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A. E. BAILEY, JR

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ILLUMINATION CONTROL SYSTEM

Filed June 28, 1929

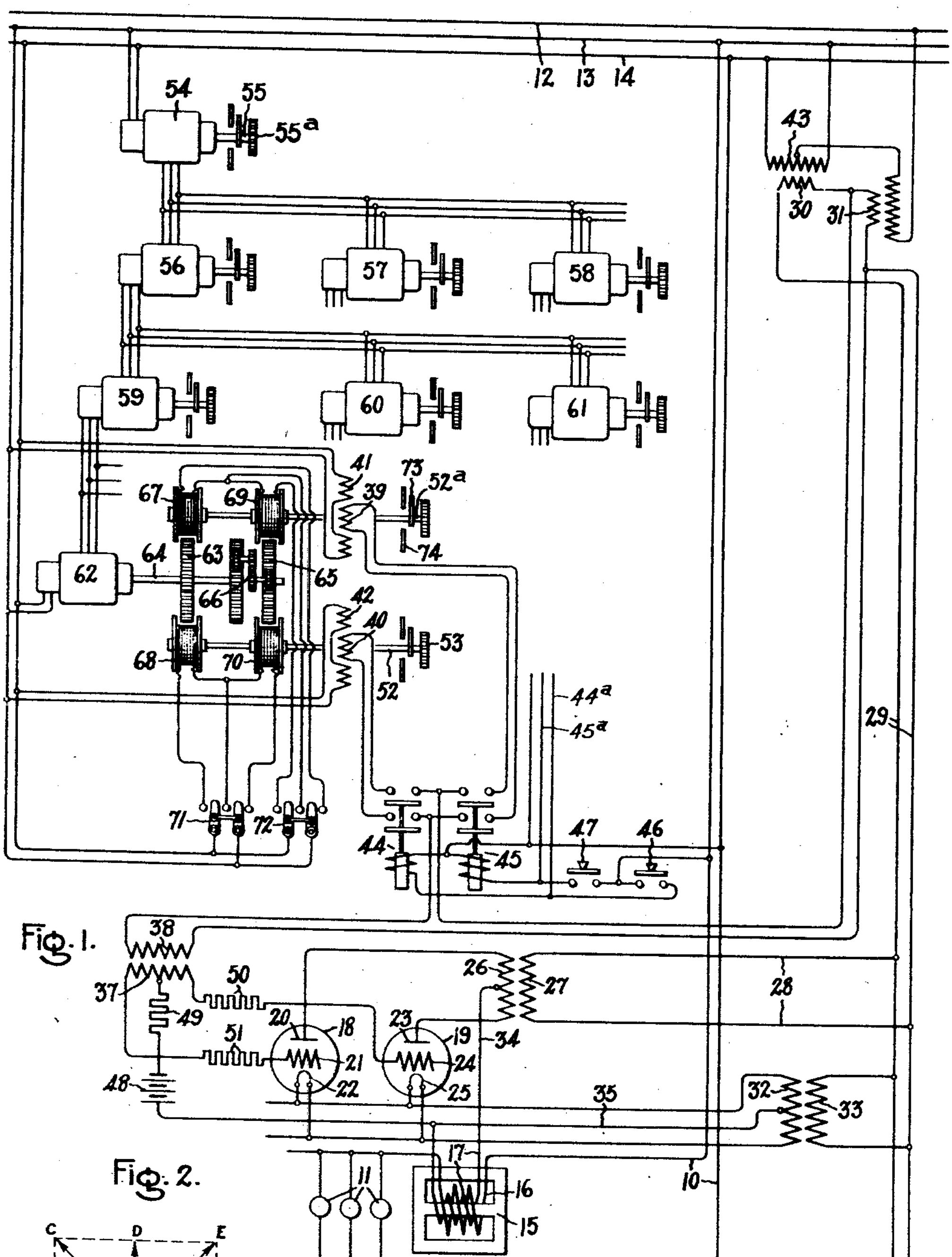
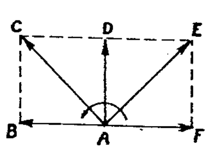


Fig. 1.

