Aug. 6, 1935. F. L. NICHOLS 2,010,559

SAFETY APPARATUS FOR MOVING PICTURE MACHINES

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Fig. 1

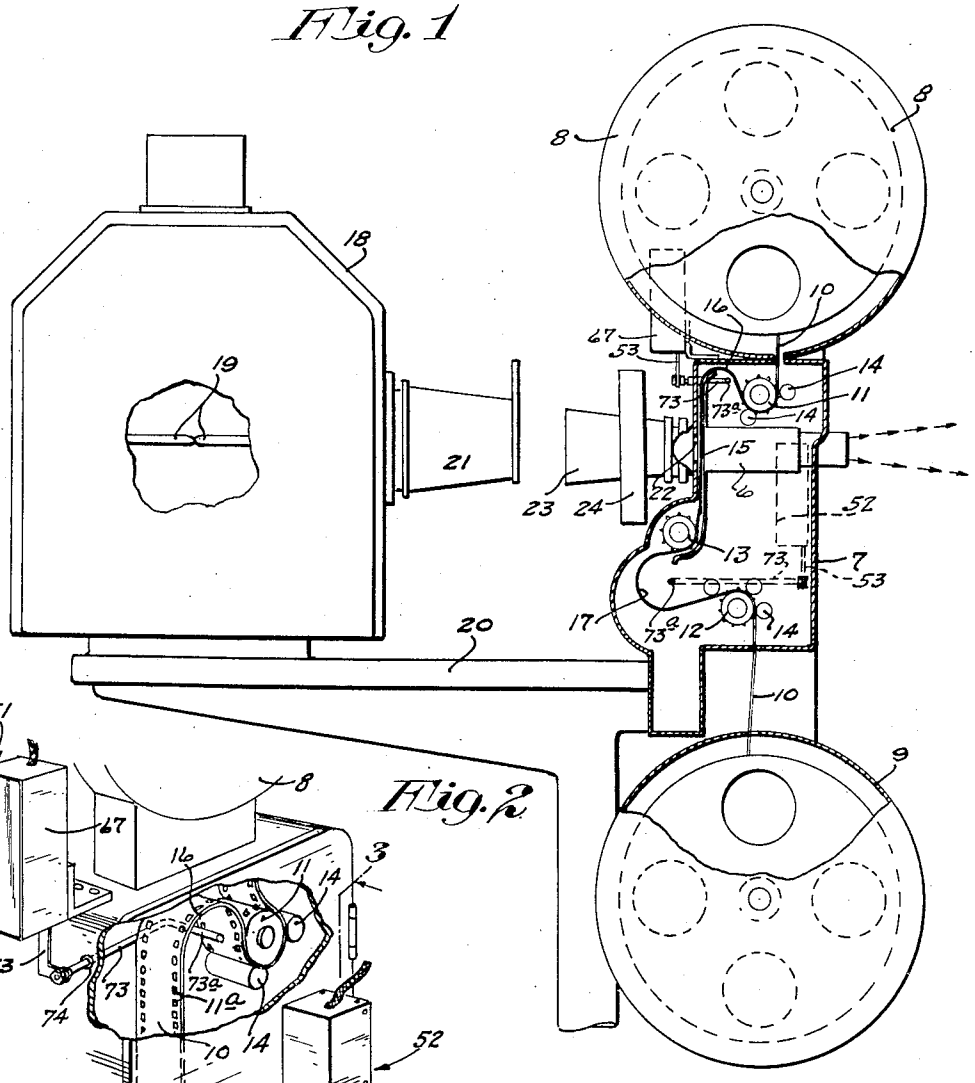


Fig. 2

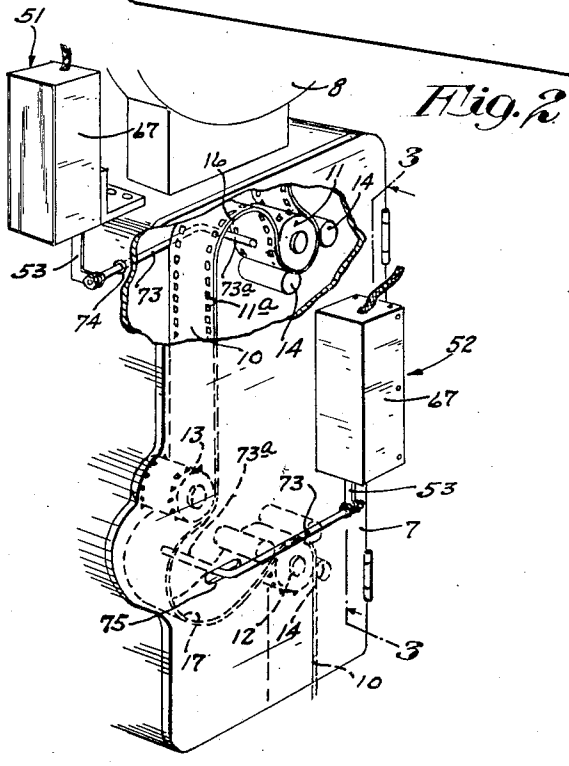
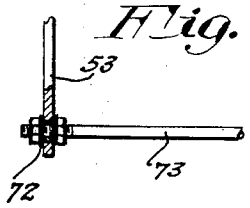


