Dec. 10, 1935. W. H. FRANK 2,023,878

CIRCUIT CONTROLLING ARRANGEMENT

Filed Aug. 19, 1933

FIG. 1.

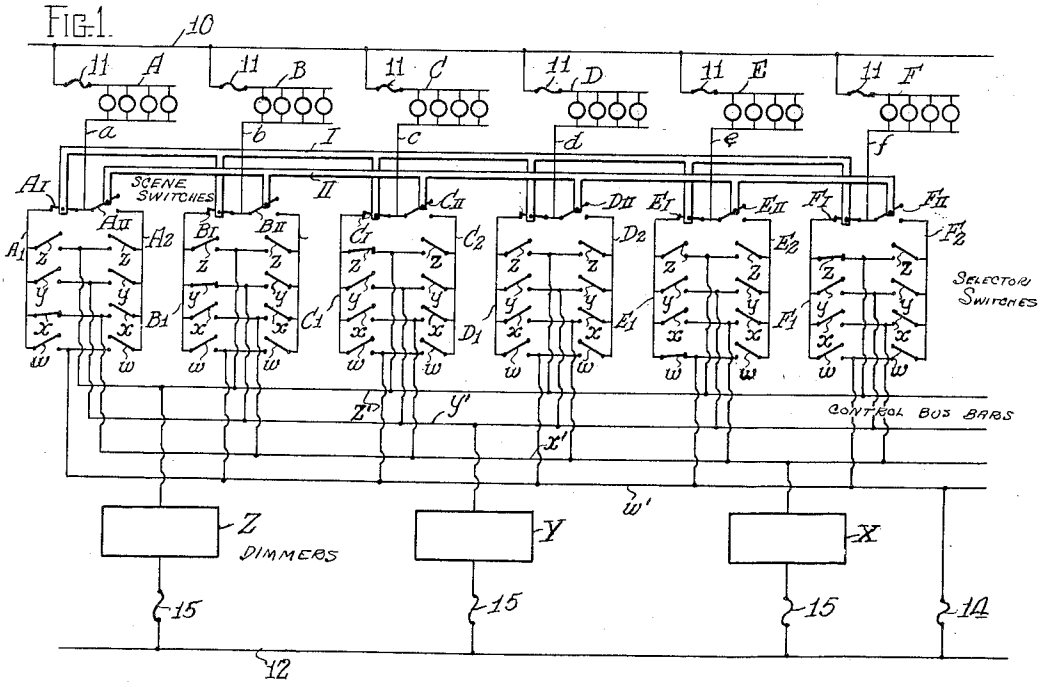


FIG. 2.

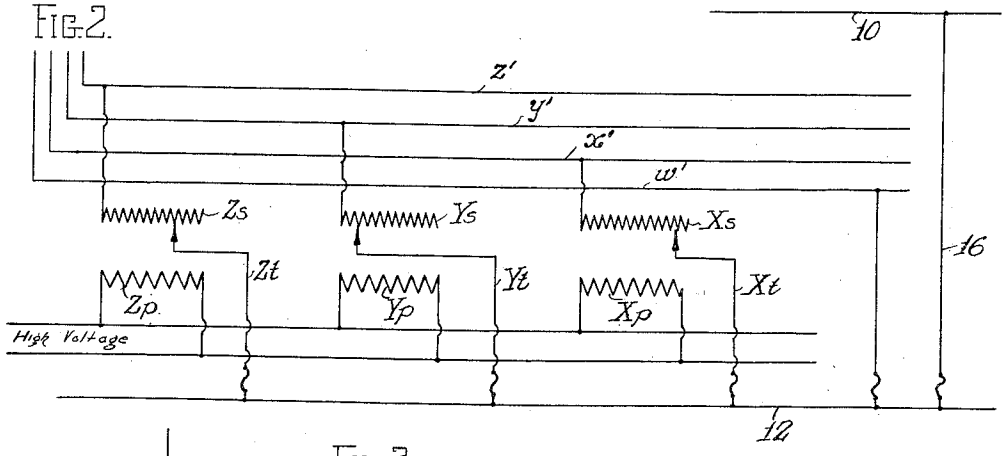
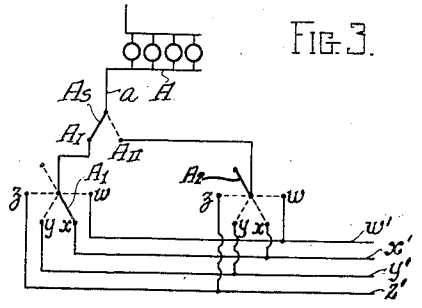


FIG. 3.



