37 into engagement with the switch bar 31 adjacent the carbon contact 32 thereon. The opposite end of the rocker arm is fashioned for engagement with the periphery of a rotatable cam 40 forming a part of the mechanism 33 and having a cammed surface 41 formed by notching the periphery of the cam. As will be presently described, the cam 40 rotates one complete revolution from the position thereof shown in Figure 3 upon movement of the platen 19 into operative position by the treadle 20. Rotation of the cam 40 in the direction of the arrow 42 shown in Figure 3 causes the end of the rocker arm 34 adjacent the cam to ride over the surface 41 into engagement with the periphery of the cam. The cam surface 41 is so determined that movement of the aforesaid end of the rocker arm 34 from the surface 41 to the periphery of the cam causes the arm to rock in a clockwise direction about the pivot pin 35 and in so doing effects a movement of the upper carbon contact 32 downwardly into engagement with its cooperating lower contact to complete the circuit 30 to the illuminating means 17. In this connection, it is to be noted that movement of the upper contact into engagement with its cooperating lower contact is effected by the return-bent end of the rock arm through the medium of the adjustable element 39 constantly engaging the upper contact bar 31 of the switch for maintaining the same under a slight tension variable by adjustment of said element. Owing to the fact that the upper contact bar 31 of the switch is normally under a slight tension, the same operates through the adjustable element 39 to urge the forward end of the bar 34 into engagement with the cam 40, and since this action is increased by flexing the aforesaid bar downwardly in closing the switch, it will be apparent that immediate separation of the contacts 32 is effected upon one complete revolution of the cam from the position thereof shown in Figure 3.

The cam 40 is operatively connected to the treadle 20 in such a manner that one revolution of the cam corresponds to a predetermined interval of time which in turn represents the duration of the exposure. Referring now more in detail to the particular connection between the cam and treadle illustrated herein and with special reference to Figure 3, it will be noted that the device 33 comprises a vertically extending support 45 fixed at its lower end in any suitable manner to the base 26 and having a guide in the form of a vertically extending angle bar 47 secured to the front side thereof. Mounted upon the angle bar for vertical sliding movement relative thereto is a block 48 pivotally connected

to the upper end of an actuating link 49 having the lower end thereof secured as at 50 to the operating lever 21 adjacent the connection of the latter to the treadle 20. The aforesaid connection between the block 48 and treadle 20 is such that when the latter is in its operative position shown in Figure 2, the block assumes its downwardmost position relative to the guide 47. On the other hand, when the treadle 20 is in a position wherein the platen 19 is in its inoperative position, the block 48 assumes a position adjacent the upper end of the guide 47. Thus, from the foregoing, it will be observed that rocking movement of the treadle 20 causes a reciprocation of the block 48 relative to its guide 47.

Carried by the block 48 for movement therewith as a unit is a dog 51 pivotally connected at its lower end to the block for swinging movement relative thereto and having an elongated vertically extending notch 52 in the rear edge thereof forming a shoulder 53 for engaging a cooperating shoulder 54 projecting laterally from a suitable slide 55. The slide 55 is mounted for vertical sliding movement independent of the block 48 upon a second guide 56 fixed to the device 33 in juxtaposition to the guide 47. The cooperating shoulders 53 and 54 are normally maintained in engagement by means of a spring member 57 fixed at its lower end to the block 48 and having a lateral projection 58, shown in Figure 4, engageable with the upper end of the dog 51 for urging the same toward the slide 55. The above arrangement is such that when the parts are in their position shown in Figure 3, downward movement of the dog by the treadle 20 effects a corresponding movement of the slide 55 until the dog approaches its downwardmost position whereupon the cooperating engaging shoulders 53 and 54 are released permitting return movement of the slide in the manner to be presently described. Releasing of the aforesaid shoulders is effected herein by means of a fixed projection or pin 59 arranged to engage a cam surface 60 positioned upon the dog in such a manner that engagement of the same with the pin 59 causes the dog to swing forwardly about its pivotal connection with the block 48 against the action of the spring 57 to release the slide 55.

