ABSTRACT

A control system is provided for controlling functions of a theater or auditorium in coordination with the projection of a film. The system includes a selection board and a scanning device enabling a large number of functions in the theater to be controlled in conjunction with the projection of film at preselected times. Such functions include masking arrangements for the screen, lights, non-synchronous sound, and signals, as well as initiating and stopping operation of the projectors. The system also can be used to control theater functions and projectors over a lengthy period of time such as an entire day, if desired, rather than for just one show.

4 Claims, 4 Drawing Figures
APPARATUS FOR CONTROLLING THEATER OR AUDITORIUM FUNCTIONS

This invention relates to apparatus for controlling theater functions in coordination with the projection of film therein, and more particularly to a control system including a selection board and a pulse-operated scanning device for starting and stopping operation of equipment in a theater.

There has been a trend, particularly recently, toward motion picture theaters with automatic equipment to the point that the need for employees or operators is practically eliminated. This is particularly true of smaller theaters, seating in the order of 300-400 patrons. In some instances, two to four theaters can be clustered together with one operator handling all functions of all of the theaters.

For this purpose, apparatus has been proposed for effecting automatic change-over from one projector to the other when the reel on the first is about to run out. Controls for this are set forth in detail in a co-pending application of Boudouris et al., Ser. No. 878,611, now U.S. Pat. No. 3,640,611. Controls as set forth therein operate arc lights, buzzers, dowers, projector motors, and arc-striking mechanisms of the projectors in timed relation with the film. These controls also can regulate certain auditorium functions in the theater to a limited extent.

The present invention provides an improved control system for regulating functions of equipment in a theater having greater versatility than those heretofore known. The system can control any or many of a large number of functions at almost any time and over a long period of time. The system includes a selection board capable of selectively operating a large number of components in the theater, depending upon the size of the board employed. A scanning device scans across the selection board in a predetermined number of incremental steps to control the various theater functions over a long period of time, depending upon the length of time required for the scanning device to complete one full movement across the board. The system allows the sequence or functions being controlled to be changed in a matter of seconds simply by changing control pins used in the board. Further, the selection board can energize both latch-type and pulse-type relays which provide additional versatility for the controls.

It is, therefore, a principal object of the invention to provide an improved control system for operating theater equipment, which system has greater versatility and adaptability than those heretofore known.

Many other objects and advantages of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings, in which:

FIGS. 1 and 1A are diagrammatic views of a control system embodying the invention;

FIG. 2 is a schematic view in perspective of part of the selection board of the control system of FIG. 1, with parts broken away; and

FIG. 3 is a somewhat schematic view in perspective of a pulse generating device of a motion picture film projector which can provide a pulse to operate the system of FIG. 1.

Referring to FIG. 1, a control system embodying the invention basically includes a matrix or selection board indicated at 110 and a scanning device comprising a switch wafer 112 by means of which rows of the selection board 110 are sequentially scanned. The switch wafer 112 advances one row at a time when a stepping switch drive receives a pulse. The pulse can be provided through a manually-operated switch designated MS-1 at the right-hand side of the drawing, by a pulse received from a pick-off device designated PO (see also FIG. 3) or by an automatic clock device designated AC.

In the selection board, vertical columns of vertical rows A-O are each used to start and stop individual components or equipment in the theater, with the time of starting and stopping determined by the scanning switch wafer 112 which supplies power individually to each of a plurality of horizontal rows, numbered 1-20 by means of an arm 114 and terminals 1-20. The rows 1-20 are represented by horizontal lines 116 in FIG. 1 and by an upper conductor 116 in FIG. 2. The vertical columns A-O are represented by pairs of vertical lines in FIG. 1, with left hand lines 118 represented by upper conductors 118 in FIG. 2 and the right hand lines 120 represented by lower conductors 120 in FIG. 2. When a short pin 122 is placed in one of a multiplicity of holes 124 in the board 110, this provides an electrical path between the conductor 116 of the horizontal row and the upper conductor 118 of one of the vertical columns. When power is supplied by the scanning switch to the horizontal row containing the pin 122, the power is also supplied to the upper conductor 118 engaged by the pin 122. This initiates operation of the associated theater equipment or component through relays, to be discussed subsequently. When a long pin 126 is inserted in one of the holes 124, it completes an electrical path between the upper conductor 118 of the associated horizontal row and the lower vertical conductor 120 in one of the vertical columns. With power supplied to the upper conductor 116 by the scanning switch wafer 112 and the arm 114, the power is supplied to the lower vertical conductor 120 and stops operation of the component or equipment associated with the vertical column containing the long pin 126, through relays to be discussed subsequently.

