

Feb. 27, 1945.

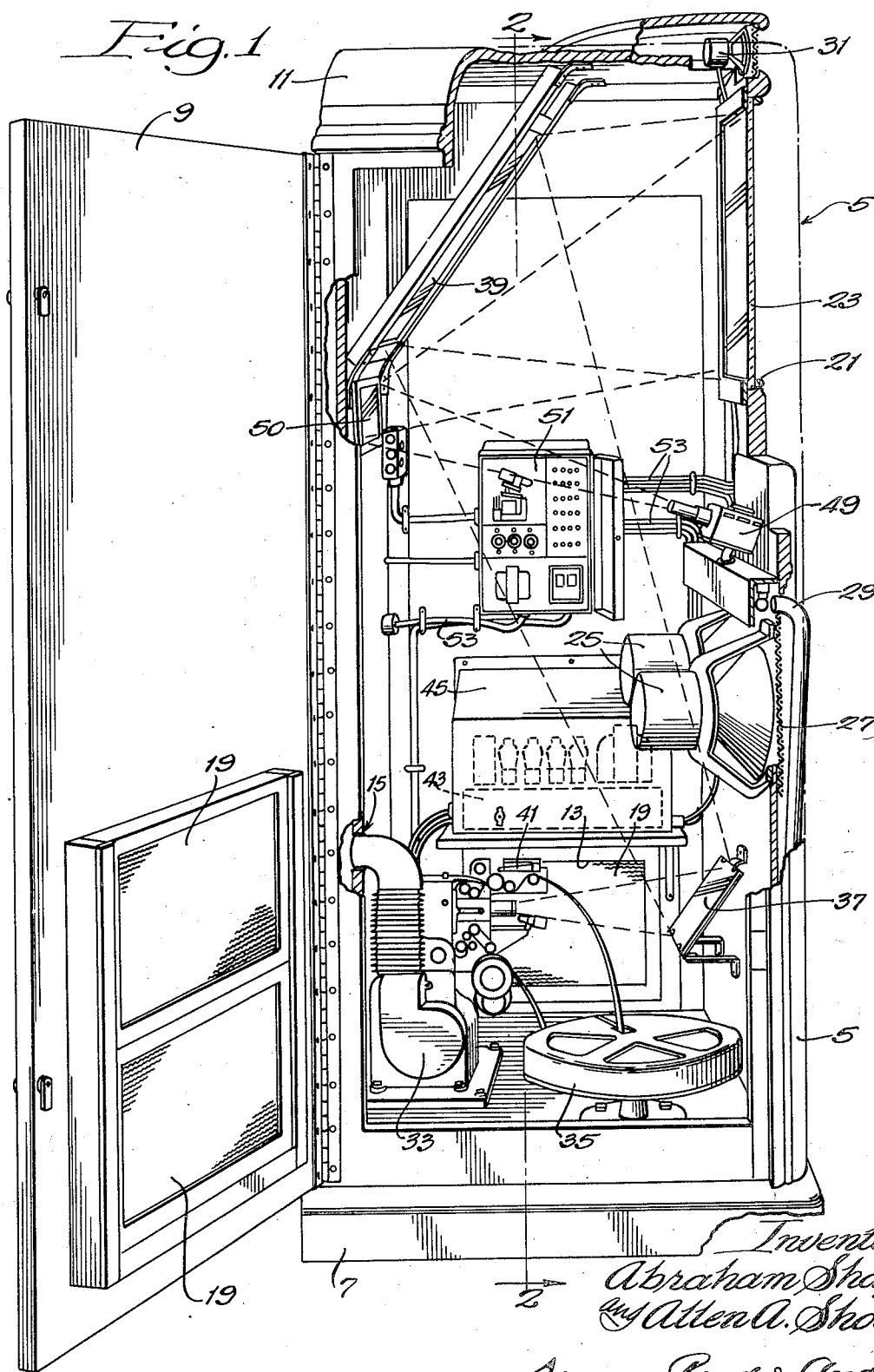
A. SHAPIRO ET AL

2,370,587

CABINET TYPE MOTION PICTURE PROJECTOR

Filed March 19, 1942

3 Sheets-Sheet 1



Inventors:
Abraham Shapiro
and Allen A. Shoup,

By Soans, Pond & Anderson
Attorneys.

Feb. 27, 1945.

