H. V. LAWLEY.

APPARATUS FOR THE PRINTING OF PHOTOGRAPHIC FILMS.

APPLICATION FILED AUG. 24, 1921.

1,435,245. Patented Nov. 14, 1922.

3 SHEETS—SHEET 1.

Fig. 1.

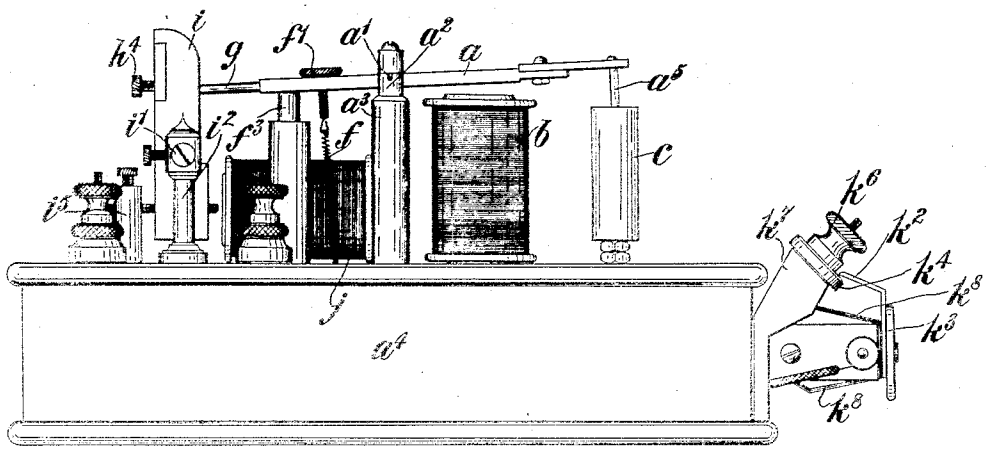
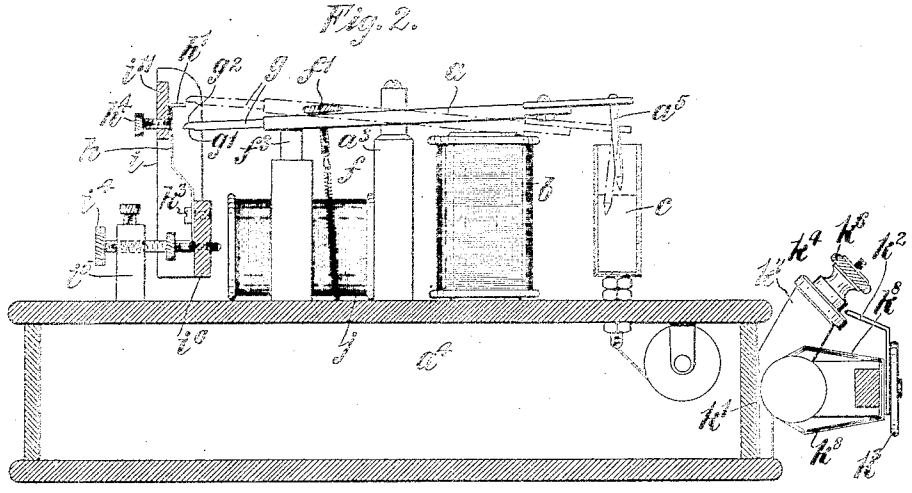


Fig. 2.



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3 SHEETS—SHEET 2.



Fig. 5.

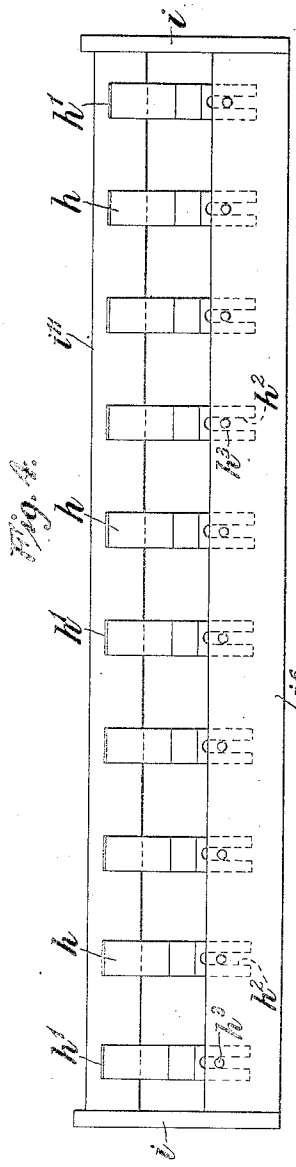


Fig. 4.