INVENTOR.

William H. Frank

BY

Daniel G. Sullivan

ATTORNEY.

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CIRCUIT CONTROLLING ARRANGEMENT

William H. Frank, Detroit, Mich., assignor to Bulldog Electric Products Company, Detroit, Mich., a corporation of West Virginia

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12 Claims. (Cl. 175—312)

This invention relates to circuit controlling systems and more particularly to controlling systems for the lighting control circuits of theater stage lighting systems.

The present practice in controlling the lights of theater stages is to provide for the control circuit of each bank or group of lights, that is to say, for each lighting control circuit, a circuit control dimmer device which may be operated in different manners during different scenes, to provide different illumination intensities for the different scenes. The various dimmers in an installation may be operated singly or in groups, through mechanical interlocking and operating means.

Inasmuch as different lighting effects are to be produced during different scenes, it is necessary for each dimmer to be preset to a starting position before a scene starts, for the particular effect desired for that dimmer's circuit and for that scene, and such presetting must be done with the circuit open and during the extremely short interval between the end of a prior scene and the beginning of the scene under consideration. In other words, during the interval between scenes, electricians must hurry from dimmer to dimmer to preset them to the proper starting positions for the scene to come, (moving their setting arms in case the terminating position in the preceding scene is not the same as the starting position for the scene to come, as is most often the case) so that their operations will be in accordance with that which is desired for that scene.

This practice, while conventional, is not satisfactory. First, of all, the necessity for presetting the dimmers during intervals between scenes makes it necessary that the scenes be so arranged that there will be appreciable intervals between them, or that the lighting effects be so chosen as to comply with the limitations imposed by the presetting necessities, and thus restricts the freedom of the stage director in arranging the scenes, and the lighting effects.

Further, conventional installations, while satisfactory with a few simple lighting circuits, become increasingly difficult in the matter of presetting all of the dimmers as the lighting circuits increase in number and in complexity, part of this difficulty being due to the requirement that there be one dimmer for each lighting control circuit.

Because of these factors, as well as because of others not here mentioned, the conventional practice is becoming increasingly objectionable, and this invention proposes to substitute a new practice for that previously used. Fundamentally, it is proposed to provide a few individual dimmers and to switch the various and many lighting circuits, singly, or in groups, as necessary, to these individual dimmers, so that all of the circuits that happen to desire a common type of operation, are connected up to one dimmer, and so that the various desires of the circuits will be accommodated by the various dimmers. It is proposed to preset the circuits to these dimmers, for the next scene, during the scene in progress, by means of selector switch means, so that in the interval between scenes, it will be necessary for the stage electrician merely to switch over each circuit from the dimmer to which it had been connected for that scene in progress to the dimmer which is to control it for the next scene, the switch over means being an instantaneously operable means, such as a single master or scene switch or a group of simultaneously operable interlocked master or scene switches.

To aid in an understanding of the conventional practice and the advantages of the proposed practice, a typical example will be followed through, with reference to both practices. Let us assume that "A" circuit is being dimmed, from full bright to half him, on Scenes I and II, and that "B" circuit is to be brightened, from half dim to full bright, on Scenes I and II. Under the present practice, at the end of Scene I, it is necessary to open both circuits, and while they are open, preset the "A" dimmer to full bright from half dim, and to preset the "B" dimmer to half dim from full bright. Then the circuits may be closed and their dimmers operated.