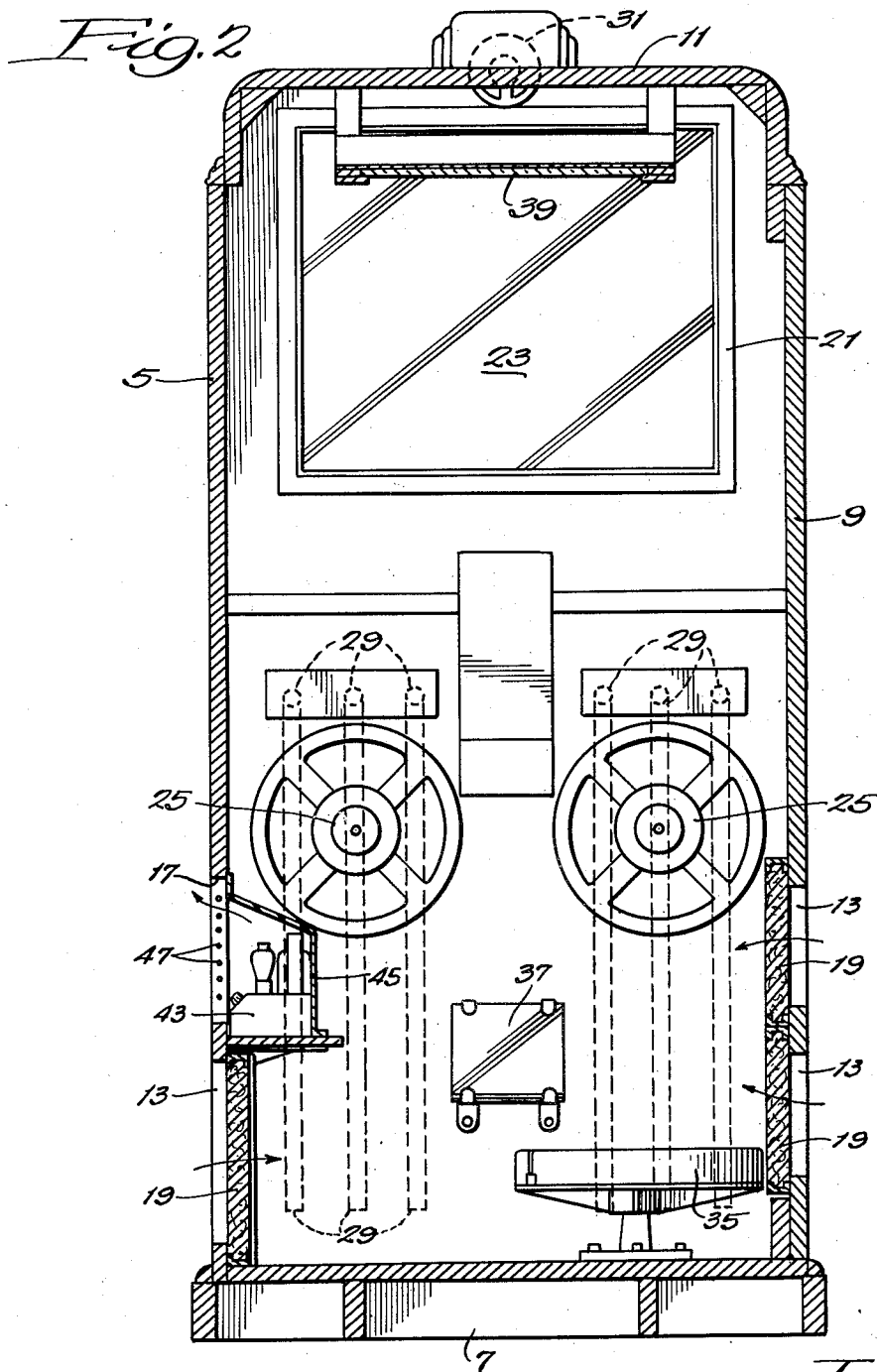
A. SHAPIRO ET AL

2,370,587

CABINET TYPE MOTION PICTURE PROJECTOR

Filed March 19, 1942

3 Sheets-Sheet 2



Inventors:
Abraham Shapiro
and Allen A. Shoup,

By Soans, Pond & Anderson
Attorneys.

Feb. 27, 1945.

A. SHAPIRO ET AL

2,370,587

CABINET TYPE MOTION PICTURE PROJECTOR

Filed March 19, 1942

3 Sheets-Sheet 3

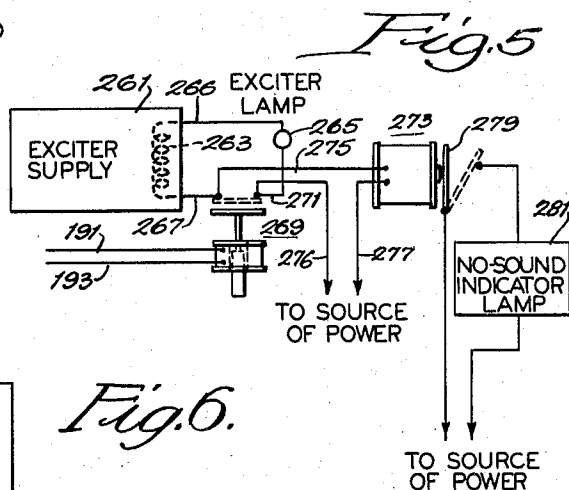
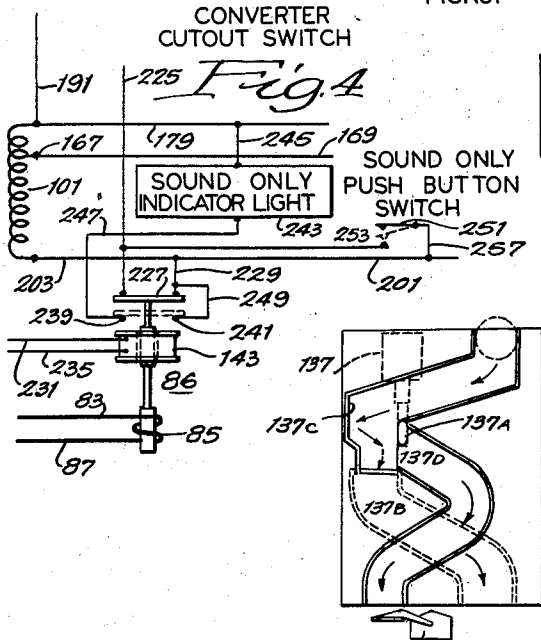
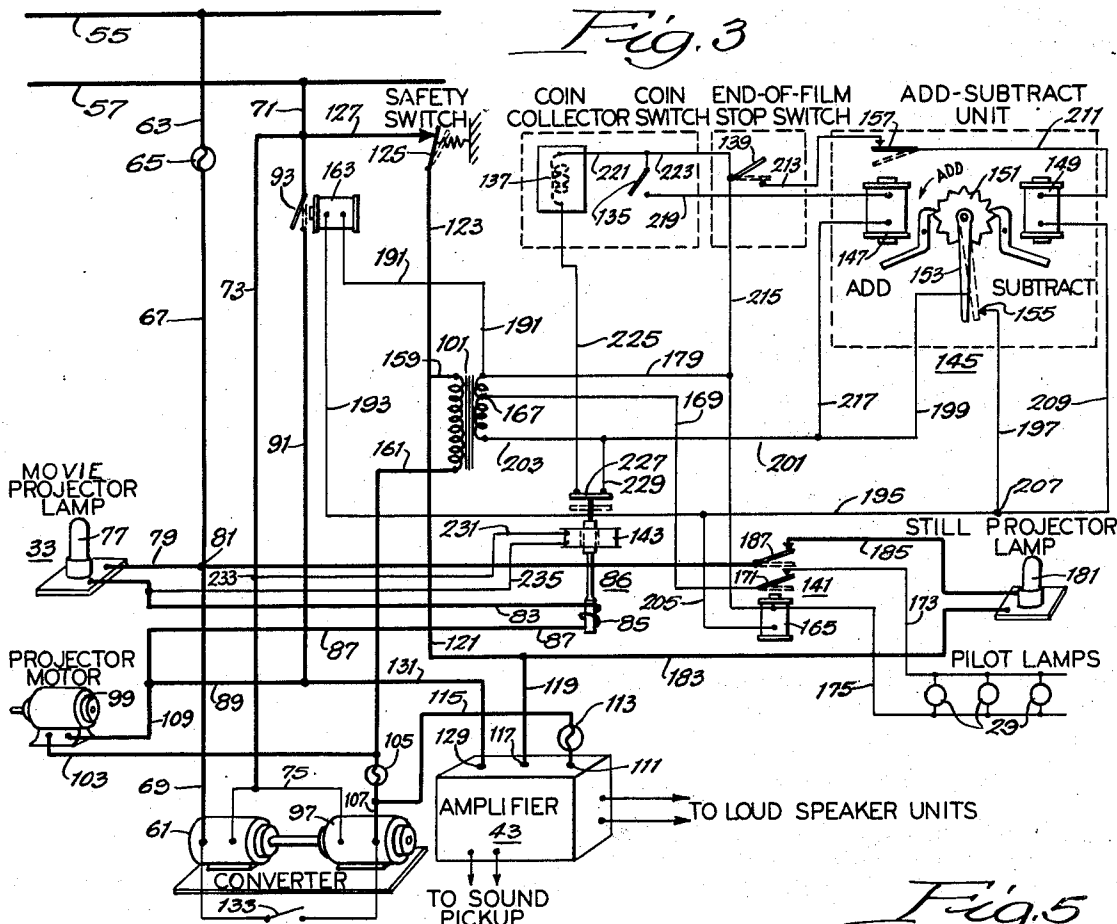
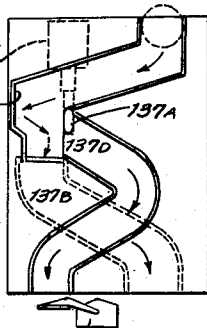


Fig. 6.