Journalled in the upper end portion of the support 45 is a transversely extending shaft 61 having one end projecting laterally beyond one side of the support and having a ratchet 62 secured to the extremity of the aforesaid end thereof. Encircling the shaft 61 between the ratchet 62 and adjacent side of the support 45 is a tension spring 63 of the spiral type having the inner end thereof fixed as at 65 to a hub 66 formed integral with a lever 67 to be presently described. The outer end of the spring 63, on the other hand, is fixed as at 65' to a member 64 mounted upon the support 45 for rotation relative to the hub 66 to adjust the tension of the spring. The hub portion 66 of the lever 67 extends into a suitable casing 63 for the spring 63 and is journaled upon the shaft 61 for rotation relative thereto. The lever 67 extends diametrically beyond opposite sides of the hub 66 and the upper end thereof is connected to the slide 55 by means of a link 70. The opposite end portion of the lever forms a support for a suitable pawl 71 which is pivotally connected to the lever and urged into engagement with the teeth 72 on the ratchet 62 by means of the spring 73 having the opposite ends respectively engaging the pawl and fixed to the lever.

The foregoing construction is such that down-

ward movement of the slide 55 by the dog 51 from the position thereof shown in Figure 3 causes a rotation of the lever 67 in the direction of the arrow 74 relative to the shaft 61 through the intermediary of the link 70, and since the inner end of the spring 63 is fixed to the hub 66 of the lever 67, rotation of the latter in the aforesaid direction tensions or winds the spring 63. The pawl 71 is positioned upon the lower portion of the lever 67 in such a manner that when the latter is rotated relative to the shaft 61 or ratchet 62 in the above mentioned direction, the pawl merely slides over the ratchet in a counterclockwise direction for engaging the next adjacent ratchet tooth. The angular distance between the teeth 72 on the ratchet 62 is predetermined in dependence upon the degree of arcuate travel of the lever 67 by movement of the slide 55 from its uppermost to its lowermost position so as to insure engagement of the pawl 71 with the teeth 72 in both the above mentioned positions of the slide.

With the construction as thus far described, it will be apparent that downward movement of the platen 19 to its position shown in Figure 2 by the treadle 20 effects a corresponding downward movement of the slide 55 from its position shown in Figure 3 through the intermediary of the dog 57 and link 49. As previously stated, downward movement of the slide tensions the spring 63 and when the same is in its lowermost position, the pawl 71 engages one of the teeth 72 on the ratchet 62 so as to positively connect the shaft 61 through the ratchet to the lever 67. When the slide 55 has reached its lowermost position, the dog 51 is actuated in the manner specified above to release the slide permitting the same to return to its uppermost position under the action of the spiralled spring 63. In other words, releasing of the slide 55 by the dog in effect releases the inner end of the spring 63, and since the latter end is secured to the hub 66 of the lever 67 which in turn is connected to the shaft 61 through the ratchet and pawl 71, it will be apparent that the spring in returning to its normal position rotates the shaft 61. In the present embodiment of the invention, the shaft 61 is rotated through an arc of 45° each time the slide 55 moves from its lowermost to its uppermost position, and, as shown in Figure 5, the shaft 61 is connected to the cam 40 by means of gearing 80 designed to rotate the cam 40 one complete revolution each time the shaft 61 is rotated one-quarter turn. Rotation of the cam from the position thereof shown in Figure 1 closes the switch 28 through the intermediary of the rock arm 34 in the manner hereinbefore described to actuate the illuminating device 17 and maintains the switch closed until the cam rotates one complete revolution. As will be observed from the foregoing, the time required to turn the cam one complete revolution depends upon the speed of movement of the shaft 61 and may be accurately controlled by adjusting the member 64. Inasmuch as time is an important factor in the operation of the mechanism, the length of travel of the slide 55 must be maintained uniform, and this is accomplished herein by providing a stop 85 for engaging the lower end of the lever 67 to definitely limit upward travel of the slide. While the stop 85 may be secured to the support 45 adjacent the aforesaid end of the lever 67 if desired, nevertheless, I have shown the same as fixed to the shaft 86 for one of the gears in the train 80 since in the present instance the latter shaft rotates a complete number of revolu-

tions each time the slide 55 is operated, and, as a consequence, serves to accurately engage the lever 67. Release of the slide 55 at the same point in its downward travel throughout successive operations is insured by the cam 60 on the dog 51 and the cooperating pin 59 on the support.

