Dec. 31, 1935. K. ROSENBERG 2,026,437

CONTROL DEVICE FOR INCANDESCENT LAMP CINEMATOGRAPHIC APPARATUS

Filed March 22, 1934

FIG. 1.

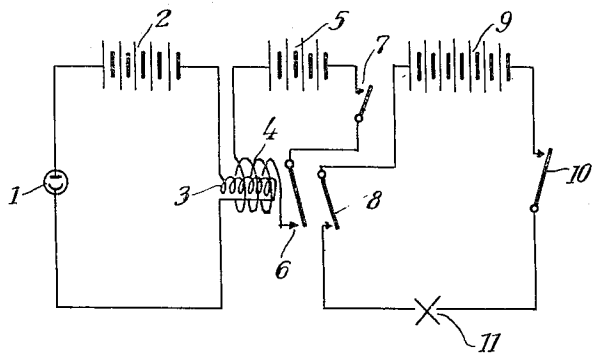


FIG. 2.

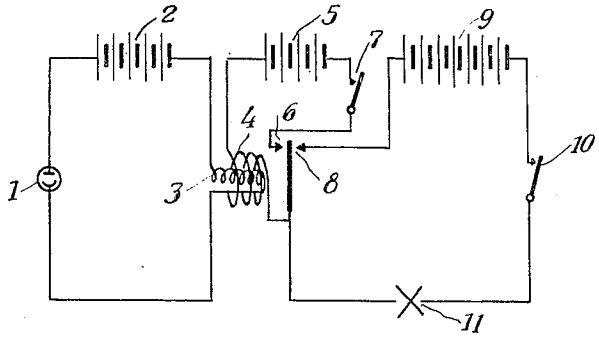
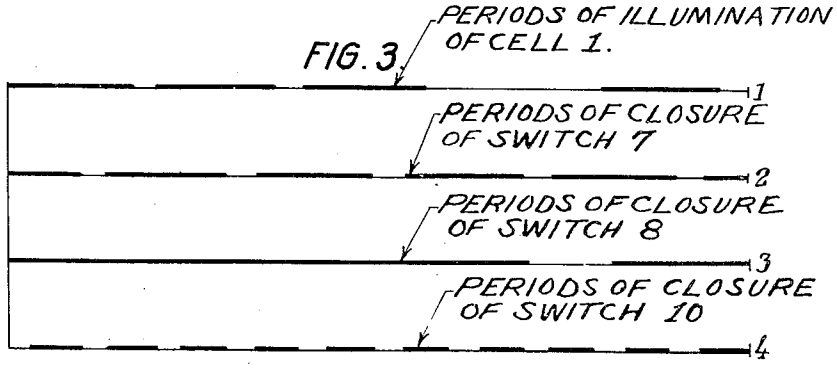


FIG. 3.



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CONTROL DEVICE FOR INCANDESCENT LAMP CINEMATOGRAPHIC APPARATUS

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1 Claim. (Cl. 177—346)

This invention relates to means for reproducing pictures on a screen of incandescent lamps by means of a film projector projecting on to a bank of photo-electric cells, and mechanical relays interposed between each cell and the corresponding lamp on the screen.

Up to now holding coils were provided for the relays which, being arranged in the electrical circuit of the lamps, were put in circuit by the relay, upon the current for the lamp being switched on, and held the relay armature in its attracted position, a circuit-breaker, arranged in the main circuit, interrupting the current for the lamps after each alternating film picture, thus causing the relay armature to fall off. The number of changes in the film picture, taking place in the projection apparatus per time unit, had to correspond to the number of interruptions (about 24 per second). This number, however, does not in all cases correspond to the real change of the phases in a film to be transmitted.

If for instance, a film is transmitted, showing for a certain period of time a picture without a movement, then the relays controlling the various picture points, continually have to carry out their switching action in correspondence with the changes taking place in the film picture, i. e. after each and every single film picture, in spite of the fact that it would be sufficient to carry out only one switching-on and one switching-out operation covering the entire period of time during which a portion of the film picture is transmitted which does not show a change.