The 15 vertical columns A-O provide sufficient circuits to enable the selection board to control almost any imaginable function desired in a theater or auditorium. By way of example, the 15 columns can be employed to control functions as follows:

<table>
<thead>
<tr>
<th>COLUMN</th>
<th>SHORT PIN</th>
<th>LONG PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Start Left Projector</td>
<td>Stop Left Projector</td>
</tr>
<tr>
<td>B</td>
<td>Start Right Projector</td>
<td>Stop Right Projector</td>
</tr>
<tr>
<td>C</td>
<td>Masking Widescreen</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Masking Cinemascope</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Masking 70 MM</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Houselights ON</td>
<td>Houselights OFF</td>
</tr>
<tr>
<td>G</td>
<td>Curtain Lights ON</td>
<td>Curtain Lights OFF</td>
</tr>
<tr>
<td>H</td>
<td>Footlights ON</td>
<td>Footlights OFF</td>
</tr>
<tr>
<td>I</td>
<td>Worklights ON</td>
<td>Worklights OFF</td>
</tr>
<tr>
<td>J</td>
<td>Lobby Lights ON</td>
<td>Lobby Lights OFF</td>
</tr>
<tr>
<td>K</td>
<td>Non-Sync Power ON</td>
<td>Non-Sync Power OFF</td>
</tr>
<tr>
<td>L</td>
<td>Non-Sync Sound ON</td>
<td>Non-Sync Sound OFF</td>
</tr>
<tr>
<td>M</td>
<td>Curtains CLOSE</td>
<td>Curtains OPEN</td>
</tr>
<tr>
<td>N</td>
<td>Alert Manager</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>Start SELF-PULSE</td>
<td>Stop SELF-PULSE</td>
</tr>
</tbody>
</table>
Most of the above functions need no, or only a brief, explanation. The masking is used to change the screen size to accommodate particular types of film, when such masking is used. The worklights are relatively bright lights employed during clean-up, repair, etc. The “non-sync” power and sound is for background music, etc. during intermission. The “start self-pulse” causes the scanning switch wafer to move an additional row or rows, when desired, rather than stopping at the next row. The “stop self-pulse” stops the scanning at the row desired.

When one of the short pins 122 is inserted in one of the holes 124 to connect one of the horizontal rows 1-20 with the left hand line of one of the vertical rows A-O, a path is completed through the conductor in the vertical row and, when the wafer switch 112 supplies power to the appropriate horizontal row, power is supplied to the appropriate one of twenty relays RA-RO. The relays RC-RO are latch-type, when jumped as shown, and hold themselves in when energized by contacts RC-1 to RO-1. Contacts RC-2 to RN-2 then move accordingly to supply power to the appropriate equipment in the desired manner when the corresponding relay is energized.

When one of the long pins 126 is placed in one of the holes 124, a path is completed between one of the horizontal rows 1-20 and the right hand line of one of the vertical rows A-O. When the switch wafer 112 supplies power to the conductor 116 of the appropriate horizontal row, an appropriate relay RAA-ROO is energized. When one of the relays RCC-RNN is energized, corresponding contacts RCC-1 to RNN-1 open to de-energize the corresponding relay RC-RN. Corresponding contacts RCC-2 to RNN-then switch to provide an alternate function for the appropriate equipment energized through the associated contacts RC-1 to RN-1.

Each of the short pins 22 has two conducting sections 128 and 130 (FIG. 2) separated by an insulating section 126 which spaces the sections 128 and 130 apart a predetermined distance. The sections 128 and 130 are electrically connected through a diode located in a cap 134 of the pin. When the pin 122 is in one of the holes 124, the section 128 is in contact with the upper conductor 116 while the lower section 130 is in contact with the upper vertical conductor 118. A path is thereby completed between the conductors 116 and 118 through the diode in the cap 134.

