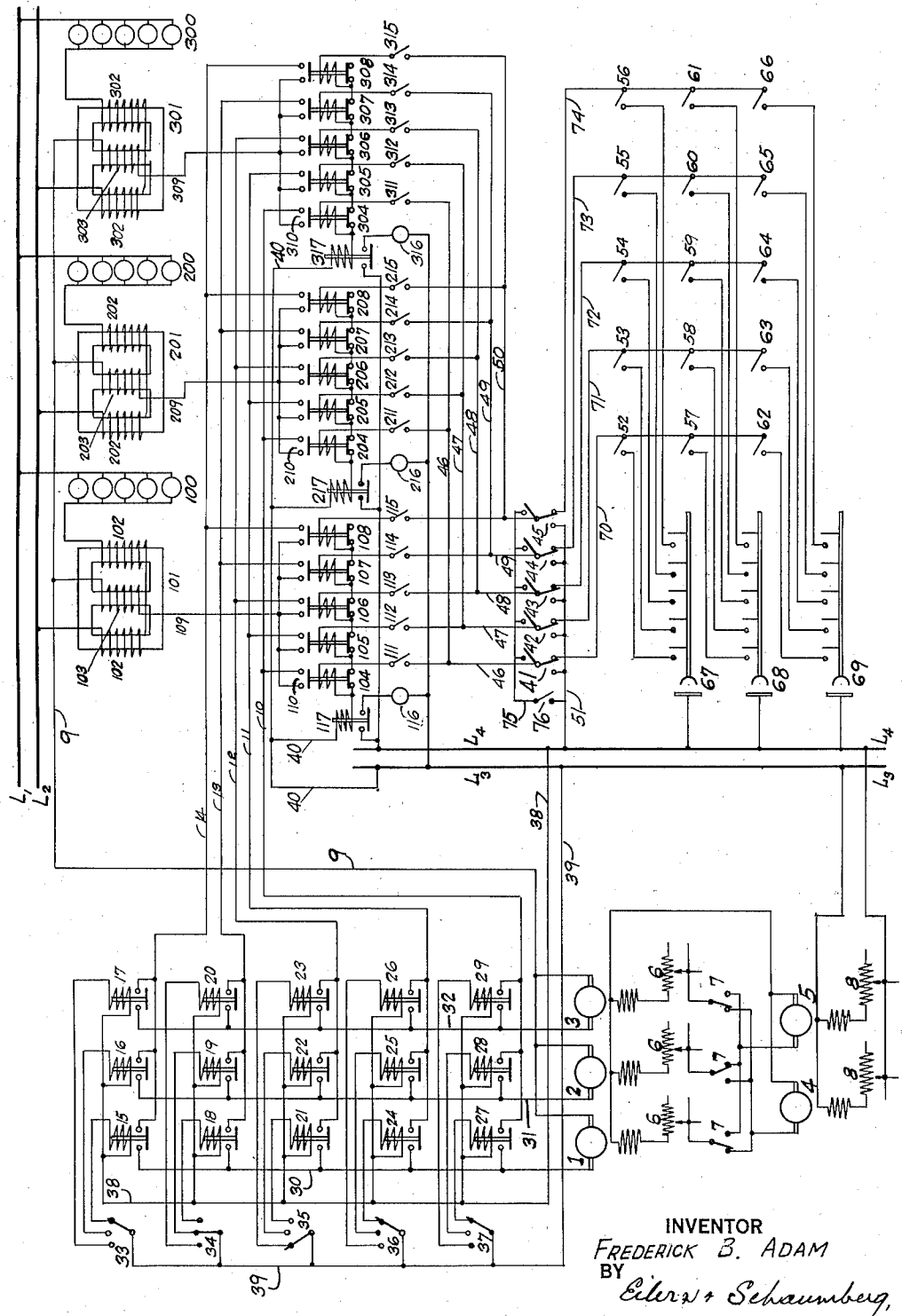
June 6, 1933. F. B. ADAM 1,912,613

LIGHTING CONTROL SYSTEM

Filed Oct. 21, 1929



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Patented June 6, 1933

1,912,613

UNITED STATES PATENT OFFICE

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LIGHTING CONTROL SYSTEM

Application filed October 21, 1929. Serial No. 401,342.

This invention relates to lighting control systems and particularly to a system in which any number of predetermined lighting effects, both as to illumination and intensity, may be set up for subsequent selective display. Heretofore, the prevailing practice has been to preset only the illumination, and to adjust the dimming means between successive lighting scenes. This practice, insofar as it relates to the dimming, is very undesirable because it results in a transition delay during the accomplishment of the dimming.