Under the proposed practice, during scene I, "A" circuit will be preset, through a selector switch, to the "B" dimmer, and "B" circuit will be preset, through a selector switch, to the "A" dimmer, all without disturbing the circuits or the dimmers. Then at the end of scene I, both circuits will be switched over to the proper dimmers, as electrically predetermined or preset. The act of switching over can be accomplished instantaneously, and without manipulation of the dimmers, and without any visible effect "front stage", that is to say, without creating any lighting disturbances visible to the audience.

The foregoing reveals that the operations of presetting for the next scene, are performed during a preceding scene, when there is plenty of time, and without disturbing the lighting effects during that scene; and that the operation of switchover, the only operation that need be performed during the interval between scenes, may be performed instantaneously and without producing visible effects. The presetting operations will be performed on selector switches, and the switchover operations will be performed on master or scene switches.

Features and objects of the invention will be brought out more particularly upon reference to the following detailed description of a control

system of the invention, shown in the appended drawing, whose

Fig. 1 is a schematic wiring diagram of a six-circuit, three-dimmer, installation, shown during the progress of Scene I and just prior to the presetting operations for Scene II; and whose

Figs. 2 and 3 show partial modifications of the same.

Referring to Fig. 1 of the drawing, it will be seen that there are shown six lighting circuits A to F inclusive, each of which might represent lighting groups, for example, as follows: A—red footlights: B—white footlights: C—blue footlights: D—red border lights: E—white border lights: F—blue border lights. Each circuit is connected on one side to a supply bus bar **10**, preferably through a fuse **11**; and on the other side, through conductors *a*—*f*, to the common center post of a pair of single throw master or scene switches AI—FI and AII—FII. The scene switches are individually connected in series to individual banks or sets A**1**—F**1**, A**2**—F**2**, of selector switches *w*, *x*, *y*, and *z*, and the six pairs of these banks of selector switches are connected in parallel to the four control bus bars w^1, x^1, y^1, and z^1. The first of these bus bars, w^1, is directly connected to a second supply bus bar **12**, preferably through a fuse **14**, and the other control bus bars x^1, y^1, and z^1 are connected to the supply bus bar **12** through dimmers X, Y, and Z, and preferably fuses **15**.

The individual ones of the sets of scene switches AI—FI and AII—FII for all of the circuits are interconnected by suitable means, such as a mechanical interlock represented by the operating rods I, II, so that all of the scene switches may be operated simultaneously.

In the foregoing there have been shown for the six lighting circuits, means providing four types of operation. Three types are provided by the three dimmers X, Y, and Z; the fourth type of operation is provided through the medium of the conductor which connects control bus w^1 directly to supply bus **12**.

While for purposes of illustration there have been shown six lighting circuits and four dimmer circuits, it is to be understood that this number is shown only by way of illustration, as there is no limit to the number of lighting circuits or to the number of dimmer circuits that may be provided in any installation. The determining factor, in choosing the proper number of dimmer circuits for any one installation is determined by the lighting effects-flexibility that is desired.

It is noted that in conventional installations, means are provided for grouping the various individual circuit control dimmers so that they may be operated by common or master controls. In the systems of the invention, the number of circuit control dimmers provided would correspond to the number of master controls that would be provided in equivalent conventional systems plus, if desired, a few extra dimmers for individual operation of spot lights, etc., just as is provided in conventional installations. Since in conventional installations the master controls are few in number, as compared to the number of individual circuit control dimmers, it is readily apparent that to give the same type of control, under the invention, that is provided in conventional systems, would require only a few circuit control dimmers plus the few desired extra dimmers. This causes a reduction in the number of dimmers, to say nothing of the improvement in electrical efficiency and the saving of space required by the control apparatus.

The operation of the system here shown is as follows:

Let us assume that in Scene I, circuit A is to be lowered from full bright to full dim; B—lowered from full bright to half dim; C—raised from full dim to bright; D—not to be used at all; E—to remain full bright; and F—to be raised from full dim to full bright.

Let us also assume that dimmers X and Y are preset to the full bright position; and dimmer Z is preset to the full dim position.

The selector switches, for Scene I and before Scene I starts, will then be closed as follows: A_1—*x*; B_1—*y*; C_1—*z*; D_1—none; E_1—*w*; F_1—*z*.