Fig. 6



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Fig. 4

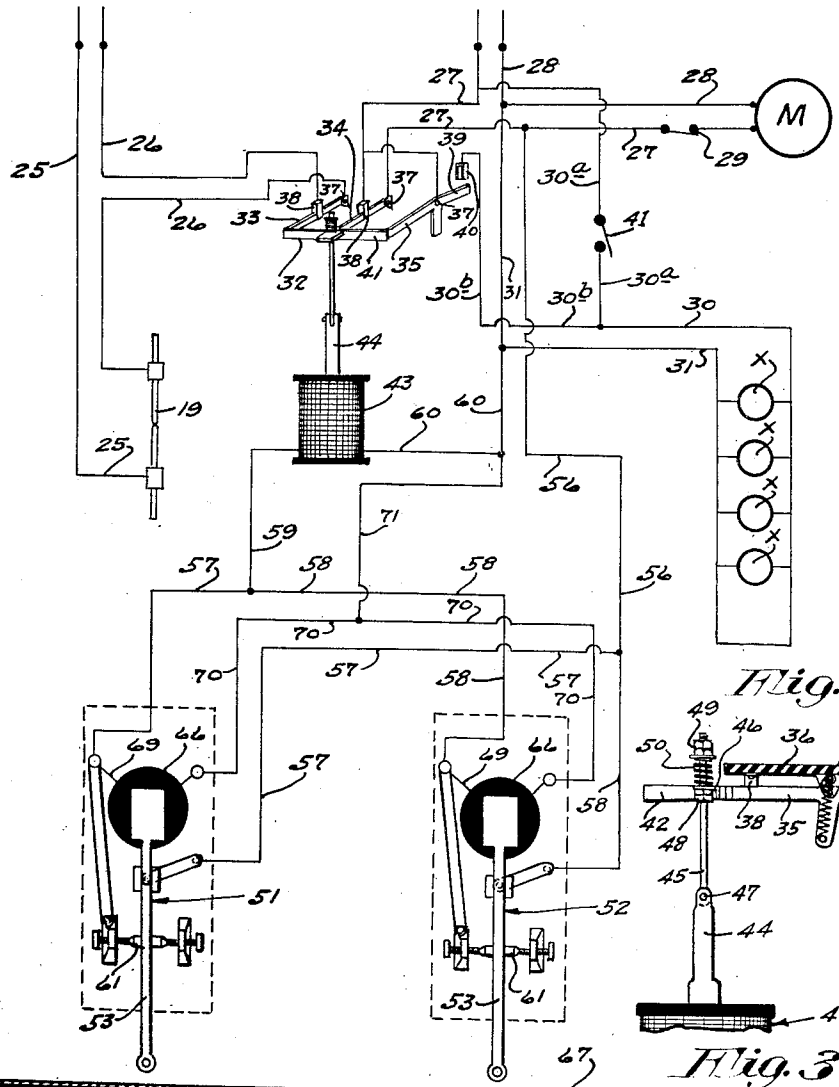
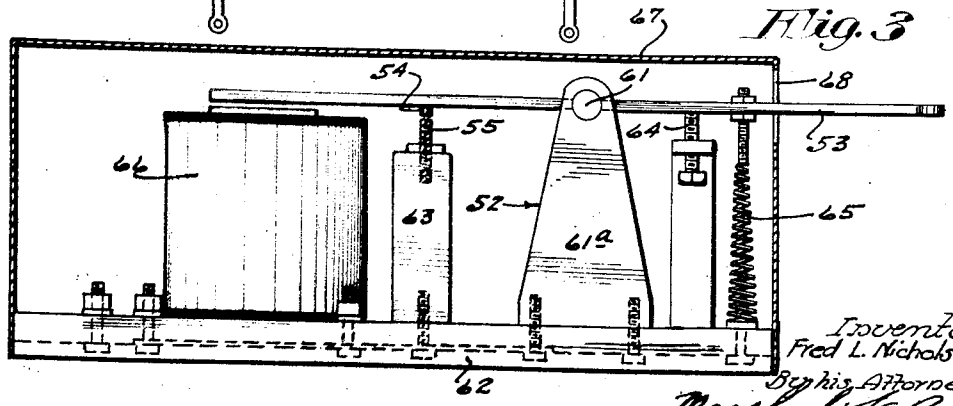