The present invention realizes this task by the arrangement of holding coils in a separate circuit, and by providing an adequate successive arrangement in the interruption operations taking place within the different circuits. The idea of invention is explained by the drawing:

Figure 1 is a relay arrangement with holding coil, in which the relay is provided with two connecting contacts.

Figure 2 is a relay arrangement with one connecting and one disconnecting contact.

Figure 3 is the time graph of the single interruption operations.

In the first figure 1 is the cell, 2 the source of current for the relay, 3 the coil of the relay, 4 the holding coil, 5 the source of current for the holding coil, 6 the pair of contacts for the circuit actuating the holding coil, 7 a circuit-breaker (collector or the like), 8 the pair of contacts closing the circuit for the lamps, 9 the source of current for said circuit, 10 another circuit-breaker, and 11 the incandescent lamp.

The switching operations in the different circuits are the following:

The film is projected on to the photo-cell screen. If a cell is exposed to light, falling on it, the relay armature is attracted accordingly, whereby the circuit for the holding coil is closed by means of a pair of contacts 6, the relay armature thus being kept in its position by the action of the holding coil attracting it. The circuit-breaker 7 arranged in the circuit actuating the holding coil 4, acting synchronously and being in phase with the film transportation device, as will be explained below in detail, is to be considered to have its closed position.

Upon the relay armature being attracted, the pair of contacts 8, arranged in the circuit for the lamps is also closed, whereas the main circuit-breaker 10, also acting synchronously and in phase with the film transportation is opened, and is closed only after the relay armature having been attracted, the pair of contacts 8 thus being brought into its closed position when the circuit is dead.

The holding current having once been closed by the action of the pair of contacts 6, a discontinuance of the cell-current in case of the cells no longer being exposed to light, as takes place for instance in the dark intervals during the transportation of the film reel—which current otherwise would have an influence on the relay coil—does not exert any influence on the position of the relay armature, but on the contrary this armature will only be released after both the cell-current and the current for the holding coil have been taken off.

A variation of the arrangement described in Figure 1, is shown in Figure 2.

In the second figure 1 is the photo-electric-cell, 2 the source of current for the relay, 3 the relay coil, 4 the holding coil, 5 the source of current for the holding coil, 6 the contact closing the circuit for the holding coil, 7 a circuit-breaker, 8 the contact switching on the current for the lamps, 9 the source of current for the lamps, 10 a second circuit-breaker, and 11 the incandescent lamp.

The circuit for the lamps is closed, by way of the contact 8, when the relay armature is in its dead position, whereas the circuit for the holding coil is closed, by way of the contact 6, when the relay armature takes its attracted position. The film picture being projected is, so to say, the negative of the picture appearing on the lamp screen, in view of the fact that a darkening of the photo-electric-cells causes the relay armature to fall

off, the lamps thus being switched on, whereas light falling on to the cells causes the relay armature to be attracted, the lamps thus being switched off. The interruptions within the various electric circuits by means of the interrupters 7 and 10 are otherwise the same as above, and as illustrated by Figure 1.

The sequence of the stages of operations taking place in the different circuits (in the relay coils, in the holding coils and in the electrical circuit for the lamps) is explained more fully by the graph, Figure 3. (The lengths of the single sections do not represent any definite numerical values, as the latter can well be neglected, as far as the principle underlying the inventive idea is concerned.)

Line 1 represents the chronological sequence of the relay emanating from the film projecting apparatus. The intervals interrupting line 1 represent the periods of darkness caused by the rotating diaphragm when concealing the film transportation movement. At the same time line 1 represents the photo-electric current passing through the relay coil, as the cell supplies current when exposed to light.