An object of this invention, therefore, is to provide a means whereby any number of predetermined lighting effects may be preset, both as to illumination and dimming, and thereafter selectively displayed as desired.

Another object of my invention is to provide a lighting control system in which any number of desired dimming effects may be preset for subsequent selective display in a manner similar to the presetting and display of the illumination effects.

A further object is to provide a lighting control system in which the switching and dimming controls are so combined that any number of predetermined lighting effects, both as to illumination and dimming, may be preset for subsequent selective display, and which fulfills the stringent space requirements demanded in theatre and auditorium installations.

A further object of my invention is to provide a lighting control system in which the dimming may be preset for any desired number of scenes.

A further object is that of rendering such preselections, both illumination and dimming, effective through the actuation of a single switch.

A still further object of my invention is that of providing an improved and simplified system of the nature above referred to which affords a more complete, flexible, and facile control than the systems heretofore employed.

Other objects and advantages will appear from the following detailed description and accompanying drawing, which is a schematic wiring diagram showing an application of my invention to the control of three lighting circuits as that number is sufficient to illustrate the means and methods employed and give a clear understanding of the operation of my system.

The lighting circuits to be controlled are numbered 100, 200 and 300, and for convenience and clarity of description these circuits will be designated respectively as white foots, white borders and white pockets. These circuits are supplied with alternating current from the lines L_1 and L_2, or they may be supplied from different sources having similar characteristics. Reactance dimmers 101, 201 and 301, of conventional type, having main circuit windings 102, 202 and 302, and control circuit windings 103, 203 and 303, are arranged in the respective lamp circuits in such a manner that the main circuit current flowing through the windings 102, 202 and 302, and their associated groups of lamps may be regulated and controlled by a relatively small current in the windings 103, 203 and 303. The arrangement of the recited windings on the magnetic cores of the reactance dimmers is such that the illumination intensity of the lamps in each circuit is approximately an exact function of the current in the associated control winding, as will readily be understood by those familiar with the art. Alternating current of a substantially different frequency than that of the supply lines L_1 and L_2 may be employed in the control circuit, but I prefer to use direct current as the controlling medium, and provide control generators such as 1, 2 and 3, to be driven at constant speed by suitable means (not shown) to furnish the control energy. These generators are separately excited, each field being adapted for selective connection to either of the two exciter generators 4 and 5, for a purpose hereinafter appearing, through individual rheostats 6. The selection is accomplished by means of double throw field switches 7, as shown. The exciter generators are also by preference separately excited, their fields being connected in multiple

through rheostats 8, and thence to the D. C. line L_4.

The method herein described for accomplishing the presetting of desired lighting effects and intensities consists in regulating the control generators to voltages that will produce certain predetermined illuminating intensities in the lamp groups, and associating any number of the lamp groups with one or more of the generators for subsequent energization. The selective combination of lamp groups is obtained by means of a system of switching and commutation of control coil circuits, to be hereinafter described.

Each of the control windings 103, 203 and 303, is provided with a group of individually operable selector relays such as 104 to 108, inclusive, the number of relays in each group being dependent upon the number of scenes desired to be preset. By means of these relays, the control windings associated therewith may be selectively connected, through common conductors 109, 209 and 309, and the contacts such as 110, 210 and 310, to any one of the conductors, numbered from 10 to 14.

A selective connection of any of the conductors 10 to 14 with any of the control generators is accomplished by means of relays numbered from 15 to 29, hereinafter referred to as generator selector relays. Each conductor is provided with a number of such relays corresponding to the number of control generators. Thus, in the present example, conductor 14 is connected to a terminal contact of each of the relays 15, 16 and 17, the complementary terminal contact in each instance leading to a control generator through one of the conductors 30, 31 or 32.

The control circuits, which include the dimmer coils 103, 203 and 303 and the control generators 1, 2 and 3 are completed through a conductor 9 which is shown connecting all of the recited control coils and control generators.

Means for selectively actuating the generator selector relays are provided in single pole, multi-throw switches numbered from 33 to 37, and to be hereinafter referred to as generator selector switches, each having a number of operating positions corresponding to the number of relays associated with each of the conductors such as 14. Considering now, for example, the relays 15, 16 and 17, adapted for actuation by the generator selector switch 33, one end of each relay coil is connected to an individual terminal of said switch 33, and the other to a source of energy, as through conductor 38 which leads to one of the D. C. lines L_4. A conductor 39 connecting the common terminal of the switch 33 and the lines L_3 completes the electrical circuit. All of the relays and generator selector switches are circuited in the manner described, the conductors 38 and 39 preferably serving the entire group. Now, for example, if it is desired that the conductor 13 and its attending dimmer control coils be connected to generator 2, the relay 19 is actuated by the selective operation of switch 34.