Similarly, the long pin 126 has an upper conducting section 136 and a lower conducting section 138 separated by a long insulating section 140 which spaces the sections 136 and 140 apart a predetermined distance. The sections 136 and 138 are also connected through a diode in a cap 142. When the pin 126 is inserted in one of the holes 124, the upper conducting section 126 contacts the appropriate horizontal conductor 116 and the conducting section 138 contacts the lower vertical conductor 20. A path is thereby completed between the conductors 116 and 120 through the sections 136 and 138 and the diode in the cap 142. The diodes prevent a reversal of current flow and false signals from being transmitted which can otherwise occur.

When it is desired to supply power from the scanning switch wafer 112 to the next row, this is physically accomplished by moving the conducting arm 114 to the next one of terminals 1-20 on the wafer 112. This movement is achieved through a stepping switch drive which can be operated in response to the closing of the main manual switch MS. When this is closed, a pulse is supplied to energize a relay R1 (FIG. 1A) of the stepping switch, only certain components of which are shown. When the relay R1 is energized, it closes contacts R1-1 which supply power to a stepping switch solenoid designated SOL, having an arm which moves one-half a revolution and causes the arm 114 to move one increment. During the movement, built-in contacts SS-1 of the stepping switch open to momentarily de-energize a relay R2. A pulse is supplied through contacts R2-2 and R1-3 (FIG. 1) to the selection board through the switch wafer 112. These contacts only apply the pulse after the switch has advanced to the next position. The stepping switch is a commercially available device which can be obtained, for example, from Lexed Inc., 123 Webster Street, Dayton, Ohio 45402.

Row O is used to cause the stepping switch to advance more than one row when desired. If, for example, it is desired to have the arm 114 of the switch wafer 112 move from row 18 to row 20 when functions in row 18 are completed and the switch arm would normally advance one row, one of the short pins 122 is placed in the hole 124 at horizontal row 19 and vertical row O. When the arm is advanced to terminal 19 to supply power to the horizontal row 19, the relay RO is energized, closing contacts RO-2 to energize the relay R1 and cause the arm 114 to advance immediately to the next row. The arm 14 continues to advance the self-stepping action of relay contacts R1-2, R2-1, and RO-2, driving the relay R1 until the long pin 126 is sensed in row O. If it is desired that the switch wafer then stop on row 20, one of the long pins 126 is placed in the hole 124 of rows 20 and O. When the arm 114 reaches row 20, the relay ROO is energized to cause its contacts ROO-1 to open and de-energize the relay RO, causing contacts RO-2 to open and the relay R1 to stop self-pulsing whereby the switch wafer 112 will not index beyond row 20.

Rows A and B are used to initiate operation of the projectors. When a short pin 22 is in row A and the relay RA is energized, it closes contacts RA-2 which energize a “start-left” relay in the projector changeover circuit, as also shown in the co-pending application of Boudouris et al, Ser. No. 878,611. The left-hand projector is then caused to operate without further signals from the selection board. When the film on the left-hand projector is about to run out, through a foil strip 144 (FIG. 3) on the outside edge of film 146, the right-hand projector is started along with the associated change-over operations. The right-hand projector will then operate until its film has run out. If there is to be an intermission at that time, the left-hand projector must not be operated again. To prevent the left projector from starting, the sequence circuit is signalled by the “stop-left” projector relay RAA at some time during the showing of the reel of film on the right-hand projector. To operate this automatically, one of the long pins 126 is placed in the appropriate hole 124 in the row A to operate the relay RAA which, through its contacts RAA-1, holds itself in until one of the relays
RA and RB is energized again. The relay performs the same function as the left shut-down switch in the sequence circuit through its contacts RAA–2 (FIG. 1A). To operate this relay, a strip 148 of foil is located on the inside edge of the film in the right-hand projector which foil supplies a pulse to the stepping switch to advance the arm 114 one row through the relay R1. If this foil is near the end of the reel, appropriate short pins 122 in vertical columns F–I for the lights, columns K and L for the sound, and column M for closing the curtains can also be used to initiate these functions as the reel and show come to an end and an intermission is to begin. At the end of the intermission, the scanning switch arm 114 can be advanced to the next row, No. 3, at which time the left-hand projector is started once again. The advance can be effected by closing the manual switch MS or through the automatic clock which supplies a pulse at the end of the intermission. Time delay relays can be employed with some of the columns such as G–J to delay brightening of the lights somewhat, if desired.