Inventors:
Abraham Shapiro
and Allen A. Shoup,

By Soans, Pond & Anderson
Attorneys.

UNITED STATES PATENT OFFICE

2,370,587

CABINET TYPE MOTION-PICTURE
PROJECTORAbraham Shapiro and Allen A. Shoup, Chicago,
Ill., assignors to Ampro Corporation, a corpo-
ration of Illinois

Application March 19, 1942, Serial No. 435,362

9 Claims. (Cl. 194—12)

The present invention relates to motion picture projectors of the automatic type, and has particular relation to portable, unitary devices of this character which are operable in response to the actuation of a coin switch or similar means to project a selected program with or without sound accompaniment.

The principal object of the invention is to provide an improved, portable, automatic type motion picture projector unit which shall be more satisfactory and reliable in operation than the apparatus heretofore known to the art. As hereinafter will appear, this object is accomplished by the provision of certain novel structural combinations and arrangements of apparatus whereby improved projection and improved sound reproduction are attained. A further and more specific object of the invention is to provide an improved electrical circuit for the control of automatic motion picture projectors of the above type, which circuit shall not only afford complete and continuous protection for the various parts of the apparatus but, in addition, shall automatically correct, or otherwise provide for, all possible failures or abnormal conditions which may occur during the operation of the apparatus.

The foregoing and other objects and advantages of the invention will be made more apparent by reference to the accompanying drawings, and the following description of a preferred embodiment thereof.

In the drawings:

Fig. 1 is a perspective view partially in section of an automatic motion picture projector of the type to which the present invention particularly pertains;

Fig. 2 is a sectional view on the general line 2—2 of Fig. 1;

Fig. 3 is a schematic circuit diagram of the control circuit of the apparatus illustrated in Figs. 1 and 2; and

Figs. 4 and 5 are fragmentary circuit diagrams showing modified control arrangements which may be used with the complete circuit of Fig. 3.

Figure 6 is a diagrammatic view of the coin collector of a commonly used type embodying a two-way coin path wherein the travel of the coin through one or the other of the paths is determined by the pin actuated by a solenoid.

Projector units of the type to which the present invention particularly pertains usually comprise a motion picture projector of the continuous or endless film type, sound reproduction apparatus which includes a suitable optical type pick-up, amplifier, and loud speaker means for

use in conjunction with the projector, a mirror and screen arrangement for showing the image produced by the projector, a control circuit which includes coin responsive switching means for accomplishing the operation of the device, and a cabinet or other closure for the entire apparatus. The structure, preferably, also includes apparatus for projecting an advertisement of the still picture type on the screen when the motion picture mechanism is not operating, and it may include other types of advertising or decorative illumination.

In the particular structure illustrated in Figs. 1 and 2, the closure or cabinet 5 is generally rectangular in shape and includes a suitable base 7, preferably of fabricated metal, four side wall members, one of which comprises a hinged door as illustrated at 9 in Fig. 1, and a suitable top 11. The various elements of the closure are fastened together to provide a strong, rigid structure which facilitates movement of the apparatus as a unit when desired. Except for air inlet openings 13, an air outlet opening 15, and an opening 17 for admitting cooling air to the amplifier unit, the cabinet 5 is substantially air-tight. The air inlet openings 13 are rectangular in shape and are covered by suitable porous filters 19, which prevent any dust from being drawn into the cabinet during the operation of the apparatus. In view of the fact that the film and the optical portions of the apparatus are necessarily exposed within the cabinet closure, this air filtering means is an important feature of the invention in assuring continued reliable operation of the apparatus with complete freedom from any of the usual troubles which result from dust accumulations.

The front panel of the cabinet 5 is provided with a rectangular opening 21 near its upper end to receive the translucent screen 23 used in conjunction with the apparatus. This screen may be of any standard type. The front panel is also provided with suitable openings for the two main loud speakers 25, which are located a short distance below the screen 23, and which are covered with dust proof fabric 27. Decorative lighting of the tube and lamp type may be provided in the front panel as illustrated generally at 29 in Fig. 1. A third loud speaker 31 is supported in the top portion 11 of the cabinet 5. The loud speakers 25 should be of the type having a high response characteristic to low frequency audio impulses, and the third speaker 31 which is mounted above the screen 23 should have a high response characteristic to high frequency audio impulses. The speakers 25 should be of a capac-

ity to utilize about 90% of the amplifier output, and the speaker 31 should utilize the remaining approximately 10%.

The use of loud speakers having the above stated response and capacity characteristics, and disposed in the spaced positions illustrated in the drawings, has been found to be of very great value in accomplishing clear and audible sound reproduction, especially in crowded rooms, and constitutes one of the novel features of the present invention.

The projector 33 and the continuous type film handling mechanism 35 are preferably mounted on the base of the apparatus. The projector 33 may be of any standard type, and it should be equipped with an end of the film stop switch, a film break safety switch, and other protective devices as will hereinafter appear. The heated air expelled from the projector by the cooling fan for the projector lamp is discharged from the cabinet 5 through the air outlet opening 15. The continuous film mechanism is preferably of the type which is described in detail in my co-pending application Ser. No. 369,871, which was filed on December 12, 1940, and which is assigned to the assignee of this invention. Any other apparatus, however, which is capable of feeding the film in a continuous manner may be used. It will be noted that the continuous film mechanism is located below the level of the projector lamp forming a part of the projector 33 and is in the path of the incoming, filtered, cool air drawn into the cabinet 5 by operation of the projector fan during operation of the projector. This arrangement is of great value in preventing overheating of the film during extended periods of continuous operation, and is considered an important feature of the invention.

The optical system of the apparatus includes, in addition to the projector 33, two mirrors 37 and 39 which are arranged to direct the projected image onto the screen 23 in the front panel of the cabinet 5, while at the same time providing the maximum possible throw in the minimum possible space, all with the fewest possible number of mirrors. The arrangement of the projector, reflecting mirrors and screen disclosed is believed to be new, and is a valuable feature of the invention. It will be noted that the incident and the reflected beams overlap in both mirrors, and that the distances from the optical center of the projector lens to the screen are optically equal along all possible paths. This assures distortion free projection, and makes the most efficient possible use of the space available for projection.