Obviously, the system described above for selectively connecting the conductors 10 to 14, to the desired generator may be accomplished in a similar manner without the use of the magnetic relays. Since, however, the requirements of a certain scene may be such that the energizing current for a large number of dimming control coils might be supplied by a single generator, and through a single generator switch, the current might become too unwieldy for direct commutation, and I, therefore, prefer to use the relays as described.

The following description deals with the method and means employed for setting up any number of combinations of lighting groups in advance of the time they are to be selectively energized for display.

As previously mentioned, I provide a group of selector relays for each lighting unit. Referring now to a selector relay, such as 104, disposed in the group associated with lighting circuit 100, it is noted that two pairs of contacts are provided, each pair being adapted for non-concurrent electrical connection with respect to the other. The upper pair, for instance, 110, normally open when the associated relay coil is deenergized, has been hereinbefore mentioned and its purpose explained. The lower pair, normally closed under the recited condition, is connected in series with the corresponding pairs of the other relays 105, 106, 107 and 108, which comprise the group. The relay coils of the group are arranged and circuited with the series of lower paired contacts in such a manner, to be hereinafter described, as to prevent two or more relay coils of the group from being concurrently energized. Thus, the coils are adapted to receive energy from the D. C. line L_3, through a feeder conductor 40, which leads through the coils of pilot relays 117, 217 and 317, to be hereinafter described, and thence to the initial lower contact of the series and connects the adjacent contacts of adjacent pairs.

As shown in the drawing, I provide pilot lights 116, 216 and 316, one for each group of selector relays, for the purpose of indicating whether or not any of the selector relays are energized. The illumination of the pilot lights are dependent upon the closing of pilot relays 117, 217 and 317, hereinbefore mentioned.

One end of the relay coil associated with the relay 104, is connected directly to the feeder 40, and the corresponding ends of each of the remaining coils of the group are connected to those portions of the feeder 40

which connect the adjacent pairs of contacts in series. Thus, it is evident that by energizing the coil of relay 104, the circuit feeding the remaining coils in the group is broken and their relays rendered inoperative. In like manner, the actuation of relay 106 renders relays 107 and 108 inoperative.

Each relay is individually circuited with a single pole switch such as 111, hereinafter referred to as a presetting switch, the switches preferably being arranged in groups as shown. These presetting switches, having corresponding positions in their respective groups, are preferably connected to a conductor which leads to the common terminal of a single pole triple throw switch, such as 41. Thus the presetting switches 111, 211 and 311 are connected to the conductor 46 which leads to the switch 41, hereinafter referred to as a cue switch, and the switches 115, 215 and 315 to the conductor 50, leading to the cue switch 45, etc.

One terminal of each of the recited cue switches is connected directly to the D. C. supply line L_4 through conductor 51. Therefore, the circuiting of any of the conductors 46 to 50 with conductor 51 through this terminal of the cue switch enables immediate energization of the selector relays. A second terminal of each of the cue switches is connected to a conductor such as 70 to 74, inclusive, and the actuation of a cue switch into the position shown in the drawing, serves to transfer the control of selector relay energization to cue master switches 67, 68 and 69, in a manner hereinafter described. The actuation of the cue switches in their third position circuits the conductors 46 to 50 with the conductor 75, whereby the control of the selector relays may be effected by the cue master 76.

To avoid the concurrent manipulation of a plurality of cue switches, and for the purpose of providing means enabling preselective grouping of the conductors 46 to 50 for subsequent energization, I provide a plurality of single pole switches, numbered from 52 to 66, hereinafter referred to as cue selector switches. Leading from terminals of the cue switches 41 to 45, respectively, are conductors 70 to 74. To each of these conductors is connected in multiple, a plurality of the cue selector switches. Thus switches 52, 57 and 62 are associated with conductor 70; switches 53, 58 and 63, with conductor 71, etc. As indicated on the drawing, cue selector switches 52 to 56 are connected to individual terminals of a multi-pole switch 67, referred to above as a cue master switch. Switches 57 to 61 are similarly associated with cue master 68 and switches 62 to 66 with cue master 69. The common terminals of the cue masters 67, 68 and 69 are connected with the D. C. line L_4.