Then upon the simultaneous closing of the scene switches AI—FI, at the beginning of Scene I, the lights will be on as follows: A—full bright; B—full bright; C—full dim; D—black out entirely; E—full bright; F—full dim. During Scene I, by manipulation of the dimmer controls for dimmers X, Y, and Z, the proper lighting effects will take place.

At the end of Scene I, the dimmers will be in the following positions: X—full dim; Y—half bright; Z—full bright; and the lighting circuits will be in the following conditions: A—full dim; B—half bright; C—full bright; D—black out; E—full bright; and F—full bright.

Now let us suppose that in Scene II, circuit A is to start out at full bright and be brought to full dim; B—to be full bright during the entire scene; C—to start out dim and be brought to full bright; D—to start out half bright and be raised to full bright; E—to start and continuously be blacked out; and F—to be brought from full bright to full dim.

Accordingly, during the progress of Scene I, while the master scene switches AII—FII are open, the selector switches for Scene II are closed as follows: A_2—*z*; B_2—*w*; C_2—*x*; D_2—*y*; E_2—none; F_2—*z*. Then when Scene II is to take place, the scene switches AI—FI are opened, and scene switches AII—FII are closed, all by operation of control rods I—II.

The closing of scene switches AII—FII is the switch-over operation and switches the circuits from the dimmers by which they had been controlled for Scene I, to the dimmers by which they are to be controlled for Scene II, as follows:

Circuit A—from dimmer X to dimmer Z; B from Y to line **12** direct through no dimmer at all; C from Z to X; D from no connection to Y; E from W to no connection; and F from Z to Z.

In other words, between Scenes I and II, and in a moment, the circuits will be switched over A from a dimmer (X) in full dim to a dimmer (Z) in full bright; B from one (Y) in half bright to line **12**, full bright; C from one (Z) in full bright to one (X) in full dim; D from no dimmer at all to one (Y) in half bright; E from line **12** to no dimmer at all; and F from a dimmer (Z) in full bright to one (Z) in full bright.

During Scene II, dimmers X, Y, and Z are operated as predetermined, these operations being as follows: dimmer X will be raised from full dim to full bright; dimmer Y will be lowered from half bright to full dim; and dimmer Z will be lowered from full bright to full dim; so that, at the end of Scene II, the dimmers will have the following positions: dimmer X will be in full bright; dimmer Y will be in full dim; and dimmer Z will be in full dim.

For the next scene, Scene III, the proper selec-

tor switches of banks A1—F1 will be closed during Scene II, to preset the system to the operations desired for Scene III in a manner similar to that just explained for presetting the system for Scene II during Scene I. When switch-over for Scene III is to take place, movement of controls I and II will shift the system to the setting for Scene III and will disconnect the system from the setting for Scene II. This method of operation is repeated for as many scenes as desired, using alternate scene switches and alternate banks of selector switches. However, if preferred, there may be provided more than two master scene switches, and their corresponding banks of selector switches, for as many preset scenes as may be desired.

The dimmers X, Y and Z may be of any type and no particular type is specified or shown in Fig. 1. For example, they may well be resistance type dimmers or reactance type dimmers, both types being well known; and in this case the dimmers are designed for a particular load to provide a particular dimming characteristic. Consequently, unless the loads used on the dimmer are kept the same, the dimming characteristic will vary correspondingly. In some cases, this may be a desirable feature, because it permits the dimmers to have different operating characteristics when different loads are used, and will give a variable dimming operating characteristic feature to the system.

If this feature is not desired, instead of using conventional resistance or reactance type dimmers, transformers having variable taps may be used. The substitution of this type of transformer for conventional dimmers is illustrated in Fig. 2. With a variable transformer in place of a conventional dimmer, the dimming characteristic is the same regardless of load, varying only by regulation of the transformer which may be made negligible; or if desired, a combination of transformers and conventional dimmers may be employed to give a combination of both systems. However, it is not the purpose of this application to claim specifically the type of dimmers used, but rather to claim the system used, with these types in combination.