Fig. 2.



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His Attorney.

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UNITED STATES PATENT OFFICE

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ILLUMINATION CONTROL SYSTEM

Application filed June 28, 1929. Serial No. 374,592.

This invention relates to illumination control systems, more particularly to systems in which each of a plurality of groups of lamps is divided into a plurality of individual circuits, and has for an object the provision of a flexible and versatile control system for varying the intensity of illumination of the lamps either individually in circuits or simultaneously in groups, together with means having a minimum of open switching for remotely controlling large groups of lamps consuming proportionately large blocks of power.

In carrying my invention into effect in one form thereof, I provide an independently operable control device driven by a motion receiving device for controlling each individual lamp circuit together with a motion transmitting device and connections between the transmitting device and the receiving device for jointly controlling the intensity of illumination of all of the individual circuits simultaneously.

In illustrating my invention in one form thereof, I have shown it as embodied in an illumination control system particularly adapted for controlling the intensity of illumination of the lighting system of a theater, in which the aggregate of lamps are divided into color groups, each of which is divided into sub-groups, the sub-groups in turn being divided into individual lamp circuits across which are connected one or more lamps.

For a better and more complete understanding of my invention, reference should now be made to the accompanying drawing, in which Fig. 1 is a diagrammatic representation of an embodiment of my invention, and Fig. 2 is a vector diagram showing the relation of voltages applied to different elements of a device for controlling the intensity of illumination of an individual circuit.

Referring now to the drawing, the total aggregate of lamps in the theater are divided into a plurality of color groups which in turn are subdivided into a plurality of sub-groups each of which comprises a plurality of individual circuits, such, for example, as that represented in the drawing by the two conductors 10 across which are connected a plurality of lamps 11. The circuit 10 may be an individual circuit of any color groups, for example, the red group. Alternating current is supplied to the lamps 11 from any suitable single phase source of supply, such, for example, as the two lines 13—14 to which the conductors 10 are connected, and which, as shown in the drawing, form one phase of a three-phase supply line represented by the three conductors, 12, 13, 14.

In a theater lighting system it is necessary that the intensity of illumination of the lamps be variable in various groups, and in combinations of groups and sub-groups, from full brilliance of the lamps to complete darkness thereof for the successful production of desired lighting effects for various scenes, such, by way of example, as sunrise, sunset, moonrise, and storm scenes.

In order to vary the intensity of illumination of the individual lamp circuits, a variable reactance having a soft iron core 15, is provided with a reactive winding 16 wound upon the core which is connected in each individual lamp circuit in series relationship between the lamps 11 and their source of supply 13—14. The core 15 is further provided with a saturating or control winding 17 which is connected in the output circuit of a full wave rectifying device shown in the drawing as two electrostatically controlled vapor-electric discharge devices of the type known to the art by the term of "thyratron". The thyratron is a three electrode tube differing from the ordinary three-element vacuum tube in that after exhaust a small quantity of inert gas, such, for example, as mercury vapor, is introduced into the envelope, the presence of which changes the pure electron discharge from the cathode, into an arc stream so that the thyratron becomes an electrostatically controlled arc rectifier. In the drawing, the tube 18 is provided with an anode 20, a grid 21, and a thermionic cathode or filament 22; tube 19 being provided with similar elements indicated respectively by the reference numerals 23, 24, 25.

The anodes 20, 23 of the thyratrons are

connected to the opposite terminals of the secondary winding 26 of an anode transformer, the primary winding 27 of which is connected as by conductors 28, 29 to the terminals of the series connected legs 30 and 31 forming the secondary windings of a Scott or T-connected transformer, the significance of which will be made to appear more fully hereinafter in the description and explanation which follows. The filamentary cathodes 22, 25 of the tubes are heated by current supplied thereto from the terminals of the secondary winding 32 of a filament transformer, the primary winding 33 of which is connected by conductors 29 to the terminals of the secondary windings 30—31 of the Scott-connected transformer.