Now, assuming the cue switches are positioned as shown in the drawing, and having previously closed cue selectors 52, 53 and 54, the actuation of cue master 67 will produce the same result as if cue switches 41, 42 and 43 were simultaneously operated to connect with conductor 51. Also, other combinations of closed selector switches may be prearranged such as selectors 58, 59 and 61, associated with cue master 68, whereupon the closing of that switch effects a different combination than that produced by the closing of cue master 67.

A brief description of the operation of my system as applied to the setting up and display of three lighting scenes is as follows:

Assume that scene one requires the illumination from all three of the lighting circuits shown, but each at a different illumination intensity from that of the others. Thus, the white foots 100 are to be displayed at 100% intensity; white borders, 200, at 75% intensity; and white pockets, 300, at 50% intensity. In scene two, lighting circuits 100 and 200, only, are required, and they at 50% illumination intensity. During the presentation of the second scene, these lighting circuits are to be gradually brightened to 100% intensity. In scene three, let it be assumed that the circuits 100 and 300, only, are required, the former initially at full bright or 100% intensity, to be gradually dimmed out, while the latter, initially dim, is to be brightened to its fullest extent.

Since the three lighting circuits employed in scene one are to be energized at different intensities, it is necessary that they each be influenced by a different generator, hence through different conductors leading to the generators. Thus, set up switches 111, 212 and 313 are closed, which enables the lighting circuits 100, 200 and 300 to be circuited with the conductors 10, 11 and 12 through selector relays 104, 205 and 306, respectively. By reason of the particular lighting scenes chosen for the purposes of this description, scenes two and three require no additional set up switches to be employed, other than those previously closed in the setting up of scene one. However, it will be obvious that were the present illustrative description broadened to cover the application of my system to an installation of practical size, say for example, a system employing fifty or seventy-five lighting circuits, the bringing in of additional lighting circuits to those used in a prior scene would require the use of additional selector switches and also additional cue switches, the operation of which will be hereinafter explained.

In order to have control of the selector relays for each scene, available at a single switch, the cue masters 41, 42, 43, etc., are actuated into "control transfer" position, viz., that shown in the drawing. Now, by closing cue selectors 52, 53 and 54, scene one

may be effected by the actuation of cue master 67. Also cue selectors 57, 58, 62 and 64 are closed, making it possible to effect scenes two and three, respectively, by the actuation of cue masters 68 and 69.

Now, to go back to scene one, the lighting circuits 100, 200 and 300, respectively, have been preselectively associated with the conductors 10, 11 and 12. Generator 1 will be chosen to produce the influencing voltage for lighting circuit 100. Its terminal voltage is regulated, preferably, by means of its field rheostat 6, to a value known to produce 100% illumination in any lighting circuit or circuits associated therewith. By actuating the generator selector switch 37, into the position for energizing generator selector relay 27, this relay is closed, and conductor 10 is connected to generator 1 through the conductor 30. In a similar manner, generators 2 and 3 are regulated to produce the desired influencing voltage and conductors 11 and 12, respectively, are connected with these generators by the proper positioning of switches 36 and 35 to effect the actuation of relays 25 and 23.

The scenes are now in readiness for display. It will be remembered that the relays 104, 205 and 306 are, as yet, unenergized, their actuating coils having merely been circuited through relay selector switches, cue switches and cue selectors for subsequent energization by means of the cue masters.

After presentation of scene one, cue master 67 is opened, causing relays 104, 205 and 306 to become deenergized which breaks the circuits between the reactance dimmer control coils and the conductors 10, 11 and 12.

The generators 1 and 2 are readjusted to effect 50% illumination as is desired for scene two. Upon closing cue master 68, relays 164 and 205 are again energized, relay 306 remaining deenergized, since cue selector switch 59 was left open in the set up for scene two. At the appropriate time during this scene the voltages of generators 1 and 2 are raised by means of their respective field rheostats, or by means of the exciter generators, which ever method is most desirable. Thus the lighting intensity of groups 100 and 200 are increased to the desired 100%.

After scene two, cue master 68 is opened and the generator voltages again readjusted, for scene three, in this case it being necessary only to reduce the voltage of generator 3. Now, upon closing cue master 69, lighting group 100 is energized full bright and lighting group 300, dim, to produce scene three. At the appropriate time during scene three, the voltage of generator 1 is gradually reduced, dimming lights 100 while generator 3 is regulated to gradually brighten the lights 300.