In Fig. 2 the wiring diagram for the dimmers would be as follows:

The control bus bars *x*, *y* and *z* are shown as connected to transformer secondaries X^s, Y^s, and Z^s provided with taps X^t, Y^t, and Z^t all connected to the supply bus 12 which is in turn connected to supply bus 10 by connection 16. The transformer primaries X^p, Y^p, and Z^p are connected in multiple across the line of high voltage system. The operation of the system, with the variable tap transformers utilized as the dimmers, is obvious from the foregoing and will not here be described.

It is observed that with separate switches used for the selector switches, and for the scene control switches, as shown in Fig. 1 that it is possible to close an individual circuit to more than one dimmer at the same time, thus creating interfeeds and possibly short circuits. To prevent such a condition, it is contemplated to substitute rotary type switches for the scene switches and for the selector switches so that it would be possible to connect a circuit to one dimmer only, and similarly to connect a circuit to one group only of scene switches.

Fig. 3 indicates the mode of substitution of rotary switches As—Fs for the master switches AI—FI, AII—FII shown in Fig. 1, and the mode of substitution of rotary selector switches A1—F1 and A2—F2 for the corresponding banks of selector switches of Fig. 1.

Now having described a control system of the invention, reference will be had to the appended claims which determine the limitations of the invention.

I claim:

1. A lighting circuit control system comprising a plurality of individual lighting circuits, and a group of dimmers of different intensity varying characteristics, with the entire group common for all the circuits, and with no dimmer individually related to a circuit and with no circuit individually related to a dimmer, and means for selectively switching individual ones of the circuits to any one or ones of the dimmers of the common group.

2. A lighting circuit control system comprising a plurality of individual lighting circuits, and a group of dimmers of different characteristics, with the entire group common for all the circuits, and means presettable during the recital of a scene for selectively switching individual ones of the circuits to any one or ones of the dimmers of the common group, without disturbing the previously existent association of individual circuits to dimmers of the common group, and means operable at the end of the recital of a scene for switching over the individual circuits from the dimmers of the common group with which they had been associated during the recital of the scene to the same or other ones of the dimmers of the common group, in accordance with the arrangement of the selective switching means that had been set up during the recital of the scene.

3. A lighting circuit control system including a plurality of individual lighting circuits, a group of dimmers of different characteristics, with the entire group common for all the circuits, the dimmers being operable during the recital of a scene, for varying the lighting intensities of those ones of the aforementioned circuits which happen to be connected thereto, a plurality of multiposition master scene switches, one for each circuit, and a plurality of groups of selector switch sets, including a group of selector switch sets for each circuit, each group of selector switch sets serving to connect the corresponding circuit, through the corresponding master scene switch, to the dimmers, in accordance with the setting of that group of selector switch sets, one of the selector switch sets in each group serving to connect its circuit to the dimmers, during the recital of a scene and another of said selector switch sets in each group being preset during the recital of that scene, without then affecting the circuit connected to the dimmers through the other set of selector switches of the group, for the scene to follow, the plurality of master switches serving to switch over the circuits, at the end of the recital of the scene that was being recited from the ones of the group of selector switch sets that had been used during the recital of that scene to the others of the group of selector switch sets, namely the ones that had been preset during the recital of that scene for the scene to come.

4. A lighting circuit control system comprising a plurality of individual lighting circuits, and a group of dimmers of different intensity varying characteristics, with the entire group common for all the circuits, and with no dimmer individually related to a circuit and with no circuit individually related to a dimmer, and means electrically located between the dimmers and the circuits for selectively switching individual ones of

the circuits to any one or ones of the dimmers of the common group.

5. A lighting circuit control system comprising a plurality of individual lighting circuits, and a group of dimmers of different characteristics, with the entire group common for all the circuits, and means for selectively switching individual ones of the circuits to any one or ones of the dimmers of the common group, said means including dimmer selector switches which can be preset during the recital of a scene and scene switches which can be manipulated at the end of that scene to switch over the circuits to the selected dimmers through the selector switches that were preset during the recital of that scene.