From the foregoing, it will be seen that I have provided efficient mechanism for closing the switch 28 to the illuminating device 17 and for automatically opening this switch after a predetermined interval of operation to maintain the duration of exposure constant. As previously stated, provision is made herein for printing negatives of different density by varying the intensity of the illuminating means 17. This is accomplished herein by providing a resistance 87 having a plurality of taps 88 for connecting different portions of the resistance in series with the circuit 30 and each of the taps are controlled by a switch 88'. The switches are arranged in a bank 89 located on the printer for convenient manipulation by the operator and while they may be of any suitable construction, I have shown the same herein as of the push button type. Although the specific construction of the switches is not shown in detail, nevertheless, the arrangement is preferably such that each switch is held in its closed position upon depressing the button controlling the same until another of the switches is closed at which time the previously closed switch is automatically opened.

Referring now more in detail to the diagrammatic showing of the switch system in Figure 9, it will be noted that when the switch 28, together with the end switch 90 in the bank 89, is closed and the remaining switches 88' are open, the bulbs 18 are connected with the source of electrical energy through the entire resistance 87 with the result that the aforesaid bulbs reflect the minimum amount of light through the screen 16. On the other hand, when the opposite end switch 91, as well as the switch 28, is closed and the remaining switches 88' are open, the resistance 87 is shunted out of the circuit 30 permitting the maximum amount of light to be reflected by the bulbs 18. It will be apparent from the foregoing that the light intensity may be varied between the above extreme positions by selectively manipulating the intermediate switches 88' in conjunction with the switch 28.

Assuming now that the parts of the printer are in their normal or inoperative positions and it is desired to print a negative, the operator merely positions the latter on the screen 16 in accordance with the usual practice and in so doing, determines the density of the negative. After the operator is satisfied as to the condition of the negative, the resistance in the circuit 30 is increased or decreased depending upon the density of the negative by manipulation of the proper switch 88' whereupon a piece of printing paper is placed over the negative and the foot treadle operated to clamp the platen upon the paper. Actuation of the platen by the treadle effects a closing of the switch 28 through the medium of the mechanism 33 in the manner described with some particularity above to illuminate the bulbs 18. The switch 28 remains closed until the cam 40 completes one revolution whereupon the switch is automatically opened and the treadle actuated by the operator to return the platen to its normal position. In the event a number of prints are desired of the negative on the screen 16, the operator merely replaces the paper and again actuates the treadle without varying the resistance in the

circuit. Inasmuch as the time of exposure remains constant, it will be readily seen that uniformity in the resulting photographs is insured without any attention on the part of the operator.

While the resistance 87 and number of switches 88' are accurately predetermined so as to compensate for negatives of average variation, nevertheless, provision is made herein for printing negatives of abnormal density. This is accomplished by a separate switch 95 arranged in the circuit 30 in such a manner as to shunt the resistance 87 as well as the switch 28 when in its closed position. The switch 95 is positioned on the printer for convenient manipulation by the operator and permits the printer to be actuated in accordance with conventional practice.

What I claim as my invention is:

1. A photoprinter having a movable platen, actuating means for the platen, means for exposing a negative including an electrically operated illuminating device arranged in a circuit with a source of electrical energy, a switch in said circuit for making and breaking the same, means operable in timed relation to movement of the platen to its operative position by said actuating means for closing said switch, and means operable independent of the actuation of said platen for automatically opening said switch after a predetermined interval of time has elapsed.