Fig. 5

Fig. 3



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SAFETY APPARATUS FOR MOVING PICTURE MACHINES

Fred L. Nichols, Minneapolis, Minn.

Application March 20, 1933, Serial No. 661,745

6 Claims. (Cl. 88—17)

My present invention relates to extremely simple but very dependable and otherwise efficient safety apparatus for moving picture projecting machines, and generally stated, the invention consists of the novel devices, combinations of devices and arrangement of parts hereinafter described and defined in the claims. Among the objects of the invention is the provision of means for preventing damaging of the moving picture film by breakage or fire. The above and other important objects and advantages of the invention will be made apparent from the specification and claims.

In the accompanying drawings, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a view in side elevation of the motion picture projecting machine, incorporating certain elements of the invention, some parts of the machine being broken away or omitted, and some parts being shown in section;

Fig. 2 is a fragmentary perspective view with some parts broken away or omitted and illustrating certain elements of the invention in connection therewith;

Fig. 3 is a detail view of one of the relay switches of the apparatus with some parts thereof shown in section, and some parts shown in full, said view being taken approximately on the line 3—3 of Fig. 2; and turned ninety degrees in a counter-clockwise direction;

Fig. 4 is a diagrammatic view illustrating the electrical hook-up of the novel safety apparatus and certain circuits controlled thereby;

Fig. 5 is a detail view with some parts broken away of a safety control switch shown diagrammatically in Fig. 4; and

Fig. 6 is a fragmentary detail view with some parts broken and some parts shown in section.

The machine illustrated is of conventional design and includes a projector cylinder 6 mounted in a casing 7. Mounted on the upper portion of the casing 7 is a film-feeding reel 8 and mounted on the lower portion of the casing 7 is a similar film-receiving reel 9.

The film indicated by 10, is fed from the feeding reel 9 through the casing 7 and past the projector cylinder 6 to the film-receiving reel 9 by mechanism including continuously driven sprocket-tooth-equipped feed rollers 11 and 12 and an intermediate intermittently driven sprocket-tooth-equipped feed roller 13. The sprocket teeth of the film-feeding rollers 11, 12 and 13 work in apertures 11a on the edge portions of the film. The film 10 is held in engagement with the feed sprockets 11 and 12 by suitable guide rollers 14. The feed rollers 11, 12 and 13 and film-receiving reel 9 may be assumed to be driven from a suitable electric motor M illustrated only diagrammatically in Fig. 4, through suitable transmission mechanism, not shown. In accordance with customary practice, the film is fed through a guide way 15 extending beyond opposite sides of the projector barrel 6 and the customary film loops 16 and 17 are maintained beyond opposite sides of the projector and guide way.

For supplying the necessary light to the projector, a suitable lamp house 18 containing arc electrodes 19 is mounted on a supporting bracket 20 extending from the projector casing 7. The front of the lamp house 18 is provided with the customary condenser cone 21, which is positioned to project a beam of light through an aperture 22 in the back of the projector casing 7, directly in line with the projector cylinder 6 through a light beam receiving cone 23, the passage through which is controlled by what may be assumed to be a conventional rotary shutter 24.

In the ordinary operation of machines of this type, the film loops 16 and 17 are normally maintained substantially as illustrated, but in some instances, due to faulty film or improper threading of a new film into the machine, one or the other of the loops 16 and 17 will be diminished or completely eliminated so that an undue tension will be placed upon the film. This tension, of course, places such strain on the film that damage to the film or complete breakage thereof usually results. In cases where the film breaks just ahead of the intermittently driven film feeding roller 13 and below the light aperture 22, the portion of the film in the guide way 15 above the break will remain stationary and presents a serious fire hazard since the intense beam of light being projected therethrough will heat the same to a combustible temperature in a very short lapse of time. It will, of course, be apparent that whenever a film breaks at some point in the machine intermediate the film feeding rollers 11 and 12, as a result of either one or the other of the loops 16 and 17 being diminished, some portion of the film will be caused to bunch up or wad, and in any of these instances, serious damage will be done to the film and a possible serious fire hazard presented unless the film feeding mechanism and light beam are cut out of action almost instantaneously or within a very short space of time subsequent to the break.

