

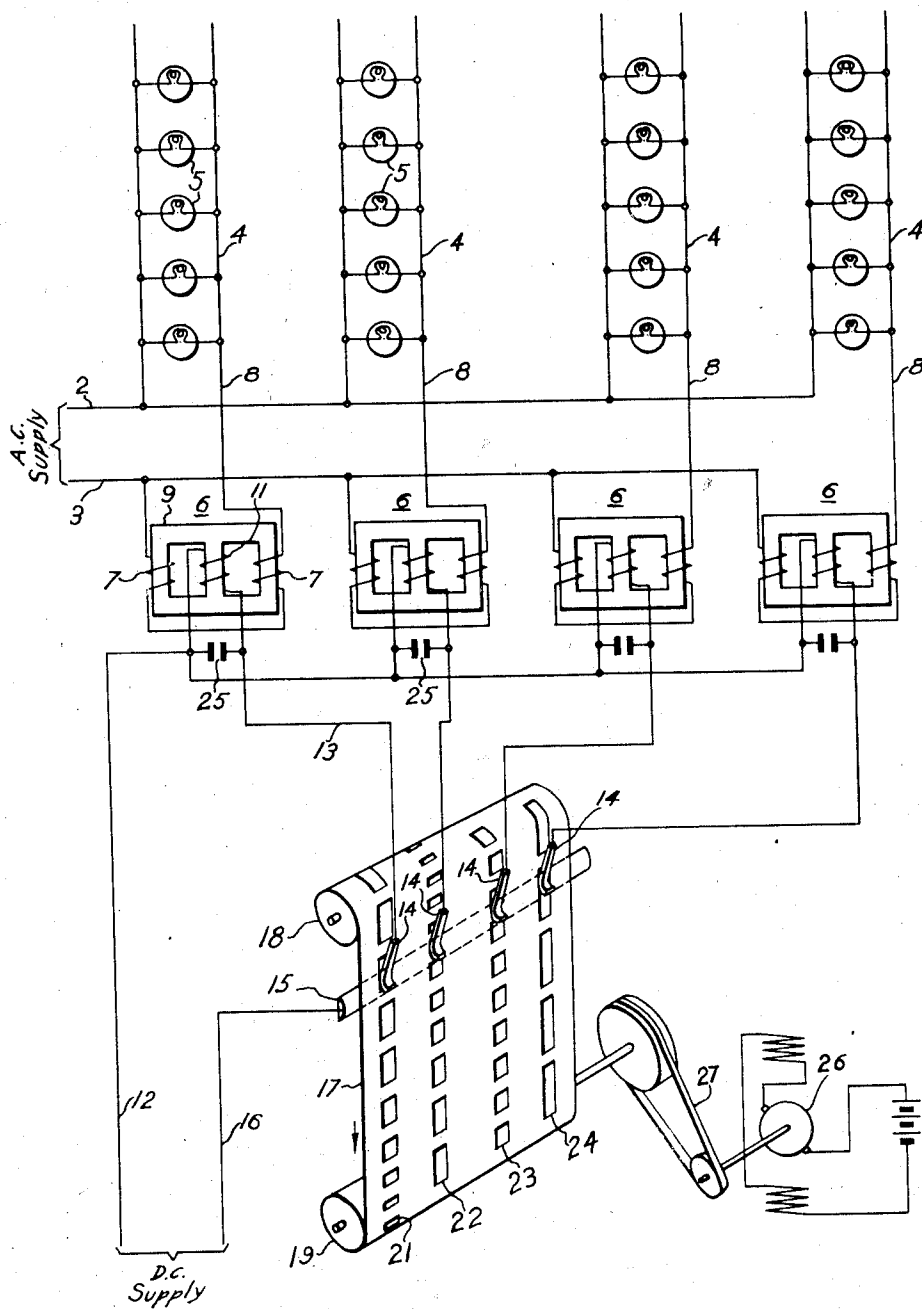
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THEATER SWITCHBOARD

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THEATER SWITCHBOARD

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6 Claims. (Cl. 171-242)

My invention relates to circuit-controlling apparatus and particularly to control apparatus for lighting circuits used in theaters and indoor and outdoor ornamental-lighting auditoriums.

5 The object of my invention is to provide lighting apparatus having a plurality of lighting circuits wherein the current potential of the lighting circuits is so controlled that each circuit may be operated at predetermined current and lighting
10 values and wherein the values are determined by control apparatus for each circuit that may be pre-set for any desired number of scenes or for different light combinations.