As previously pointed out in this specification the control or saturating winding 17 of the variable reactance of the lamp circuit is connected in the output circuit of the full wave rectifying device comprising the tubes 18, 19. That is to say, one terminal of the winding 17 is connected to the midpoint of the secondary winding 26 of the anode transformer by a conductor 34, whilst its opposite terminal is connected by the conductor 35 to the midpoint of the secondary winding 32 of the filament transformer.

As is well understood by persons skilled in this art, the time of starting of the output current of a thyratron with respect to the beginning of each half cycle of the wave to be rectified can be controlled by the grid. After starting, the grid has no further control over the arc, either to modulate, to limit, or to extinguish it; the instantaneous value of the magnitude of the current depending almost entirely upon the impedance of the external circuit. However, since the time of starting can be controlled in each half cycle, it is clear that the average value of the current in the output circuit can be controlled, and as a result of this control in the particular connections shown in the drawing, the value of the current in the saturating winding 17 of the reactance, the value of the reactance itself and likewise the value of the current flowing in the lamps 11 may be controlled.

Although any suitable method may be used for controlling the phase of the grid voltage with respect to the anode voltage, I prefer to use the arrangement shown in the drawing, which is described and claimed in copending application of Harold B. La Roque, S. N. 379,556, filed July 19, 1929, assigned to the same assignee as the assignee of the present invention.

In this arrangement the grids 21 and 24 of the tubes 18, 19 are connected to opposite terminals of the secondary windings 37 of a grid transformer, the primary winding 38 of which is connected in series relationship with the secondary leg 31 of the Scott-connected transformer and either one of the secondary windings 39, 40 of the grid phase-shifting transformers, the respective primary windings 41, 42 of which are supplied from the same phase 13—14 from which the primary leg 43 of the Scott-connected transformer is supplied.

Scene changing contactors 44 and 45 respectively provided with windings connected to be energized from the phase 13—14 of the three-phase supply source in response to depression of either of the scene changing switches 46 and 47, represented in the drawing as manually operated push buttons serve to connect either of the secondary windings 39, 40 of the grid phase-shifting transformer in series with the primary winding 38 of the grid transformer and the secondary leg 31 of the Scott-connected transformer (depending upon which of the two scene changing contactors 44, 45 is energized and closed).

Although but a single pair of scene changing contactors 44, 45 is shown in the drawing, it is to be understood that there will be a similar pair of contactors for each individual lamp circuit in the system, as indicated by the open-end conductors 44*a*, 45*a*, and that all the contactors connected across conductor 44*a* and the neutral are simultaneously operated by the scene change switch 46, whilst those connected across conductor 45*a* and the neutral are simultaneously operated by the scene change switch 47. The grids of the tubes are biased slightly negatively by the biasing, or C battery 48, the negative terminal of which is connected through a current limiting resistor 49 to the midpoint of the secondary winding 37 of the grid transformer, and the positive terminal of the battery is connected by conductor 35 to the midpoint of the secondary winding 32 of the filament transformer. Current limiting resistors 50, 51 are also provided in series relationship between the grids and the secondary of the grid transformer to prevent destruction of the grids.

The manner in which the phase of the potential applied to the grids is shifted with respect to the anode potential to control the saturating or control current flowing in the winding 17 of the reactor, will now be explained and will best be understood by referring to the vector diagram of Fig. 2 in which the voltage induced in the secondary legs 30, 31 of the Scott-connected transformer may be respectively represented by the two vectors AB and AD shown differing from each other in time phase by 90 electrical degrees, or in time quadrature, as is well understood in the art. Since the primary 27 of the anode transformer is connected across the terminals of both legs 30, 31 of the Scott-transformer, the voltage induced in the secondary 26 of the anode transformer will be the geometrical sum of the voltages of the legs 30 and 31 and may be represented vectorially by the vector AC which is the resultant of the vectors AB and AD.