It is an object of the present invention to provide means whereby the film feeding mechanism

will be rendered inoperative and if desired, the beam of light to the projector immediately cut off, whenever the film loops 16 and 17 are materially changed in dimension or, in other words, whenever the film gets out of its normal path of travel.

The arc electrodes 19 in the lamp house 18 are connected to a suitable source of potential, not shown, through a circuit comprising leads 25 and 26. The electric motor M of the film feeding mechanism is adapted to be supplied with current from a suitable source of potential, preferably separate from the source used by the arc electrodes 19, through a circuit comprising leads 27 and 28, and the former of which leads has interposed therein a motor service switch 29.

A plurality of illuminating lamps, located in the building in which the projector may be assumed to be installed, and indicated individually by X, are connected in parallel to leads 30 and 31, the former of which is connectible to motor circuit lead 27 through either of a pair of branch leads 30^a or 30^b, and the latter of which connects to motor circuit lead 28.

In the preferred arrangement illustrated, a normally closed safety cut-off switch 32 is provided for emergency control of the arc, motor and general illuminating circuits. This switch 32, in the arrangement illustrated, is of the knife blade type including blades 33, 34 and 35, each pivoted to a suitable insulating base 36 at 37. For co-operation with the blades 33 and 34, are spring clip contacts 38 each mounted on the insulating base 36. The blade 35, it will be noted, is provided beyond its pivot point 37 with an extension 39 which co-operates with but is normally disengaged from a spring clip contact 40 also mounted on the insulating base 36. The blades 33 to 35, inclusive, are all connected for common movements by means of a tie-bar 41 of suitable insulating material and which tie-bar is formed or otherwise provided with a handle 42 for convenient manual manipulation of the switch.

By reference now to the arc electrode and motor circuits, it will be noted that the lead 26 of the electrode circuit includes and is normally closed through the switch blade 33 and its co-operating spring contact 38 and the motor circuit lead 27 includes and is normally completed by switch blade 34 and its co-operating spring clip contact 38.

The general illumination circuit may be closed at any time by manipulation of a service switch 41 located in the branch lead 30^a, and which is normally open when the projecting machine is in operation, for general illumination is not desired at that time. The general illuminating circuit is automatically completed when leads 33 and 34 of the safety cut-off switch are opened in respect to their co-operating contacts 38 through branch lead 30^b and normally open blade and contact 39 and 40, respectively, which latter are automatically closed when the switch blades 33 and 34 are opened in respect to their co-operating contacts 38, so that in case operation of the machine is interrupted by the safety cut-off switch 32, the lights in the house will be instantly turned on.

For positively moving the safety-cut-off switch 32 from its normal position illustrated and in which position the motor and arc electrode circuits are closed therethrough to a position wherein said circuits are opened, and the general illuminating circuit is closed, when improper feeding of the film through the machine occurs, I provide the highly efficient system hereinafter immediately described, and which includes a relatively strong pull solenoid 43, the plunger 44 of which solenoid is suspended from the cross bar 41 of the switch 32 through connections including a link 45 and a bracket 46. The link 45 is pivotally connected to the plunger 44 at 47 and the other end portion thereof works through the bracket 46 for movements that are limited by nuts 48 and 49, and a compression spring 50 that has preferably just sufficient strength to support the plunger without being appreciably compressed.

The switch blades 33 and 34 are manually closed with their respective spring contacts 38 and are normally held in that position by the frictional engagement of the contacts, which may be assumed to be sufficient to support the weight of the plunger 44. Obviously, with the switch 32 and actuating mechanism illustrated, the switch blades 33 and 34 will remain engaged with their respective contacts 38, until the solenoid 43 is energized and, at that time, the plunger 44 will have sufficient magnetic pull exerted thereon to free the blades 33 and 34 from their respective contacts 38, and aided by the action of gravity, to move the projecting end of the blade 35 into engagement with its co-operating spring clip contact 40, thereby opening the motor and arc electrode circuits and closing the general illumination circuit.