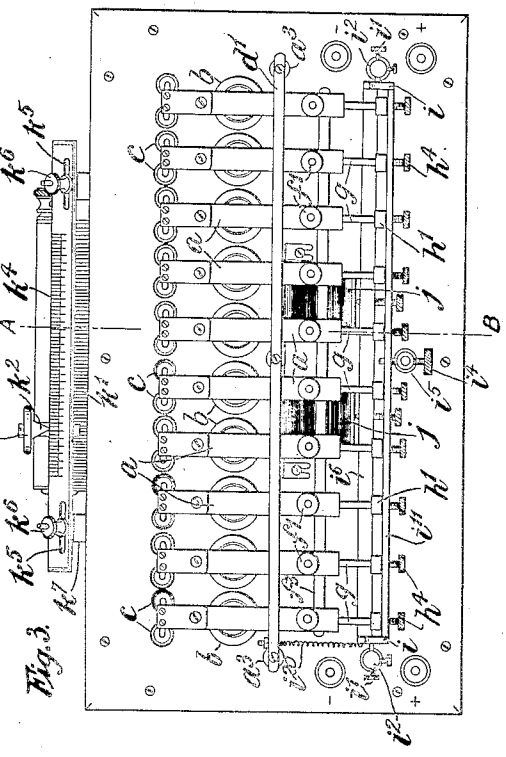


Fig. 3.

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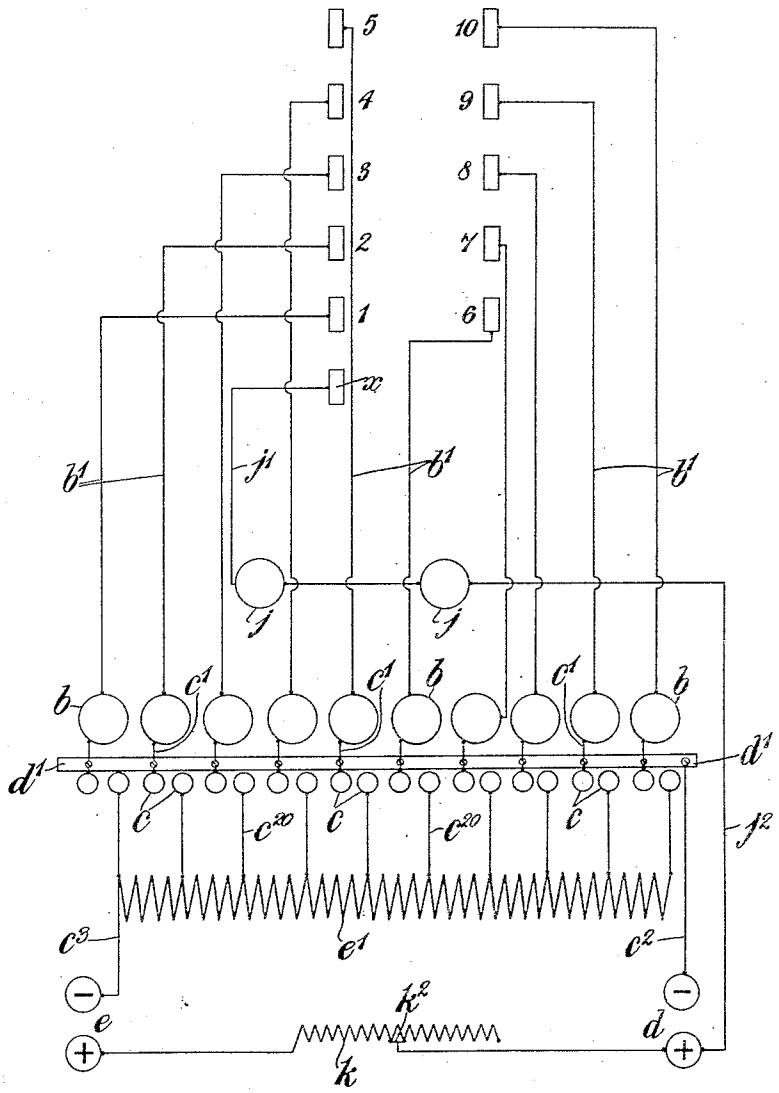
APPARATUS FOR THE PRINTING OF PHOTOGRAPHIC FILMS.

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3 SHEETS—SHEET 3.

Fig. 6.



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Patented Nov. 14, 1922. 1,435,245

UNITED STATES PATENT OFFICE.

HENRY VASSAR LAWLEY, OF LONDON, ENGLAND.

APPARATUS FOR THE PRINTING OF PHOTOGRAPHIC FILMS.

Application filed August 24, 1921. Serial No. 494,767.

To all whom it may concern:

Be it known that I, HENRY VASSAR LAWLEY, of London, England, British subject, have invented certain new and useful Improvements in or Relating to Apparatus for the Printing of Photographic Films, of which the following is a specification.