The projector 33 is also provided with an optical type, sound pick-up apparatus 41 which co-operates with the sound track of the film in instances where sound movies are to be shown. The pick-up apparatus 41 is electrically connected to a suitable amplifier unit 43, which in turn, connects with the loud speaker units. The amplifier unit 43 is preferably of the vacuum tube type, and under normal operating conditions the filaments of these tubes will be continuously energized. To provide for the dissipation of the heat thus liberated, the amplifier unit 43 is positioned in a secondary closure 45 which serves to close off the amplifier unit from the interior of the main cabinet 5. This secondary closure 45 communicates with the opening 17 in one of the side walls of the cabinet, as illustrated in Fig. 2, to permit free circulation of air over the ampli-

fying tubes to effect their cooling. A protective screen 47 should be placed over this opening.

The apparatus may conveniently include a still picture projector 49 and mirror for projecting advertising or other material onto the screen 23 during those periods when the motion picture apparatus is not in operation.

A terminal board 51 which is preferably enclosed within a suitable fireproof box, and which may include, transformer, switch, and fuse elements is supported on one of the side members of the cabinet 5 as illustrated in Fig. 1. The various electrical elements of the apparatus are connected together by wiring of a conventional type illustrated generally at 53.

The electrical circuit is one of the more important features of this invention, and is designed to accomplish a number of different functions. Included among these is the provision of means, including a converter, whereby the apparatus may be used with either direct or alternating current source. If a direct current power supply is used, only the amplifier and the projector motor will be energized by the alternating current from the converter; the other electrical elements of the apparatus, including the movie projector lamp, the still projector lamp, and the pilot or decorative lighting will all be energized from the direct current source. This arrangement makes possible a substantial reduction in the size and rating of the converter. Also included is an improved coin control circuit and mechanism which is much simpler and much more satisfactory than the prior known mechanisms. The coin control mechanism includes a coin switch and a simple add-subtract switch which employs only two switches, a single pole electrically operated switch and a single pole mechanically operated switch. Complicated switch and relay combinations have been used in the past.

By virtue of suitable interconnections and relays the control circuit and switching apparatus effects automatic return of coins if the motor fuse burns out due to failure of the motor or for other cause, if the safety or film break switch operates due to breakage of the film or due to failure of the continuous feeding apparatus, if the power is off, or if the projector lamp burns out. This arrangement takes care of practically all, or substantially all abnormal conditions which may be encountered during the operation of the machine, and practically eliminates any possible customer difficulty, due to failure of the machine to respond to a coin or to return the coin if it is incapable of operating. The add-subtract switch which determines the number of units shown at any one time is of particularly simple construction, and is designed to operate on a minimum possible power consumption.

The circuit also embodies a novel arrangement of the motor and lamp circuits, and a novel arrangement for fusing these circuits. The circuit also provides for sequential disconnection of the various units to preserve at least a partial operative condition of the apparatus as long as possible, and at the same time includes protective means for effectively preventing injury to any single unit.

Considering the detailed features of the circuit, and the various units included therein, reference may be had to Fig. 3. As shown in that figure, power is supplied to the apparatus from a suitable A.-C. or D.-C. source indicated by power supply lines 55 and 57. One side of the

driving unit 61 of a motor driven rotary converter is connected to one side 55 of the power source through a suitable conductor 63, main fuse 65, and conductors 67 and 69. The other or common side of the converter driving unit 61 is connected to the other power supply line 57 through conductors 71, 73, and 75.

As stated previously, the projector lamp 77 for the motion picture projector unit is energized directly from the line regardless of whether an A.-C. or D.-C. power source is utilized. One side of the lamp 77 is connected to one side 55 of the line through the conductor 67 by a conductor 79 which connects with the conductor 67 at the junction 81. The other side of the projector lamp 77 is connected by means of the conductor 83, the operating coil 85 of a two coil, current and voltage responsive relay 86, and conductors 87, 89, and 91 to one side of the normally open single pole switch 93 of the movie projector control relay. The contact arm of the switch 93 is connected to the other side 57 of the line through the conductor 71.

When a D.-C. power supply is used, the output from the alternating current unit 97 of the converter is utilized to energize the projector motor 99, the filament heaters of the amplifier tube units, and the transformer 101 which provides power to the various operating coils of the control apparatus. One side of the projector motor 99 is connected to one of the terminals of the alternating current converter unit 97 by a conductor 103, a fuse 105 and a second conductor 107. The other side of the projector motor is connected to the common terminal of the converter by means of conductors 109, 89, and 91, the normally open switch 93 of the movie projector control relay and the conductor 73.

The common input terminal 111 of the amplifier 43 is connected to one terminal of the alternating current unit 97 of the converter by means of a fuse 113 and a conductor 115. The standby input terminal 117 of the amplifier 43 which provides for the continuous energization of the filament heaters is connected to the common output terminal of the alternating current unit 97 of the converter by means of conductors 119, 121, and 123, the normally closed safety switch 125, the conductor 127, and the conductors 73 and 75. The third or run position amplifier input connection 129 is connected to the common output terminal of the alternating current unit 97 of the converter through the conductor 131, the conductor 91, the normally open switch 93 of the movie projector control relay and the conductors 73 and 75.

It will be apparent that under normal operating conditions the converter will be running and hence in operative condition at all times. Also, the standby input terminal 117 and the common input terminal 111 of the amplifier 43 will be connected to a source of alternating current power whereby the filament heaters for the amplifying tube filaments shall be kept heated. The movie projector lamp 77, and the projector motor 99 will not, however, be energized until the normally open switch 93 of the motor and lamp control relay is operated.

When the apparatus is used in connection with a source of alternating current power, the converter unit is unnecessary, and is cut out of the circuit by a jumper or cut-out switch 133 which is connected to a bridge onto the two converter units 61 and 97. One of the input leads to the motor 61 should also be disconnected.

The control circuit and mechanism also includes a coin collector having a normally open coin operated switch 135 which is adapted to be closed for a short interval when a coin is dropped into the coin collector; a coin collect and return mechanism operable to effect the automatic return of coins put in the coin collector, unless the solenoid 137 forming a part thereof has been energized; a normally open end-of-the-film stop switch 139; a double pole single throw magnetically operated, lamp control relay 141; the voltage coil 143 of the relay 86, which is operable to effect coin returns in the event the projector lamp burns out; and an add-subtract switch 145 for cooperation with the coin collector and switch 135 and the coin return 137 to permit more than one coin to be placed in the coin collector at any one time.