Current for energizing the safety cut-off switch actuating solenoid 43 is supplied from the motor circuit leads 27 and 28 through either of a pair of like circuits, each of which includes and is controlled by a like film-operated relay switch 51 and 52. Each of these relays 51 and 52 includes a pivoted switch arm 53 carrying a contact 54 and a relatively fixed but adjustable contact 55. The solenoid supply circuits through each of the relay switches 51 and 52 includes a lead 56 extending from the motor circuit lead 27, and common to both circuits, branches 57 and 58 from the lead 56, the former having interposed therein the relay switch 51 and the latter the relay switch 52, a common lead 59 extending from a junction of the branch leads 57 and 59 beyond the switches 51 and 52 to the solenoid 43, and a lead 60 connecting the solenoid 43 to the motor circuit lead 28 through illuminating circuit lead 31.

In the preferred arrangement illustrated, the switch arms 53 of the relay switches are each pivoted at 61 to a bracket 61^a that is mounted on an insulated base 62 and the fixed contacts 55 of said switches are adjustably mounted in brackets 63 that project from the bases 62. The arms 53 of the relay switches are normally yieldingly held in a position wherein their contacts 54 are spaced slightly from their respective fixed contacts and against adjustable stops 64 by light tension springs 65. One projected end of the switch arm of each relay switch overlies and is spaced from an electro-magnet 66, which, when properly energized, have sufficient power to close and maintain relay switches firmly closed. The various elements of each relay switch and its respective co-operating magnet is enclosed in its own case 67 through which the arms 53 thereof project and are free to work in slots 68.

The circuit of each electro-magnet 66 includes the common relay switch circuit lead 56, part of its co-operating relay switch branch lead 57 or 58, is co-operating relay switch 51 or 52, a lead 69 branching from a branch lead 57 or 58 at a point beyond its co-operating relay switch 51 or 52 and connecting thereto, and a lead 70 extending there-

from to a common lead 71 through which and the lead 60 connection is made to the motor circuit lead 28.

The cases 67 containing the relay switches 51 and 52 and their respective electro-magnets 66 are suitably mounted at the exterior of the projector machine casing 7, and in the preferred arrangement illustrated, the case containing the relay switch 51 is located in the vicinity of the film loop 16 and the case containing the relay switch 52 is located in the vicinity of the lower film loop 17. Carried by but electrically and magnetically insulated from the switch arm 53 of each relay switch 51 or 52 at 72 is a film-actuated switch arm extension 73 preferably of non-magnetic material, such as brass, having an offset free end portion 73a. The extension 73 of the arm 53 of the relay switch 51 works axially through an aperture 74 in the casing 7 of the projector with its offset free end portion 73 extended into the film loop 16. The offset free end portion 73a of the extension 73 of relay switch 52 works through a slot 75 in the projector casing 7 and extends into the film loop 17.

It will now be evident that when either of the film loops 16 or 17 become materially diminished, a cooperating relay switch 51 or 52 will be closed, thereby completing the supply circuit to the solenoid 43 and the circuit through its co-operating electro-magnet 66. The co-operating electro-magnet 66, upon being energized, will exert considerable pull on the overlying end portion of the relay switch arm 53 and will hold the relay switch contacts 54 and 55 firmly closed.

The safety switch-operating solenoid 43, upon being energized, will pull the blades 33 and 34 of the safety cut-out switch 32 out of engagement with their co-operating spring clip contacts 38, thereby opening the circuit of the arc electrodes 19 and the motor circuit, and the action of said solenoid 43, aided by the action of gravity, will continue movement of the switch blades 33 to 35, inclusive, until the projecting end 39 of the blade 35 is brought into engagement with its co-operating spring clip contact 40, thereby closing the supply circuit for the general illumination lamps X. The circuit of the film-feeding motor M, is in this manner interrupted before a diminishing film loop 16 or 17 is completely eliminated, so that the film-feeding mechanism is rendered inoperative and comes to a stop before damaging tension is exerted on the film, and since the circuit of the arc electrodes 19 is interrupted simultaneously with opening of the motor circuit, the intense beam of light normally projected through the film is cut off before the film is heated to a combustible temperature thereby, even though a portion of the film should come to a stand-still in front of the light aperture 22. Not only will the relay switches 51 or 52 be closed by diminution of a film loop 16 or 17, but also if ballooning of a film loop occurs, the resultant bunching up of the film in the vicinity of a normally looped portion of the film will cause closing pressure to be exerted on the adjacent relay switch arm extension 73a and the mechanism will be immediately rendered inoperative and usually before any material damage has been done to the film.

It will, of course, be understood that the relay switches and their operating connections may be located adjacent any portion of a path normally travelled by the film through the machine, where it is found that the film is apt to leave its normal path and, further, that relay switches may be provided for in as many places along the path normally travelled by the film as are desirable for the protection of the film and elimination of the ordinary fire hazard.