The system according to the invention can be used to operate projectors for an entire day, if desired. For example, assume that a motion picture show is to last two hours and the film is on two 1-hour reels, one for each of two projectors. Also assume that the first show begins at 12 noon and the last one ends at 1 a.m. with 12-minute intermissions between the shows. At noon, the manual switch MS can be closed by an operator to cause the arm 114 to advance from the twentieth row to the first row. In the first row, a short pin 122 is located in column A which energizes the relay RA and initiates operation of the left-hand projector. At the same time, appropriate pins can be located in the first row for other columns to dim the various lights, open the curtains, etc. By using an automatic timer to supply this pulse, it is not even necessary for the operator to be at the site until the end of the first show, two hours later, to rewind the films.

As the first reel of film on the left-hand projector runs out, through the change-over circuit of the aforesaid patent application, the right-hand projector is started automatically. At an intermediate point on the film of the right-hand projector, the foil 148 is located on the inside edge to supply a pulse to the relay R1 and cause the arm 14 to advance to row No. 2. Here, a long pin 126 can be located in column A to operate the stop left relay and prevent the first or left-hand projector from starting up again as the film runs out on the right-hand projector.

Near the end of the film on the right-hand projector, a second piece 148 of foil can be located on the inside edge which then causes the arm 114 to advance to row No. 3. In this row, the short pins 122 can be located in the appropriate columns to cause the various lights to brighten, the curtain to close, the non-synchronous sound to begin as the right-hand reel of film runs out and the 12-minute intermission is to begin. During the intermission, the operator rewinds both reels of film and can then push the switch MS to advance the arm 114 to the fourth row which again contains one of the short pins 122 in the row A which causes the left-hand projector to start again with additional pins employed to dim the lights, open the curtain, etc. A timer can be used to automatically initiate the pulse at the end of the intermission, if desired. The sequence is then repeated every three rows through the eighteenth row. As the operator rewinds the films at the end of the show, he can press the button MS to advance the arm 114 to the 19th row and, with a short pin 122 in the row O, the arm 114 continues to the twentieth row where a long pin 126 in row 0 stops the arm in readiness for the show to begin the next day.

The various theater lights can be independently controlled by a remote lighting switch designated RLS in FIG. 1A. This enables the lights to be turned on and off at non-scheduled times, in case of emergency, by way of example.

The switch wafer 112 can be employed with two additional switch wafers 150 and 152 having arms 154 and 156 which are driven by the stepping switch and the solenoid SOL, along with the arm 114 of the switch wafer 112 through a common shaft C. These control "tens" read-out lamps indicated at 158 and "unit" read-out lamps indicated at 160 to visually indicate to the operator the row with which the scanning switch wafer arm 114 is electrically connected.

The pick-off device PO, constituting one of the three possible sources of pulses or signals for the stepping switch for the switch wafers, is shown schematically in FIG. 3. This device is shown and described in more detail in co-pending application of Angelo Boudouris and Harold M. Plumadore. The device includes a pair of contact shoes 162 and 164 connected together by an insulating member 166 and suitably mounted in a sprocket arm or a projector wall 168 by a shaft 170. The shoes are mounted adjacent film sprockets 172 which are grounded. Conductors 174 and 176 (see also FIG. 1A) are connected to the contact shoes 162 and 164 but are insulated from the sprockets 172 by the film 146. When an electrical path is to be completed between one of the contact shoes 162 and 164 and the corresponding sprocket, the metal foil or tab 144 or 148 is placed on the film 146. When the path is completed between the shoe 162 and the outer sprocket 172, a pulse is provided to effect a change-over circuit as previously described and as described in Boudouris et al application, Ser. No. 878,611. When a path is completed between the contact shoes 164 and the inner sprocket 172, the pulse is provided through the conductor 176 for the relay R1 to cause the stepping switch to advance the switch wafer arms 114, 154, and 156 to the next terminal.

The automatic clock device AC has an intermission timer therein which is started by a relay R4 associated with columns A and B in FIG. 1. This relay operates contacts R4–1 of FIG. 1A. Manually-operated contacts MS–2 are used to reset the intermission re-timer when the timer is not allowed to completely time out for an intermission.