The coin collect and return mechanism is of a type commonly used for controlling the travel of a coin through one or the other of two paths depending upon the position of the pin 137A as more clearly shown in Figure 6. When the solenoid 137 is deenergized, the pin 137A is positioned so that the coin on its rebound from the shoulder 137C strikes the pin 137A and is required to travel the path 137B from whence the coin is rejected by the coin collector and returned to the one who deposited it. On the other hand, when the solenoid is energized, the pin 137A is retracted from the entrance to path 137D to allow the coin to be accepted by the coin collector. As the coin is discharged from the path 137D it comes into contact with the coin switch 135, momentarily closing the connected circuit.

The add-subtract switch includes two voltage type coils 147 and 149, one for add operations and one for subtract operations, a toothed wheel operating mechanism 151 which is mechanically actuated in one direction by energization of the add coil 147 and in the other direction by energization of the subtract coil 149. The toothed wheel operating mechanism 151 is also provided with a switch arm 153 and cooperating contact 155 which are normally out of engagement with each other but which are moved into closed circuit engagement with each other when the number of add operations exceeds the number of subtract operations, i. e., when one or more coins are put in the coin collecting mechanism. Operatively associated with the add coil 147 is a single pole, single throw switch 157 which is normally closed.

The primary side of the transformer 101 is energized from the line direct if A.-C. power is available or from the converter when the apparatus is used with D.-C. power. One of the primary terminals is connected to the common terminal of the converter by means of the conductor 159, the conductor 123, and the normally closed, film break safety switch 125, the conductor 127, and the conductors 73 and 75. The other primary terminal is connected to the other output terminal of the A.-C. converter unit 97 by means of the conductor 161, the motor fuse 105, and the conductor 107. The secondary of the transformer 101 provides 24 volts for the operating coil 163 of the movie projector control relay, the operating coil 165 for the two pole, lamp control relay 141, and the operating coils 147 and 149 of the add-subtract mechanism 145. It also includes a 6-volt tap 167 for energizing the pilot or other decorative lamps 29 used in conjunction with the apparatus.

The 6-volt tap 167 is connected to one side of the pilot or decorative lamp circuit by the con-

ductor 169, the switch arm 171 of the relay 141, and the conductor 173. The other side of the pilot lamp circuit is connected to the proper side of the transformer terminal by the conductors 175, 177, and 179.

One terminal of the still projector lamp 181 is connected to one side of the main power supply through the conductor 183, the conductors 121 and 123, the normally closed, film break, safety switch 125 and the conductors 127 and 71. The other side of the still projector lamp 181 is connected to the other side of the main power supply by the conductor 185, the switch arm 187 of the normally closed lamp control relay 141, the conductor 189, the conductor 67, main fuse 65, and the conductor 63. It will be apparent that in the normal non-operating condition of the apparatus, the still projector lamp 181 will be energized and the pilot or decorative lamps 29 will also be energized.

One side of the operating coil 163 for the projector motor and lamp control relay is connected to one side of the secondary of the transformer by the conductor 191. The other side of the operating coil 163 is connected to the other side of the transformer by the conductors 193 and 195, the conductor 197 which connects to the terminal 155 of the main switch in the add-subtract mechanism, the switch arm 153 of that switch, the conductor 199 and the two conductors 201 and 203.

One terminal of the energizing coil 165 for the still projector and pilot lamp control relay 141 is connected to the conductor 195 by a conductor 205 and thence through the conductors 195 and 197 to the terminal 155 of the main switch in the add-subtract mechanism 145, the switch arm 153 of that switch, and thence by the conductors 199, 201, and 203 to the secondary of the transformer. The other side of the transformer secondary is connected directly to the other terminal of the operating coil 165 of the still projector and pilot lamp control relay by the conductors 179 and 177.

One side of the subtract coil 149 is connected to the junction 207 by a conductor 209, and thence through conductor 197, the contact 155, switch arm 153, and the conductors 199, 201, and 203 to one side of the transformer. The other side of the subtract coil 149 is connected by a conductor 211 to one terminal of the normally closed switch 157 forming a part of the add-subtract unit, and thence through the switch arm and contacts of that switch and the conductor 213 to one side of the normally open, end-of-the-film stop switch. The other terminal of the normally open, end-of-the-film stop switch is connected to the other side of the transformer secondary through the conductors 215 and 179.

One terminal of the add coil 147 is connected to one side of the transformer secondary by the conductors 217, 201, and 203. The other terminal of the add coil is connected to one side of the normally open coin switch 135 by the conductor 219. The other side of the coin switch 135 and one side of the operating coil 137 for the coin return mechanism are connected together by the conductors 221, and are connected by the conductors 223, 215, and 179 to the other side of the transformer secondary. The other terminal of the operating coil 137 for the coin collect mechanism is connected to the other side of the secondary of the transformer 101 by a conductor 225, and the switch arm 227 of the normally closed, voltage and current responsive relay 86; the other

side of the relay 86 is connected to the transformer secondary by conductors 229 and 203.

One of the terminals of the voltage responsive, operating coil 143 for the relay 86 is connected to one side of the line by a conductor 231 which taps into the conductor 73 at the point 233, the circuit being completed through the conductor 73 and the conductor 71 to the power supply line 57. The other side of the voltage operating coil 143 for the relay 86 is connected to one of the terminals of the movie projector lamp 77 by a conductor 235, and the circuit is completed to the other line 55 through the filament of the projector lamp, the conductor 79, the junction 81, the conductor 67, the main fuse 65, and the conductor 63. When the apparatus is in the normal not operating or standby condition, this arrangement effects continuous energization of the coil 137 to render the coin collect mechanism operative, provided that the filament of the movie projector lamp 77 is not burned out.

Movement of the switch arm 93 forming a part of the movie projector control relay to the closed circuit position at the beginning of each operation of the apparatus shorts out the voltage responsive operating coil 143 of the relay 86. Hence, to make possible the collection of coins when the projector is operating, the switch 227 forming a part of the relay 86 is also adapted to be held in the closed circuit position by the current responsive operating coil 85 which is energized by current flow to the movie projector lamp 77. For best results during the change over from energization of the voltage coil 143 to the current coil 85, the relay 86 should be of a delayed or slow action type. The above described arrangement prevents collection of coins if the filament of the movie projector lamp 77 is burned out, and at the same time it assures proper collection at all times when coins should be received.

When all of the parts of the mechanism are in operative condition, the various relays and switches will be in the positions illustrated in full in Figure 3. If a coin is then dropped in the coin collecting mechanism, the coin switch 135 will be operated to the closed circuit position for a short interval of time. This operation will energize the add coil 147 of the add-subtract unit 145, thereby causing the notched wheel attached to the switch arm 153 to move in a counter-clockwise direction, this movement causing the switch arm 153 to engage the switch point 155. By virtue of the closing of this switch, the operating coil 163 for the movie projector motor and lamp control relay will be energized and the switch arm 93 of that relay moved to the closed circuit position, effecting the energization of the movie projector lamp 77 and the projector motor 99, whereupon the next film in the sequence contained in the continuous film mechanism 35 will be shown. The closing of the switch 93 also accomplishes the energization of the operating coil 165 of the still projector and pilot lamp relay 141. This moves the switch arms 171 and 187 to the open position, thereby cutting off the still projector lamp 181 and the pilot or other decorative lamps 29. The operation of the projector motor and lamp control relay also completes the circuit from the run terminal 129 of the amplifier to the side 57 of the power source, and places the amplifier in operative condition. The projection will, therefore, operate automatically to project the next run of film in the machine.