The relay switches 51 and 52 are preferably made very sensitive so that they will be closed by a very light pressure exerted thereon by the film and the electro-magnets 66, co-operating therewith, should preferably be of sufficient strength to maintain the relay switches closed firmly until the circuit therethrough is broken, and which breaking of the circuit does not, of course, occur until the motor and arc electrode circuits have been opened. The relay switches must, in a device of this character, close the circuit through the solenoid 43 for a sufficient period of time to cause complete withdrawal of the switch blades 33 and 34 from their co-operating contacts 38 and that such action might not result from a very short closing period of a relay switch or an intermittent series of short closings thereof. With this arrangement, however, the complete operation of the safety cut-off switch 32 is insured since the relay switches once closed are caused to remain closed during a complete operative period of the solenoid 43.

What is claimed is:

1. The combination with a motion picture machine provided with a projector, a film, means including an electric motor and parts driven therefrom for moving the film past the projector, and a supply circuit for the said motor, of a normally closed safety cut-off switch in the motor supply circuit, an electro-magnetic actuator for the said safety control switch, a supply circuit for said safety switch actuator, a normally open relay switch interposed in and controlling the supply circuit of the said safety switch actuator and having an operating element extending into close relation to the path normally travelled by the film where it will be engaged by the film and caused to close the said relay switch when and only when the film leaves its normal path, and an electro-magnetic device connected to be operated from the circuit of and controlled by the relay switch and operatively arranged so that when energized as a result of even momentary relay switch closing pressure exerted by the film, it will close and hold closed the said relay switch during the complete period of operation of the safety cut-off switch actuating means.

2. The combination with a motion picture machine provided with a projector, a film, means including an electric motor for moving the film past the projector, an electrically operated lamp arranged to project a beam of light through the film and projector, and supply circuits for said motor and lamp, of normally closed safety switch means controlling said circuits, normally inoperative electro-magnetic actuating means for said safety control switch means, a supply circuit for said electro-magnetic actuator, a normally open relay switch interposed in and controlling the said circuit of the electro-magnetic safety switch-actuating means and having an operating element extending into close relation to the path normally travelled by the film where it will be engaged by the film and moved thereby to close the relay switch when and only when the film leaves its normal path, and an electro-magnetic device connected to be operated from the supply circuit of the safety control switch-actuating means and to be controlled by said relay switch and operative when energized as a result of even momen-

tary relay switch closing pressure exerted by the film to retain the relay switch closed during the complete period of operation of the safety control switch operating means.

3. The structure defined in claim 1 in which the supply circuit of the electro-magnetic safety switch actuator is controlled by the said safety control switch, whereby it will be opened when the motor circuit is open.

4. The structure defined in claim 2 in which the supply circuit of the electro-magnetic safety switch actuator is controlled by the said safety controlled switch, whereby it will be opened when the motor and lamp circuits are opened.

5. In a motion picture projecting apparatus, the combination with a film, means for projecting a beam of light through the film, and means for moving the film past the projector, of means for cutting off the beam of light to the film, an electro-magnetic actuator for said light beam cut-off, a supply circuit for said electro-magnetic actuator, a normally open relay switch interposed in and controlling the supply circuit of said electro-magnetic actuator and having an operating element extending into close relation to the path normally travelled by the film where it will be engaged by the film and caused to close said relay switch when and only when the film leaves its normal path, and an electro-magnetic device connected to be operated from the circuit of and controlled by the relay switch and operatively arranged so that when energized as a result of even momentary relay switch closing pressure, exerted by the film, it will close and hold closed the said relay switch during the complete period of operation of the safety switch-actuating means.

6. The combination with a motion picture machine provided with a projector, a film, and means including a motor and driving connections for moving the film past the projector, of means for rendering the driving mechanism inoperative on the film, an electro-magnetic actuator controlling operation of said last named means, a supply circuit for said actuator, a normally open relay switch interposed in and controlling the supply circuit of the said electro-magnetic actuator and having an operating element extending in close relation to the path normally travelled by the film where it will be engaged by the film and caused to close the relay switch when and only when the film leaves its normal path, and an electro-magnetic device connected to be operated from the circuit of and controlled by the relay switch and operatively arranged so that when energized as a result of even momentary relay switch-closing pressure exerted by the film, it will close and hold closed the said relay switch during the complete period of operation of the electro-magnetic actuator.

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