Manual override switches SWF, SWG, SWH, SWI, and SWJ enable any set of lights to be individually and independently controlled. These switches actuate the associated pairs of relays similarly to the short and long pins when pulses in the selection board. The manual override switches are single-pole, double-throw, momentary-center-off switches. When the switch SWF, for example, is moved to the "on" position, it will energize the relay RF which will then self latch, as described previously; when the switch SWF is moved to the "off"
position, it will pulse the relay RFF and reset the relay RF.

Various modifications of the above described embodiment of the invention will be apparent to those skilled in the art and it is to be understood that such modifications can be made without departing from the scope of the invention, if they are within the spirit and the tenor of the accompanying claims.

We claim:

1. Apparatus for operating electrical devices in a predetermined relationship to the projection of film, said apparatus comprising a matrix board with a plurality of mutually perpendicular first and second rows of holes, upper conductors electrically connecting the holes in each of the first rows, an intermediate conductor electrically connecting all of the holes in each of the second rows, a lower conductor electrically connecting all of the holes in each of the second rows, a plurality of latch-type relays, one electrically connected to each of said intermediate or lower conductors, a plurality of pulse-type relays, one electrically connected to each of the other of said intermediate or lower conductors, said pulse-type relays, when energized, causing any energized latch-type relays associated with the same second row to be de-energized, scanning means for supplying power sequentially to each of said upper conductors, a plurality of short pins for electrically connecting one of said upper conductors with one of said intermediate conductors when inserted in one of the holes, a plurality of long pins for electrically connecting one of said upper conductors with one of said lower conductors when inserted in a hole, a stepping switch for advancing said scanning means one row at a time when subjected to a predetermined pulse, an additional latch-type relay electrically connected to said stepping switch and effective to cause continued pulses to be supplied to said stepping switch to cause said stepping switch to sequentially advance in steps when said additional latch-type relay is energized, and an additional pulse-type relay in the same row with said additional latch-type relay to de-energize said additional latch-type relay to stop said stepping switch when said additional pulse-type relay is energized, said additional latch-type relay being electrically connected to an additional one of said intermediate or lower conductors, and said additional pulse-type relay being electrically connected to an additional one of the other of said intermediate or lower conductors.

2. Apparatus according to claim 1 characterized by a pick-off device associated with a film to be projected, said pick-off device causing a pulse, when contacted by a conducting tab on the film, to advance said scanning means, and a manually-operated switch in parallel with the pick-off device to supply a pulse to said pulse-responsive means independently of said pick-off device.

3. Apparatus for initiating and stopping auditorium functions in a predetermined relationship with respect to the projection of motion picture film, said apparatus comprising a selection board having a plurality of openings arranged in a predetermined pattern, said selection board having a plurality of levels of conductors, a plurality of first relays which are energized when a predetermined two levels of the conductors are electrically connected and power is supplied thereto, a plurality of second relays which are energized when another two levels of the conductors are electrically connected and power is supplied thereto, said relays having contacts effective to control certain one of the functions in the auditorium, scanning means for supplying power selectively to portions of one level of conductors, means for selectively connecting portions of the conductors at predetermined levels, a stepping switch for moving said scanning means sequentially to other portions of said one level of conductors when receiving predetermined pulses, an additional relay electrically connected to said stepping switch and effective to cause said stepping switch to sequentially advance in steps when said additional relay is in one position, and to stop said switch when said additional relay is in another position, said additional relay being in said one position when said predetermined two levels of the conductors are electrically connected, and said additional relay being in said another position when said another two levels of conductors are electrically connected.

4. Apparatus according to claim 3 characterized by means for supplying pulses to said pulse-responsive means and comprising a pick-off device associated with a motion picture film to be projected, said film having conducting means thereon effective to cause said pick-off device to supply a pulse when in contact therewith, and manually-operated switch means for supplying a pulse independently of said pick-off device.

* * * * *
UNIVERSAL STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Angelo Boudouris and Stanley J. Kulish, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 10, before "motion" insert --equipping--.
Column 3, line 59, the numeral "38" should be --138--;
line 60, the numeral "20" should be --120--.
Column 4, line 34, the numeral "14" should be --114--;
line 46, the numeral "22" should be --122--.
Column 5, line 48, the numeral "14" should be --114--.

Signed and sealed this 3rd day of April 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCALK
Commissioner of Patents
UNIVERSAL STATES PATENT OFFICE
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