So long as the main switch of the add-subtract unit 145 remains closed and the remainder of

the apparatus is in operative condition, the operating coils 163 and 165 for the movie projector control relay and the lamp control relay 141 will remain energized. The main switch of the add-subtract unit 145 will remain closed until the number of operations of the subtract mechanism equals the number of operations of the add mechanism. Each time a coin is dropped into the coin collector, the add coil 147 is energized, and serves to rotate the notched wheel 151 one notch toward the add direction, and the unit 145 should be designed to accommodate at least a number of operations.

Coincident with each energization of the add coil 147, the switch arm 157 of the normally closed switch forming a part of the add-subtract unit 145 is moved to the open circuit position, and this opens the control circuit for the subtract coil 149. The purpose of this is to prevent operation of the subtract mechanism when coins are being placed in the coin collector. Heretofore, some difficulty has been experienced in this type of apparatus when a coin was placed in the machine just at the instant that the stop switch operated. The usual result has been the failure of the add mechanism to operate, with considerable annoyance to the user of the apparatus. In the circuit of the present invention the end-of-the-film stop switch 139 is operable to stop the mechanism independently of the add-subtract unit, and to operate the subtract coil automatically at some subsequent time; the invention thus overcomes this difficulty with the prior apparatus and provides a completely fool-proof structure.

As soon as the coin has passed the coin switch 135, that switch returns to the normal open circuit position illustrated and de-energizes the add coil 147 of the add-subtract unit 145. The de-energization of the add coil 147 permits the switch arm 157 of the normally closed switch to return to its normal position, and thereby permits energization of the subtract coil 149 and subtract operations. The subtract coil 149 is normally energized upon operation of the end-of-the-film stop switch 139, the usual arrangement being to provide an opening in the film through which a switch arm projects to contact a cooperating contact. When the film stop switch 139 operates, it moves from the normally open circuit position shown in full in Fig. 3 to the closed position shown in dotted in that figure, and, providing that the add coil 147 is not then energized, it energizes the subtract coil 149 to move the toothed wheel 151 one notch in the subtract direction. If this movement is such as to equalize the number of add operations and the number of subtract operations, the notched wheel 151 will be moved to its normal position in which the switch arm 153 of the main add-subtract switch is out of contact with its cooperating contact 155. This opening movement will then deenergize the subtract coil regardless of the position of the film stop switch.

Simultaneously, the opening of the main switch of the add subtract unit in response to movement of the notched wheel 151 will de-energize the operating coil 163 for the movie projector control relay and the operating coil 165 for the still projection and pilot lamp relay 141, thereby shutting off the projector motor 99 and the movie projector lamp 77, and reducing all power input to the amplifier 43, except that necessary to energize the filament heaters. At the same time movement of the relay switch 75

arms 171 and 187 to normal closed circuit position will energize the still projector lamp 181 and the pilot lamps 29. De-energization of the movie projector lamp 77 will de-energize the current responsive operating coil 85 of the relay 86, but simultaneously with this operation, and provided that the filament of the projector lamp is intact, the voltage responsive coil 143 will be re-energized to maintain power on the coil 137 which must be energized to render the coin return mechanism inoperative.

Insofar as the safety and other special features of the circuit are concerned, the following will be particularly noted. Any circuit failure of the apparatus which results in blowing the line fuse 65 will automatically cut off the entire mechanism including operating relays, converter, pilot lamps, and the still projector; the coin return mechanism being so arranged that the coil 137 must be energized in order to retain coins in the coin box, hence any money which is placed in the coin collectors will be automatically returned.

In the event of motor failure alone, the protective fuse 105 for the motor will open the motor circuit. This will also de-energize the primary of the transformer 101 which is used as the main energizing means for the control circuit, and in so doing, will de-energize the coil return mechanism 137 causing that mechanism to reject any coin which may be placed in the coin collectors. The opening of the fuse 105 will not, however, de-energize the still projector lamp, and to that extent the usefulness of the apparatus will be preserved.

If the movie projector lamp has burned out, the machine will not accept coins and will not start, due to operation of the current and voltage responsive relay 86 to open circuit position. If the amplifier fuse 113 burns out, the mechanism will otherwise remain operable, and the film units will be projected in sequence without, however, any sound. If desired, a no-sound indicator lamp can be provided to give warning of this condition and suitable relays can be introduced into the circuit to prevent operation in this event. Normally, however, it is desired to permit operation of the machine on failure of the sound apparatus, most customers being satisfied with the projection of the film.

The film break switch or safety 125 which is operated only in the event of breakage in the film, acts to shut down practically the entire apparatus; the still projector lamp 181 and the pilot lamps 29 are turned off, the standby current is shut off from the amplifier 43, the energizing transformer 101 for the control apparatus is de-energized, and with this the coin mechanism is de-energized assuring the rejection of any coins placed in the apparatus.

Under certain conditions, it may be desirable to provide for operation of the apparatus on sound only, and a circuit for accomplishing this is illustrated in fragmentary form in Figure 4. As will be seen by reference to that figure, the voltage and current responsive relay 86, which normally renders the coin collecting mechanism inoperative in the event the projector lamp is burned out, is provided with additional contacts 239 and 241 which are adapted to be connected by the relay switch arm 227 when both the voltage coil 143 and the current coil 85 are de-energized. One side of a sound-only indicator light 243 is connected by a conductor 245 and the conductor 179 to one side of the secondary of the transformer 101. The other side of the indica-

tor light 243 is connected to the other side of the transformer secondary by the conductors 247, the lower relay contacts 239 and 241 and the relay switch arm 227, the conductor 249, the conductor 229, and the conductor 203.

If the filament of the movie projector lamp burns out, the sound-only indicator light will be energized. Should a patron wish to operate the machine on sound only, he will be directed by a suitable sign to operate a push button switch 251, which is connected by conductors 253 and 257 so as to complete the circuit from the coin collector mechanism to the lower side of the transformer secondary, and while this button is pushed, to deposit the coin in the coin collector. By virtue of the fact that the coin collector solenoid 137 is energized through the push button switch, this coin will be received, and the apparatus will be put into operation on sound only.