By line 1 it is shown that a relay influenced by the photo-electric current would continuously switch on and off in correspondence with the darkening of the cells, because the relay current would be continually subject to interruptions corresponding to the periods of darkness. As explained above the circuit of a holding coil is being closed upon the armature of the relay being attracted. This current, however, must be periodically interrupted within short periods of time, in order to free the relay for a new light-electric operation.

These interruptions, as shown by line 2 in the graph, are so arranged as to coincide with the periods when the cell is exposed to light, i. e. those periods when the relay coil is continuously supplied with current. As long as the cell is continuously exposed to the influence of light, the relay armature therefore will continue to be kept in its attracted position, because, as soon as during the periods of darkness the current for the cells (circuit for the relay) is cut off, the holding coil will take over the function of attracting the relay armature. On the other hand, in case of the current actuating the holding coil being cut off in consequence of the periodical interruptions, the relay coil is influenced by the photo-electric current the armature thus also being kept in its attractive position. The relay armature thus will continue to be permanently attracted upon the cell corresponding to its relay being exposed to the influence of light. (See Figure 3, line 3 of the graph.)

It is possible for the relay armature, after having been attracted, to disengage itself as soon as both the current for the photo-cells and the current for the holding coil have been interrupted. This happens in the moment when the current actuating the holding coil has been interrupted, so that the attracted relay armature re-adopts its dead position, thereby disconnecting the circuit of its holding coils by means of its pair of contacts. The armature of the relay can be attracted again as soon as the cell corresponding to it is exposed to light, whereupon the circuit of the holding coil is closed again said armature will be held in its position thereafter by the photo electric current (relay current and holding current, respectively), until the film picture to be transmitted requires a new detachment and a new switching operation, respectively.

It is obvious therefrom that the armature of those relays which have to transmit photo-electrically the individual points of the picture showing no movement for a certain period of time, remain in their attracted position during the whole period of transmission, the wear and tear of the relay contacts thereby being reduced to a minimum, resulting in an increase of the working reliability of the whole plant.

The possibility is already known of breaking the current for the lamps to be switched-on and switched-off, respectively, by the contacts of the relays, just in the moment when the contacts of the relays are moving, a formation of sparks on the contacts thereby being prevented.

As shown above, the moments when the relay armatures are moving, coincide firstly with the moment when the current for the holding coil is disconnected, and again with the moment when the cell commences to be exposed to the influence of light, i. e. the moment immediately after the film reel in the projector has moved on, when the rotating diaphragm lets pass the ray of light.

In both these moments the circuit for the lamps must be broken for a short time, because just these moments offer a possibility for the armature of the relay to be attracted.

Line 4 of the graph shows the manner in which the interruptions of the circuit for the lamps are distributed. The illustration shows that the interruptions in the circuit for the lamps amount to twice the amount of interruptions in the circuit for the holding coil. This is another advantage, because by an increase in the number of interruptions the troublesome flickering, if any, of the picture to be transmitted will be reduced or abolished.

The improvement implied in the present control devices, as compared with those known up to now, is that the relays are put into operation only in case of the film picture to be transmitted requiring an alteration in the picture just being reproduced. A considerable reduction in wear and tear of the relay contacts results therefrom.

I claim,

Means for reproducing on a screen composed of incandescent lamps, film pictures projected on a bank of photo-cells comprising a cell current source and a relay coil connected in series with each photo-cell; a holding circuit and a relay holding coil, a holding coil current source, a circuit breaker and a relay contact connected in series in said holding circuit; a lamp circuit and a lamp current source, a second circuit breaker and a second relay contact connected in series in said lamp circuit, the two relay contacts being operable by either of said coils, said relay coil being controlled by said photo-cell whereby, during periods of illumination of said cell, the relay contacts are closed, means for synchronizing the operation of the two circuit breakers with the film transportation so that the holding circuit is interrupted during each projection period and closed during the intervals between projection periods and the lamp circuit is interrupted during each projection period and each of the last said intervals whereby, while the cell is illuminated, the relay remains attracted from frame to frame.

KURT ROSENBERG.