In the recitation of scene two, it is noted that lighting circuits 100 and 200 are employed at the same illumination intensity, hence, if desired, they both may be controlled by the same generator, rather than by separate generators, as outlined above for the operation of scene two. Such a set up for the scene might be desirable as it would be necessary to actuate only one control generator rheostat to effect the desired scene. In order to accomplish this arrangement an additional set up switch 112 in the group associated with lighting circuit 100 is closed along with the other set up switches, as heretofore described. Now upon closing cue master switch 68 the relays 105 and 205 are energized, which results in the association of lighting circuits 100 and 200 with conductor 11. This conductor has already been connected with generator 2 through the generator selector relay 25, and this generator may be thereby employed to influence both of the desired lighting circuits.

While the herein described means employed are sufficient to produce an operable system which fulfills the objects above noted, it would be advantageous in a system of practical size to provide a greater number of control generators than that which is shown. In such an installation certain of the generators would be set at voltages intended to produce different lighting intensities and would remain at these settings throughout the entire performance. Other of the generators would be available for such lighting groups, whose illumination intensity it was intended to vary during a scene. Thus the necessity of readjusting the generators after a scene in preparation for the scene which follows, would be obviated.

It will be seen that the described example of the invention affords a relatively simple and inexpensive, yet efficient means of obtaining a great variety of illuminating effects. It will, however, be understood that the present example represents only a single preferred embodiment, to be understood in an illustrative, and not in a limiting sense, and that the parts described, as well as their combinations and arrangement, may be varied substantially without departing from the full spirit and scope of the invention, as defined by the appended claims.

I claim as my invention:

1. In an electrical system for controlling the illumination and intensity of a plurality of lighting circuits which are adapted to be selectively associated into a number of distinct combinations, means for presetting a plurality of the combinations of lighting circuits and the intensities of circuits forming said combinations, during energization of any one of the combinations.

2. In a lighting control system, a plu-

rality of lighting circuits, means for selectively associating said circuits, while any thereof are energized into a plurality of distinct combinations, adapted for successive display, means for varying the intensity of the lighting circuits, and means for presetting the intensity of the circuits in each of said combinations.

3. In an electrical system for controlling the illumination and intensity of a plurality of lighting circuits, means for creating a plurality of combinations of said circuits for successve display, and during display of any of said circuits, and means for presetting the intensity of illumination in the circuits of a plurality of said combinations irrespective of the inclusion of the same circuit in more than one of each combination.

4. In a lighting control system for a plurality of lamp circuits, energization and intensity control means for said lamp circuits, a plurality of regulatable influencing means for said energization and intensity control means, magnetic relays for connecting said influencing means and said energization and intensity control means and means for circuiting said relays to provide any number of the possible combinations thereof during energization of any one of said relays.

5. In an electrical system, a lighting circuit, means for controlling the illumination and intensity of said circuit, said means including a plurality of generators, a plurality of magnetic relays associated with said circuit and adapted to selectively connect the circuit with any of said generators, and means for preventing concurrent operative association of the circuit, with more than one generator.

6. In a lighting control system, a plurality of lamp circuits, and energization and intensity control means for each of said circuits; said means including individual control elements, a plurality of generators for regulating the electrical conditions of said control elements, and means for selectively associating said control elements and generators; said associating means including a group of magnetic relays for each of said control elements and means constituted by each group of relays for preventing concurrent energization of a plurality of the relays of the group.

7. In a lighting control system having a plurality of lamp circuits, reactance means for controlling said circuits, a plurality of regulatable units, for influencing said reactance means, means for selectively grouping said lamp circuits, and means for selectively associating any number of said groups with each of said influencing units and during the energization of such unit.

8. A lighting control system adapted for display of selective scenes, and including a plurality of lighting circuits, intensity control means for said circuits, means operable during display of a scene, for electrically associating said control means into groups, to create a plurality of scenes, and means for effecting the display of said scenes in any desired order.

9. In a lighting control system including a plurality of lighting circuits, reactance dimmers for said circuits, a plurality of regulatable dimmer influencing means, means for selectively electrically associating said dimmers into a plurality of combinations for purposes of successive display and during the energization of one such combination, and means for selectively relating said combinations of dimmers with each of said influencing means.

10. In an electrical system for controlling the illumination and intensity of a plurality of lighting circuits, a plurality of regulatable influencing means, and switching means identified with each lighting circuit, for selectively connecting said circuit with any of said influencing means, said switching means including a plurality of magnetically operated switches, related for individual operation only, and adapted thereby for preventing the concurrent connection of the associated lighting circuit with more than one of said influencing means.

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