It is also desirable under certain conditions to provide means for indicating when the exciter lamp has burned out. This happens with some frequency and when that lamp is burned out, the apparatus will not operate on sound. A circuit for accomplishing this indication is illustrated in Fig. 5. In that figure, the exciter lamp supply 261, which will normally include a transformer coil 263, is shown connected to the exciter lamp 265 by conductors 266, 267, a voltage responsive relay 269 and a conductor 271. The operating coil for the voltage responsive relay 269 is connected to the conductors 191 and 193 of the circuit of Fig. 3 and hence is energized to complete the circuit for the exciter lamp during each operation of the apparatus. The relay 269 is normally in the open circuit position.

The operating coil of a second voltage responsive relay 273 is connected across the terminals to the relay 269 in series with a suitable source of power by means of conductors 275, 276, and 277. The relay 273 is of the single pole type, and the switch arm 279 thereof is normally biased to the closed circuit position shown in dotted in Fig. 5, and is held in the open circuit position (shown in full in Fig. 5) only when the relay operating coil is energized. A no-sound indicator lamp 281 is connected in series with a source of power through the relay 279 in such manner that the indicator lamp is energized when the relay is de-energized.

It will be evident that burning out of the exciter lamp will open the circuit for the operating coil of the relay 273 and effect the energization of the no-sound indicator lamp 281. This arrangement, similar to the arrangement shown in Fig. 4, may be readily added to the circuit of Fig. 3, and is of value in instances where indication of the type described is desired.

It will be apparent that the above described circuits provide simple and highly satisfactory control means for use in apparatus of the class described. The main control circuit as disclosed employs a minimum of switching elements and relays, the add-subtract unit has been very greatly simplified and, above all, the circuit automatically takes care of all ordinary abnormal conditions which might be encountered during the operation of apparatus of this type. It returns coins to the customer under all conditions in which coin return is warranted. At the same time, it assures against failure of the apparatus under a condition which has proven extremely troublesome in the past, namely, the circumstance where a coin is placed in the mechanism at the very instant when the end-of-the-film

stop switch is in the closed position. The supplemental control and indicating circuits disclosed provide for other special conditions.

As pointed out previously, the important novel features of the invention include, not only the novel features of the electrical circuits which have been described immediately above, but, in addition, certain important features of the general construction of the apparatus. Particularly, the provision of spaced loud speaking apparatus, which give a very desirable dimensional effect to the sound reproduction, an improved optical system for the projector mechanism, and in general, a highly satisfactory and novel arrangement of the various structural parts of the apparatus.

We claim:

1. A co-ordinated movie-sound projector apparatus, of the class described, comprising a projector lamp, a projector motor, and a sound amplifier connected in a main-electrical circuit equipped with safety fuses protecting the aforesaid units; a second electrical circuit, transformer means connecting said main and second circuits, a control switch for said main circuit, a relay coil in said second circuit arranged to operate said main-circuit control-switch, a circuit completing-switch for said second circuit, a relay coil for said second-circuit completing-switch connected in said main circuit and normally holding said switch in closed position during the functional readiness of said main circuit and said connected units, a second switch arranged in said second circuit for controlling the action of said first mentioned relay coil, a two-way coin chute having a solenoid control arranged in said second circuit and adapted to cause the reception or rejection of coins depending upon the closed or open position respectively of said second-circuit completing-switch, a coin-actuated switch associated with said coin chute for effecting the closing of said second-circuit control-switch, and an end-of-the-film switch in said second circuit for effecting the opening of said second-circuit control-switch.

2. A co-ordinated movie-sound projector apparatus, of the class described, comprising a projector lamp, a projector motor, and a sound amplifier connected in a main electrical circuit equipped with safety fuses protecting the aforesaid units; a second electrical circuit, transformer means connecting said main and second circuits, a control switch for said main circuit, a relay coil in said second circuit arranged to operate said main-circuit control-switch, a circuit completing-switch for said second circuit, current-voltage relay coils for said second-circuit completing-switch connected in said main circuit and with the filament of said lamp and normally holding said switch in closed position during the functional readiness of said main circuit and said units, a second switch arranged in said second circuit for controlling the action of said first mentioned relay coil, a two-way coin chute having a solenoid control arranged in said second circuit and adapted to cause the reception or rejection of coins depending upon the closed or open position respectively of said second-circuit completing-switch, a coin-actuated switch associated with said coin chute for effecting the closing of said second-circuit control-switch, and an end-of-the-film switch in said second circuit for effecting the opening of said second-circuit control-switch.

3. A co-ordinated movie-sound projector ap-

paratus, of the class described, comprising a projector lamp, a projector motor, and a sound amplifier connected in a main electrical circuit equipped with safety fuses protecting the aforesaid units; a second electrical circuit, transformer means connecting said main and second circuits, a control switch for said main circuit, a relay coil in said second circuit arranged to operate said main-circuit control-switch, a circuit completing-switch for said second circuit, current-voltage relay coils connected in said main circuit and with the filament of said lamp and normally holding said switch in closed position during the functional readiness of said main circuit and said units, a second switch arranged in said second circuit for controlling the action of said first mentioned relay coil, a two-way coin chute having a solenoid control arranged in said second circuit and adapted to cause the reception or rejection of coins depending upon the closed or open position respectively of said second-circuit completing-switch, a coin-actuated switch associated with said coin chute for effecting the closing of said second-circuit control-switch, an end-of-the-film switch in said second circuit for effecting the opening of said second-circuit control-switch, and an add-subtract mechanism interposed in said second circuit between said second-circuit control-switch and said coin-actuated and said end-of-the-film switches and adapted to react to the insertion of coins during the operation of said apparatus so as to accumulate demands for subsequent performances and thereby delay the action of said end-of-the-film switch until all of said paid-for performances have been rendered.

4. A co-ordinated movie-sound projector apparatus, of the class described, comprising a projector lamp, a projector motor, and a sound amplifier connected in a main electrical circuit equipped with safety fuses protecting the aforesaid units; a second electrical circuit, transformer means connecting said main and second circuits, a control switch for said main circuit, a relay coil in said second circuit arranged to operate said main-circuit control-switch, a circuit completing-switch for said second circuit, current-voltage relay coils for said second-circuit completing-switch connected in said main circuit and with the filament of said lamp and normally holding said switch in closed position during the functional readiness of said main circuit and said units, a second switch arranged in said second circuit for controlling the action of said first mentioned relay coil, a two-way coin chute having a solenoid control arranged in said second circuit and adapted to receive or reject coins depending respectively upon the closed or open position of said second-circuit completing-switch, a coin-actuated switch associated with said coin chute for effecting the closing of said second-circuit control-switch, and an end-of-the-film switch in said second circuit for effecting the opening of said second-circuit control-switch, an add-subtract mechanism interposed in said second circuit between said second-circuit control-switch and said coin-actuated and said end-of-the-film switches and adapted to react to the insertion of coins during the operation of said apparatus so as to accumulate demands for subsequent performances and thereby delay the action of said end-of-the-film switch until all of said paid-for performances have been rendered, and an auxiliary switch connected in said second circuit and associated with said add-subtract

mechanism and adapted to prevent the subtract operation of said mechanism by said end-of-the-film switch during the actuation of said coin switch.