This invention relates to the printing of photographic films in strip form as for use in cinematographs. In the specification of my prior application No. 444,118 filed 11th February, 1921, there is described a method and apparatus for the entirely automatic printing of such films, and the apparatus disclosed therein includes a switch device, or what may be termed a "controller," for closing lamp circuit in accordance with the particular relation of contacts on the film with other contacts on a stationary exposure device or "gate," through which the film passes in order to obtain various intensities of printing light for different sections of the film.

Now the present invention comprises an improved and simplified form of such a switch device or "controller" which is more certain and rapid in action than that of the prior application aforesaid, which comprises a fewer number of parts, more particularly as regards electromagnetic elements and which is more sensitive in action having regard to the rapid and momentary engagement of the contacts on the film and "gate" referred to.

The improved controller or switch device also includes means for compensating for different light values of various film stock used, and for testing and adjusting the intensity of the printing lamp at all times, for maintaining constant printing effects when a large number of films pass successively through the printing apparatus, or when a number of similar films are dealt with in different apparatus.

The accompanying drawings show a preferred embodiment of the switch device or controller.

Fig. 1 is a side elevation.

Fig. 2 a vertical section substantially on the line A—B of Fig. 3 which latter figure is a plan view on a reduced scale.

Fig. 4 is a detail plan view of a rocking armature catch plate hereinafter referred to;

Fig. 5 is a detail view of a scale for use with a sliding resistance for testing or adjusting the light densities, and

Fig. 6 is a diagram of the circuits or electrical connections employed.

As in the switch device of the prior construction mentioned above there is provided, one for each change of light, and in the present case ten in number, a tumbler switch, all of which are similar and comprise an armature a mounted on a knife edge or similar pivot a^1 in a cross bar a^2 supported at each end by a pillar a^3 carried by a suitable base a^4. At one side of the bar a^2 there is provided, one for each of the armatures a an electromagnet b designated in Fig. 6 with the numerals 1 to 10 corresponding to the different intensities of light, said electromagnets being connected by conductors b^1 to the similarly numbered contacts on the "gate." Each armature a is provided with an extension a^5 which dips into mercury cups c of which there is provided two for each armature, these cups being connected respectively over a busbar d^1, to the electromagnets b by conductors c^1 (Fig. 6) and to one pole of a battery d and lamp e by the conductors c^2 c^3, there being included in the lamp circuit a resistance e^1 to which the conductors c^{20} are coupled.

Each armature a is under the action of a light spring f connected at one end to the base a^4 and at the other end to an adjusting screw f^1 carried by the armature whereby the tension of the spring can be varied, this spring tending to hold the armature in circuit-broken position as indicated in full lines in Fig. 2 with its rear end in contact with a stop bar f^3.

At the end remote from the mercury cups each armature a is provided with an extension or nose g, slightly cut away as at g^1 and curved as at g^2 and adapted to co-operate with the angular part h^1 of a thin resilient abutment or catch plate h adjustably mounted (as by slotting the ends at h^2 and passing there through a screw h^3) in a rocking frame i carried by pin or needle pivots i^1 in end pillars i^2 mounted in the base a^4. The upper end of the plate h is also capable of adjustment in the frame i by means of a set-screw h^4 extending through the upper member i^{11} of the frame, in order that its position with regard to the cut away part of the nose g may be finely calculated to ensure proper co-operation of these parts. Further, the extent of the rocking movement of the frame i which is under the action of a light spring i^{20} may be regulated by means

of a set screw i^4 passing through a pillar i^5 on the base and abutting against the lower member i^6 of the frame i.

At the side of the pivots of the armatures opposite to that at which the electromagnets b are located, are two other electromagnets j having their axes horizontal, and which replace the ten rear electromagnets of the construction disclosed in the prior specification previously referred to. A single electromagnet j may suffice but it is preferred to use two to insure certainty of operation. These electromagnets j are coupled in series (Fig. 6) and are connected at one side by conductor j^1, to the key contact x on the "gate" and on the other side by conductor j^2 to the opposite poles of the battery and lamp, there being included in the connection between said poles the "test" or compensating resistance k above mentioned, but which will be described in more detail later.

The said magnets j, when energized by engagement of the respective key contacts on the film and gate, will momentarily attract the rocking frame i and it will be apparent from the above description that when any one of the armatures a is attracted by its magnet b according to the cooperation of any pair of contacts 1 to 10 on the gate and film, respectively, as described in the prior specification, the circuit will be closed through the mercury cups belonging to the particular armature attracted and through the connections described to illuminate the lamp e with the intensity of light desired according to the amount of resistance e^1 involved. When magnet b is momentarily energized, the same occurs to magnets j, thus rocking the frame i and permitting the nose g to pass above the catch member h^1. The magnets are then instantly de-energized, permitting the frame i to return to normal position under the action of its spring i^{20}, thereby retaining the armature in the arrested position shown in broken lines in Fig. 2. When however another change of light intensity takes place for a different film section by the engagement of the respective key contacts, the magnet b is again momentarily energized and also the magnets j, this latter resulting in the lower part of the frame i being attracted, causing said frame to be rocked about its pivot and withdrawing the catch member h^1 from the nose g thereby permitting the armature a previously attracted to return to normal position under the action of its spring f whereby it is instantly ready for another energization of its magnet b when required, and ensuring that all the armatures shall be in circuit-broken position until one or other is attracted by its magnet b according to the pair of film and gate contacts in operation.