The voltage applied to the anodes 20 and 23 is represented therefore by the vector AC which lags AB and leads AD (assuming a clockwise rotation of the vectors) by an angle of 45 degrees.

The voltage applied to the grids 21 and 24 is the sum of the voltage of one leg 31 of the Scott transformer represented by the vector AD and the voltage induced in the secondary winding 40 of the phase shifting transformer (assuming scene change switch 44 to be closed) which is 90 electrical degrees out of phase with AD and may therefore be represented by the vector AF when the coil 40 is in its normal position as shown in the drawing. The resultant AE of these two vectors represents the voltage applied to the grids, and as will be seen, it lags the vector AC of the anode voltage by 90 electrical degrees. The secondary winding 40 of the grid phase shifting transformer, however, is rotatably mounted upon a shaft 52 which is provided with a knob 53 by means of which the secondary coil 40 may be rotated in space 180 degrees from the position in which it is shown, thus causing the voltage AF induced therein to be shifted 180 electrical degrees from the position shown in Fig. 2 to a position of coincidence with AB which also effects a shift of the resultant vector AE (the grid potential) from the position shown through 90 electrical degrees to a position of coincidence with AC (the anode potential). Thus it will be clear that the grid voltage AE may be shifted either from a position 90 degrees out of phase with the anode voltage to coincidence therewith, or from a position of coincidence to a position 90 degrees out of phase therewith by rotation of the secondary coil of the phase shifting transformer.

Persons skilled in the art will appreciate that when the grid and anode voltages are exactly in phase the average value of the current in the output circuit will be maximum and that this average value will decrease towards a minimum as the phase angle between the anode and the grid voltages becomes increased. In the connection shown, the output current will be a minimum when the grid voltage lags the anode voltage 90 degrees.

From the foregoing it will be clear that the saturating current of the reactors (the output current of the tubes) will be minimum, the reactance maximum and the intensity of illumination of the lamps 11 minimum when the grid voltage is 90 degrees out of phase with the anode voltage; and that rotation of the coil 40 through one half turn will effect coincidence of the grid and anode voltages, maximum saturating current in the control winding of the reactor, minimum reactance of the reactor, and maximum intensity of illumination of the lamps 11.

The individual circuits, such as the circuit 10, are so numerous in a theater illumination system that it is not possible to vary the intensity of illumination of all the circuits simultaneously by the manually operated knobs 53. Remote control of many circuits in large groups and pre-setting of "next scene" circuits during the "present scene" becomes necessary.

In the system shown remote control is effected by remote motion transmitting devices connected to motion receiving devices which drive the shafts 52 and 52*a* upon which the secondary windings 39 and 40 of the grid phase shifting transformer are mounted.

The master motion transmitting device 54, known as a "grand master", has a single phase rotor winding, the terminals of which are connected to a suitable single phase source, such for example, as the phase 13—14 of the three-phase supply line. This winding is mounted upon a shaft 55 in inductive relation to a distributed three-circuit stator winding (not shown) and may be rotated with respect thereto by a knob 55*a*. This instrument is marketed under the trade name Selsyn. It is described in U. S. Patent 1.-637,039—E. M. Hewlett et al. dated July 26, 1927.

Intermediate motion transmitting devices 56, 57, 58, known as "color masters," are each provided with a distributed three-circuit rotor winding, and with a distributed three-circuit stator winding, the terminals of which are connected to the three-circuit stator winding of the grand master 54. These devices are on the market under the trade name of Selsyn transformers, and are described and claimed in U. S. Patent 1,612,117—E. M. Hewlett et al. dated Dec. 28, 1926. There are as many of these color masters connected to the grand master as there are color groups of lamps, i. e., the color master 56 may be for the red color group, color master 57 for the blue color group, and color master 58 for the white group.