A further object of my invention is to provide
15 a theater-lighting apparatus wherein reactors are employed for controlling the current values of the lighting circuits and wherein the control windings of the reactors are individually controlled by a common member, such as a paper or insulating roll
20 and wherein the circuit through the control windings of the reactors is intermittently interrupted by a series of perforations provided in a paper roll and wherein the current value in the control winding is prevented from falling below a prede-
25 termined amount by a current-storage means, such as a condenser, connected in parallel with the control winding.

A further object of my invention is to provide
30 a lighting-circuit control apparatus wherein a paper or insulating roll is employed for controlling the current intensities of the circuits and wherein various predetermined current values may be produced by variations in the lengths and positions of the perforations in the paper roll, it being
35 understood that a row of perforations is provided for controlling each lighting circuit.

A further object of my invention is to provide
40 a multi-scene pre-set theater switchboard apparatus wherein the construction is materially simplified and pre-setting is facilitated.

These and other objects that will be made apparent throughout the further description of my invention are attained by means of the apparatus hereinafter described, and illustrated in
45 the accompanying drawing wherein:

The single figure is a wiring diagram showing the control apparatus diagrammatically and in perspective.

50 Alternating-current feed conductors 2 and 3 serve to supply the lighting circuits 4, containing lamps 5, with alternating current that is controlled by reactors 6 having series connected windings 7 connected to the conductors 8 of the
55 lighting circuits 4, the windings 7 being wound

around the outermost legs of a three-leg iron core 9.

Each reactor is provided with a control winding 11, one terminal of which is connected to a direct-current source of supply by means of a conductor 12 and the other terminal of which is connected
60 to such source through switch contacts 14 and a contact bar 15 of a control device and a conductor 16, the switch contacts 14 being disposed to yieldingly engage the bar 15.

A sheet of paper 17, similar to the usual piano-player sheet, is wound upon rollers 18 and 19 and is provided with rows 21, 22, 23 and 24 of
65 perforations that permit the switch contacts 14 to intermittently engage the contact bar 15 to close the circuits through their respective control windings.

Reactors have been used heretofore for controlling current intensity for theater and ornamental lighting circuits but the control windings
75 have usually been controlled by rheostats or resistance elements.

As is well known, because of the reactance of the windings 7, due to the magnetic fields set-up within the iron cores, practically no current flows through the windings and the lamp circuits 4
80 unless the flux of the cores is affected by the passage of direct current through the control windings 11. The amount of current supplied to the lighting circuits through the reactor windings 7
85 is substantially proportional to relatively small amounts of direct current passing through the control windings 11 which so reduce the reactance effect of the iron cores that current is permitted to flow through such windings and the lighting
90 circuits.

In order to provide a simple and readily pre-settable means for controlling the current in the control winding, the paper which cooperates with the switch contacts 14 and the contact bar 15
95 is provided with rows of previously punched perforations, the lengths and spacing of which determine the degree of illumination.

Since the degree of illumination of each of the lighting circuits 4 is substantially proportional
100 to the current flowing through the control winding 11, it is desirable that abrupt changes in the current potential of the control winding shall be avoided and that the potential shall be varied gradually.

In order that the direct current supplied to the control winding shall have a substantially flat wave, even though such winding be intermittently disconnected from its direct-current source of supply, I have provided a condenser 25 that is
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connected in parallel with the control winding to supply sufficient current to that winding, during the interval when its circuit is open, to prevent the current potential from falling below a predetermined amount. The manner of accomplishing this result is as follows:

When the switch contacts 14 engage the contact bar 15, current flows through the control winding 11 from the direct-current supply until the contacts 14 and 15 are disengaged by the paper between two adjacent perforations. The winding 11, being an induction winding, the current therethrough does not rise to maximum value instantly but attains such value within a definite length of time after the circuit is closed. For example, if it requires one second for the current to rise to full value, and the circuit is interrupted within one-half second, the current in the coil will rise only to a fraction of maximum value. When the circuit is closed through the control winding, the condenser 25 receives a charge. After the circuit is interrupted, current continues to flow in the control winding because of the inductive effect thereof but at gradually reducing value that would soon become zero in value, were it not for the condenser, which, immediately starts to discharge its current into the control winding, upon opening of the winding circuit, and thus maintains the current value substantially uniform. By properly proportioning the capacity of the condenser, with respect to the lag of the control winding, the current value within the control winding may be maintained on a substantially mean level between the peak attained in the coil and zero value.