2. A photoprinter having a movable platen, actuating means for the platen, means for exposing a negative including an electrically operated illuminating device arranged in a circuit with a source of electrical energy, a switch in said circuit for making and breaking the latter and normally arranged in a position wherein the circuit is open, a rotatable cam operable in timed relation to movement of the platen to its operative position for closing said switch and fashioned to maintain the switch closed a predetermined interval of time.

3. A photoprinter having a movable platen, actuating means for the platen, means for exposing a negative including an electrically operated illuminating device arranged in a circuit with a source of electrical energy, a switch in said circuit for making and breaking the same, means for closing said switch and for automatically opening the same after a predetermined interval of operation of said illuminating means including a rotatable cam operatively connected to the switch, and means for rotating said cam to close the switch in timed relation to movement of said platen to its operative position.

4. A photoprinter having a movable platen, actuating means for the platen, means for exposing a negative including an electrically operated illuminating device arranged in a circuit with a source of electrical energy, a switch in said circuit for making and breaking the same, a rotatable cam for closing said switch and for automatically opening the same after a predetermined interval of operation of said illuminating means, means for rotating said cam including a spring operatively connected to the actuating means for said platen whereby movement of the latter to its operative position tensions said spring, and means operable in timed relation to the aforesaid movement of the platen for releasing the spring to permit rotation of the cam thereby.

5. A photoprinter having a movable platen, actuating means for the platen, means for exposing a negative including an electrically operated illuminating device arranged in a circuit with a source of electrical energy, a switch in said

circuit for making and breaking the same, a rotatable cam for closing said switch and for automatically opening the same after a predetermined interval of operation of said illuminating means, means for rotating said cam including a spring having one end fixed and having the opposite end operatively connected to the actuating means for the platen whereby movement of the latter to its operative position tensions said spring, and means operable in timed relation to movement of the platen to its operative position for automatically releasing the spring from the platen actuating means and for connecting the same to said cam.

6. A photoprinter having a movable platen, actuating means for the platen, means for exposing a negative including an electrically operated illuminating device arranged in a circuit with a source of electrical energy, a switch in said circuit for making and breaking the same, mechanism for actuating the switch including a rotatable shaft, means operable in timed relation to the movement of said platen to its operative position for imparting a rotative movement to the shaft, a rotatable cam, reduction gearing operatively connecting the shaft to said cam for retarding rotation of the latter from the former, and means connecting the cam to said switch for automatically actuating the latter.

7. A photoprinter having a movable platen, actuating means for the platen, means for exposing a negative including an electrically operated illuminating device arranged in a circuit with a source of electrical energy, a switch in said circuit for making and breaking the same, a rotatable shaft, means operable in timed relation to the movement of the platen to its operative position for imparting a predetermined rotative movement to the shaft, a rotatable cam, reduction gearing operatively connecting the shaft to the cam for rotating the latter one complete revolution upon the predetermined rotative move-

ment aforesaid of the shaft, and a connection between the cam and switch for automatically actuating the latter.

8. A photoprinter having a movable platen, actuating means for the platen, means for exposing a negative including an electrically operated illuminating device arranged in a circuit with a source of electrical energy, a switch in said circuit for making and breaking the same, a rotatable shaft, a spring encircling the shaft having one end fixed and having the other end fixed to a member journaled upon said shaft, a connection between the latter member and actuating means for the platen operable upon movement of the platen to its operative position to tension said spring, means operable in timed relation to movement of the platen to its operative position for releasing the tension on said spring, means for connecting the spring to said shaft for imparting a predetermined rotative movement to the latter under the action of the spring, a rotatable cam, reduction gearing operatively connecting the rotatable shaft to the cam for rotating the latter one complete revolution upon the predetermined rotative movement aforesaid of the shaft, and a connection between the cam and switch for automatically actuating the latter.

9. A photoprinter having a movable platen, actuating means for the platen, means for exposing a negative including an electrically operated illuminating device arranged in a circuit with a source of electrical energy, means operable in dependence upon movement of the platen to its operative position by said actuating means for automatically closing the switch, and means operable independent of the actuation of said platen for automatically opening the switch after a predetermined interval of operation of the illuminating means.

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