6. A lighting circuit control system comprising a plurality of individual lighting circuits, and a group of dimmers of different characteristics, with the entire group common for all the circuits, and means electrically located between the dimmers and the circuits for selectively switching individual ones of the circuits to any one or ones of the dimmers of the common group, said means including dimmer selector switches which can be preset during the recital of a scene and scene switches which can be manipulated at the end of that scene to switch over the circuits to the selected dimmers through the selector switches that were preset during the recital of that scene.

7. A lighting circuit control system comprising a plurality of individual lighting circuits, and a group of dimmers of different characteristics, with the entire group common for all the circuits, and means for selectively switching individual ones of the circuits to any one or ones of the dimmers of the common group, said means including for each circuit two sets of dimmer selector switches, one set of which is active during the recital of a scene, and the other set of which can be preset during the recital of that scene, for selectively connecting its circuits to the dimmers of the common group, and scene switches which can be manipulated at the end of that scene to switch over the circuits from the theretofore active ones of the selector switches to the theretofore preset ones of the selector switches.

8. A lighting circuit control system comprising a plurality of individual lighting circuits, and a group of dimmers of different characteristics, with the entire group common for all the circuits, and means electrically located between the dimmers and the circuits for selectively switching individual ones of the circuits to any one or ones of the dimmers of the common group, said means including for each circuit two sets of dimmer selector switches, one set of which is active during the recital of a scene, and the other set of which can be preset during the recital of that scene, for selectively connecting its circuits to the dimmers of the common group, and scene switches which can be manipulated at the end of that scene to switch over the circuits from the theretofore active ones of the selector switches to the theretofore preset ones of the selector switches.

9. A method for individually varying the lighting intensities in individual lighting circuits of a group which employs a group of intensity varying dimmer means, related as a group to the group of circuits, and without any specific dimmer means being related to a specific circuit, and without and specific circuit being related to a specific dimmer means, and in which various dimmer means of the group employed have different intensity varying characteristics, which comprises the step of selecting from the group of circuits those circuits whose intensity variations are to be common and from the group of dimmer means that means whose intensity varying characteristics are what is desired for the selected ones of the circuits, and so on, until all circuits to be varied in intensity are switched to desired ones of the dimmer means, and switching selected circuits to selected dimmer means.

10. A method for individually varying the lighting intensities in individual lighting circuits of a group which employs a group of intensity varying dimmer means, related as a group to the group of circuits, and without any specific dimmer means being related to a specific circuit, and without any specific circuit being related to a specific dimmer means, and in which various dimmer means of the group employed have different intensity varying characteristics, which comprises the step of selecting from the group of circuits those circuits whose intensity variations are to be common and from the group of dimmer means that means whose intensity varying characteristics are what is desired for the selected ones of the circuits, and so on, until all circuits to be varied in intensity are switched to desired ones of the dimmer means, and switching selected circuits to selected dimmer means, after all selections have been made.

11. A method for individually varying the lighting intensities in individual lighting circuits of a group which employs a group of intensity varying dimmer means, related as a group to the group of circuits, and without any specific dimmer means being related to a specific circuit, and without any specific circuit being related to a specific dimmer means, and in which various dimmer means of the group employed have different intensity varying characteristics, which comprises the step of selecting from the group of circuits those circuits whose intensity variations are to be common and from the group of dimmer means that means whose intensity varying characteristics are what is desired for the selected ones of the circuits. and so on, until all circuits to be varied in intensity are switched to desired ones of the dimmer means, and switching selected circuits to selected dimmer means, simultaneously and after all selections have been made.

12. A method for individually varying the lighting intensities in individual lighting circuits of a group which employs a group of intensity varying dimmer means, related as a group to the group of circuits, and without any specific dimmer means being related to a specific circuit, and without any specific circuit being related to a specific dimmer means, and in which various dimmer means of the group employed have different intensity varying characteristics, which comprises the step of selecting from the group of circuits those circuits whose intensity variations are to be common and from the group of dimmer means that means whose intensity varying characteristics are what is desired for the selected ones of the circuits, and so on, until all circuits to be varied in intensity are switched to desired ones of the dimmer means, and switching selected circuits to selected dimmer means, the arrangement being such that selection may take place without interfering with then-existent electrical interconnections between circuits and dimmer means.

WILLIAM H. FRANK.