To now refer more specifically to the "test" resistance k, this is shown mounted at the front of the base a^4 in a convenient position for ready manipulation and comprises the resistance coil k^1 with a contact k^2 adapted to be slid by a button k^3 over a graduated scale k^4 which itself is adjustably mounted as by slots k^5 and screw k^6 on brackets k^7 extending from the base. The contact k^2 has the usual or any convenient arrangement of brushes k^8 for co-operating with the coil k^1. The main purpose of this device is to enable the operator to provide for different light values of the various film stock used and to compensate for any loss of brilliancy of the lamp e should same occur due to wear of the filament or other cause, by making a photometer test and then cutting out resistance on coil k^1 accordingly, whereby in the event of similar films being passed through two or more printing machines, exactly the same intensity of light shall be available in both or all the machines for the different sections of films. In such case, and after testing the lamps and operating the compensating resistance accordingly so that the intensity of light is the same in all the machines, the graduated scale k^4 can be set so that the reading on the scale is the same on all machines, and any variation made for different light values of various makes of film stock will be uniform.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

1. A switch device for use in automatic film printing operations involving variations of light intensity comprising, for each variation of light intensity an armature, an electromagnet for each armature adapted to attract same to close an associated lamp circuit, means for retaining an attracted armature in circuit closing position, and electromagnetic means common to the complete range of armatures for releasing said attracted armature and permitting it to return to normal open circuit position, a film with contacts thereon and other contacts in circuit with said electromagnets and positioned to be engaged by said film contacts to close said circuit.

2. A switch device for use in automatic film printing operations involving variations of light intensity comprising, for each variation of light intensity an armature, an electromagnet for each armature adapted to attract same to close an associated lamp circuit, means for retaining an attracted armature in circuit-closing position comprising a rocking element having a catch member for each armature adapted to arrest same when attracted, and electromagnetic means common to the complete range of armatures adapted to attract said rocking element to release the attracted armature and arrest another when a change of printing light takes place, a film

with contacts thereon and other contacts in circuit with said electromagnets and positioned to be engaged by said film contacts to close said circuit.

3. A switch device for use in automatic film printing operations involving variations of light intensity comprising, for each variation of light intensity an armature, an electromagnet for each armature adapted to attract same to close an associated lamp circuit, means for retaining an attracted armature in circuit closing position comprising a rocking element having a catch member for each armature adapted to arrest same when attracted, electromagnetic means common to the complete range of armatures adapted to attract said rocking element to release the attracted armature and arrest another when a change of printing light takes place means for adjusting the catch member in relation to the armatures, and other means for adjusting the extent of movement of the rocking element, a film with contacts thereon and other contacts in circuit with said electromagnets and positioned to be engaged by said film contacts to close said circuit.

4. A switch device for use in automatic film printing operations involving variations of light intensity, comprising, for each variation of light intensity an armature, an electromagnet for each armature adapted to attract same to close an associated lamp circuit, means for retaining an attracted armature in circuit closing position, electromagnetic means common to the complete range of armatures for releasing said attracted armature and permitting it to return to normal open circuit position, and means associated with the lighting circuit for compensating for various light values of film stock used in the printing operation a film with contacts thereon and other contacts in circuit with said electromagnets and positioned to be engaged by said film contacts to close said circuit.

5. A switch device for use in automatic film printing operations involving variations of light intensity, comprising, for each variation of light intensity an armature, an electromagnet for each armature adapted to attract same to close an associated lamp circuit, means for retaining an attracted armature in circuit closing position, electromagnetic means common to the complete range of armatures for releasing said attracted armature and permitting it to return to normal open-circuit position and means associated with the lighting circuit for compensating for various light values of film stock used in the printing operation, said last mentioned means comprising a compensating resistance in the lighting circuit, a sliding contact adapted to be manually passed over said resistance, and an adjustable graduated scale with which the sliding contact co-operates, a film with contacts thereon and other contacts in circuit with said electromagnets and positioned to be engaged by said film contacts to close said circuit.

In witness whereof I have signed this specification in the presence of two witnesses.

HENRY VASSAR LAWLEY.

Witnesses:
HERBERT G. DAVIS,
ARTHUR C. DACEMBE.