5. A co-ordinated movie-sound projector apparatus, of the class described, comprising a projector lamp, a projector motor, and a sound amplifier connected in a main electrical circuit equipped with safety fuses protecting the aforesaid units; a second electrical circuit, transformer means connecting said main and second circuits, a control switch for said main circuit, a relay coil in said second circuit arranged to operate said main-circuit control-switch, a circuit completing-switch for said second circuit, current-voltage relay coils connected in said main circuit and with the filament of said lamp and normally holding said switch in closed position during the functional readiness of said main circuit and said units, a second switch arranged in said second circuit for controlling the action of said first mentioned relay coil, a two-way coin chute having a solenoid-control arranged in said second circuit and adapted to cause the reception or rejection of coins depending upon the closed or open position respectively of said second-circuit completing-switch, a coin-actuated switch associated with said coin chute for effecting the closing of said second-circuit control-switch, and an auxiliary circuit, indicator, and control-switch interconnected with said main and second circuits whereby the inoperative condition of one of said units actuates said indicator to register such inoperative condition.

6. A co-ordinated movie-sound projector apparatus, of the class described, comprising a projector lamp, a projector motor, and a sound amplifier connected in a main electrical circuit equipped with safety fuses protecting the aforesaid units; a second electrical circuit, transformer means connecting said main and second circuits, a control switch for said main circuit, a relay coil in said second circuit arranged to operate said main-circuit control-switch, a circuit completing-switch for said second circuit, current-voltage relay coils connected in said main circuit and with the filament of said lamp and normally holding said switch in closed position during the functional readiness of said main circuit and said units, a second switch arranged in said second circuit for controlling the action of said first mentioned relay coil, a two-way coin chute having a solenoid-control arranged in said second circuit and adapted to cause the reception or rejection of coins depending upon the closed or open position respectively of said second-circuit completing-switch, a coin-actuated switch associated with said coin chute for effecting the closing of said second-circuit control-switch, an auxiliary circuit and indicator connected across said second circuit, and special switch means for said auxiliary circuit associated with the relay coils for said second-circuit completing-switch and adapted to actuate said indicator when said relay coils have opened said circuit.

7. A co-ordinated movie-sound projector apparatus, of the class described, comprising a projector lamp, a projector motor, and a sound amplifier connected in a main electrical circuit equipped with safety fuses protecting the aforesaid units; a second electrical circuit, transformer means connecting said main and second circuits, a control switch for said main circuit, a relay coil in said second circuit arranged to operate said main-circuit control-switch, a circuit com-

pleting-switch for said second circuit, current-voltage relay coils connected in said main circuit and with the filament of said lamp and normally holding said switch in closed position during the functional readiness of said main circuit and said units, a second switch arranged in said second circuit for controlling the action of said first mentioned relay coil, a two-way coin chute having a solenoid-control arranged in said second circuit and adapted to cause the reception or rejection of coins depending upon the closed or open position respectively of said second-circuit completing-switch, a coin-actuated switch associated with said coin chute for effecting the closing of said second-circuit control-switch, an auxiliary circuit and indicator connected across said second circuit, special switch means for said auxiliary circuit associated with the relay coils for said second - circuit completing - switch and adapted to actuate said indicator when said relay coils have opened said circuit, and a manually-operated switch for closing said second circuit to bridge said second-circuit completing-switch so as to effect the energization of said coin-chute solenoid and permit the acceptance of a coin to effect the operation of the film for sound only.

8. A co-ordinated movie-sound projector apparatus, of the class described, comprising a projector lamp, a projector motor, and a sound amplifier connected in a main electrical circuit equipped with safety fuses protecting the aforesaid units; a second electrical circuit, transformer means connecting said main and second circuits, a control switch for said main circuit, a relay coil in said second circuit arranged to operate said main-circuit control-switch, a circuit completing-switch for said second circuit, current-voltage relay coils connected in said main circuit and with the filament of said lamp and normally holding said switch in closed position during the functional readiness of said main circuit and said units, a second switch arranged in said second circuit for controlling the action of said first mentioned relay coil, a two-way coin chute having a solenoid-control arranged in said second circuit and adapted to cause the reception or rejection of coins depending upon the closed or open position respectively of said second-circuit completing-switch, a coin-actuated switch associated with said coin chute for effecting the closing of said second-circuit control-switch, a no-sound indicator and operating switch connected to said main circuit, an operating relay coil for said no-sound indicator-switch connected in series with the exciter lamp for the sound projector and with said main circuit, switch-means movable into and out of position to short-circuit said exciter lamp and permit the energization of said

no-sound-indicator-switch relay independent of the exciter lamp circuit, and a relay coil for said short-circuit switch-means connected in said second circuit to be energized simultaneously with the energization of said relay coil for said main-circuit control-switch.

9. A co-ordinated movie-sound projector apparatus, of the class described, comprising a projector lamp, a projector motor, and a sound amplifier connected in a main electrical circuit equipped with safety fuses protecting the aforesaid units; a second electrical circuit, transformer means connecting said main and second circuits, a control switch for said main circuit, a relay coil in said second circuit arranged to operate said main-circuit control-switch, a circuit completing-switch for said second circuit, current-voltage relay coils connected in said main circuit and with the filament of said lamp and normally holding said switch in closed position during the functional readiness of said main circuit and said units, a second switch arranged in said second circuit for controlling the action of said first mentioned relay coil, a two-way coin chute having a solenoid-control arranged in said second circuit and adapted to cause the reception or rejection of coins depending upon the closed or open position respectively of said second-circuit completing-switch, a coin-actuated switch associated with said coin chute for effecting the closing of said second-circuit control-switch, an auxiliary circuit and indicator connected across said second circuit, special switch means for said auxiliary circuit associated with the relay coils for said second-circuit completing-switch and adapted to actuate said indicator when said relay has opened said circuit, a manually-operated switch for closing said second circuit to bridge said second-circuit completing-switch so as to effect the energization of said coin-chute solenoid and permit the acceptance of a coin to effect the operation of a film for sound only, a no-sound indicator and operating switch connected to said main circuit, an operating relay coil for said no-sound indicator-switch connected in series with the exciter lamp for the sound projector and with said main circuit, switch-means movable into and out of position to short-circuit said exciter lamp and permit the energization of said no-sound-indicator-switch relay coil independent of the exciter lamp circuit, and a relay coil for said short-circuit switch-means connected in said second circuit to be energized simultaneously with the energization of said relay coil for said main-circuit control-switch.

ABRAHAM SHAPIRO.
ALLEN A. SHOUP.