It is apparent, therefore, that the mean current value of the control winding is proportional to the length of duration of a closed-circuit condition. Assuming that the perforations in the paper roll are equally spaced and that the roll is moved past the contacts at a uniform velocity, the current value of the control coil is substantially proportional to the length of the perforations and is substantially uniform.

If the perforations are relatively long, as indicated in the row 24, the current value in the control winding will be relatively high and nearly maximum, causing the reactor to permit sufficient current to pass through the lighting circuits to cause almost maximum illuminations. If the perforations are of graduated lengths, as indicated in row 21, the degree of illumination will be gradually increased in proportion to the increasing lengths of the perforations.

As indicated in the row 22, wherein perforations gradually decrease in length, the degree of illumination resulting from movements of the paper past the contacts 14 in the direction of the arrow will gradually decrease.

A uniform spacing of the perforations and a velocity of movement of the paper is selected that will cause the paper to be moved over one determined space within the time normally required for the current in the control winding to rise to maximum value. Full illumination of the lighting circuit is achieved by forming a continuous opening in the roll, and less than full illumination of the lighting circuit is produced by making the perforations shorter and spacing them the determined distance apart.

By reason of this arrangement, the illumination of any lighting circuit may be automatically varied in a predetermined manner at any time, for instance, during a scene of a stage production, and it is obvious that a large number of lighting cir-

cuits may be simultaneously affected, as predetermined by the pre-set spacing of the perforations in the paper.

An operator may pre-set the lighting effects for an entire performance by providing the proper perforations in the paper roll; this operation being accomplished by a suitable punching machine adapted for that purpose. After a roll of paper has been perforated, it may be used to repeatedly reproduce the same lighting effects at different performances of the same character.

The roller 19 for the paper may be driven by an electric motor 26 through any preferred means such as the belt drive 27 illustrated, and the motor may be provided with control apparatus (not shown) for regulating the speed. Marks may be made on the paper for indicating various cues, and the motor speed may be so regulated that the perforations for a given cue shall be aligned with the contacts at the proper time.

While I have illustrated but one embodiment of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention, as set forth in the appended claims.

I claim as my invention:

1. In a current regulating system, the combination with a reactor having a control winding connected to a direct-current source of substantially constant potential, of means for varying the average value of current in the control winding comprising a tape of non-conducting material provided with a series of perforations progressively varying in length, and means for moving said tape to intermittently interrupt the control winding circuit.

2. In a current regulating system, the combination with a reactor having a control winding connected to a direct-current source of substantially constant potential, of means for controlling the average value of current in the control winding comprising a tape of non-conducting material provided with a plurality of perforations of predetermined lengths, means for moving said tape to intermittently interrupt the control winding circuit, and means for preventing the current in the control winding from falling below predetermined values during the period of interruption.

3. In a current regulating system, the combination with a reactor having a control winding connected to a direct-current source of substantially constant potential, of means for varying the average value of current in the control winding comprising a sheet of non-conducting material provided with a series of perforations progressively increasing in length, means for moving said sheet to intermittently interrupt the control winding circuit, and a condenser connected in parallel with the control winding for preventing the current in the winding from falling below predetermined values during the period of interruption.

4. In a current regulating system, the combination with a reactor having a control winding connected to a direct-current source of substantially constant potential, of means for varying the average value of current in the control winding comprising a sheet of non-conducting material provided with a series of perforations progressively decreasing in length, means for moving said sheet to intermittently interrupt the control winding circuit, and a condenser connected in

parallel with the control winding for preventing the current in the winding from falling below predetermined values during the period of interruption.

- 5 5. In a current regulating system, the combination with a reactor having a control winding, of switching means for connecting the control winding to a source of potential, means for varying the average value of current in the control winding comprising a sheet of non-conducting material provided with a series of perforations progressively varying in length, and means for moving said sheet to actuate the switching means to intermittently interrupt the control winding circuit, thereby producing a current in the control winding proportional to the length of the perforations in said sheet.

6. In a current regulating system, the combination with a reactor having a control winding, of switching means for connecting the control winding to a source of direct-current potential, means for controlling the average value of current in the control winding comprising a sheet of non-conducting material provided with a plurality of perforations of predetermined length, means for moving said sheet at a predetermined speed to actuate the switching means to intermittently interrupt the control winding circuit, and a condenser connected in parallel with said control winding for preventing the current in the winding from falling below predetermined values during the period of interruption.

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