The control is further refined in that a plurality of group-masters 59, 60, 61 are connected to each of the color masters, those in the drawing being shown connected to the color master 56. There will be a corresponding plurality of group masters for each of the remaining color masters 57, 58, as indicated by the open-end connections of the rotor windings of these color masters. The group masters like the color masters are transmitting transformers and their stator windings are connected to the rotor windings of their corresponding color masters.

The control is still further refined by a plurality of motion receiving instruments 62, one for each individual circuit 10 in the entire illumination system, connected to the rotor winding of its corresponding group master. The motion receiving instruments 62 are identical in construction with the transmitting device 54, i. e., they have a single phase rotor winding supplied from the same phase 13—14 as the single phase rotor winding of the transmitting device, and their three-circuit stator windings are connected to the rotor windings of their corresponding group masters. It is clear that there will be as many of these receiving instruments as there are individual lamp circuits 10 in the system.

The operation of motion transmitting and receiving instruments is well understood in the art, and will be but briefly described in the present specification. When the rotors of the transmitting device, the intermediate transmitting transformers, and the motion receiving devices are in their normal positions, the voltages induced in the three-circuit windings of the transmitting device will be exactly balanced by the voltages induced in the three-circuit windings of the motion receiving device by its single circuit winding. Likewise the voltages supplied from the three-circuit winding of the transmitting device 54 to the three-circuit windings of the intermediate transformers 56, 57, 58 will be exactly counter-balanced by the voltages supplied from the three-circuit windings of the motion receiving devices to the three-circuit rotor windings of the intermediate transmitting transformers. Should the single phase winding of the transmitting device 54 be rotated with respect to the stator winding, this voltage balance will be disturbed, and circulating currents will be set up through the three-circuit windings all the way down through the intermediate transmitting transformers to the motion receiving devices, and in accordance with a well-known property of synchronous electrical machinery, the rotors of the receiving devices 62 which are free to rotate, will assume a position to reestablish the balance and the movement necessary to reestablish this balance will be exactly the same number of electrical degrees as that through which the rotor of the transmitting device was displaced. Thus, it will be clear that any motion imparted to the rotor of the transmitting device will cause the rotors of the receiving devices 62 to follow this motion exactly.

Correspondingly, if the rotor winding of any of the intermediate transmitting transformers 56, 57, 58 is rotated with respect to its stator winding, a corresponding unbalance of the voltages induced in its secondary winding and supplied from its secondary to all the motion receiving devices connected thereto, will result, and the rotors of the motion receiving devices will follow the motion of the rotor of the intermediate transmitting transformers to reestablish the balance. The same will be true if the rotors of any of the Selsyn transformers 59, 60, 61 are rotated. The bearing systems of the transmitting device 54 and the intermediate transmitting devices, i. e. the transmitting transformers, are constructed to have sufficient drag or friction to prevent their being turned except by manual manipulation of the knobs on the shafts. The rotors of the receiving devices 62, however, turn freely. Thus it will be understood that rotation of the rotor of the transmitting device 54 or of the transmitting transformers will only effect rotation of the rotors of the receiving devices 62 which are connected thereto but will not effect rotation of the rotors of any other intermediate transmitting transformer or transmitting device to which it may be connected.

In order that the uni-directional movement of any transmitting device may be made to effect either brightening or dimming the lamps, the shaft of each motion receiving device 62 is connected to the shafts, 52*a* 52 upon which the rotors 39, 40 of the phase shifting transformers are mounted through suitable reversing gearing such as that shown in the drawing. The particular reversing gearing shown is a magnetic gearing which consists of a soft iron disc 63 mounted upon a shaft 64 of each motion receiving device 62. A second soft iron disc 65 is connected through mechanical reversing gearing 66 to the shaft 64. Upon the shafts 52*a*, 52 upon which the rotor windings 39, 40 of the grid phase shifting transformer are respectively mounted, there are provided magnetic spools 67, 68 engaging the soft iron disc 63, and magnetic spools 69, 70 engaging the soft iron disc 65. Each of the magnetic spools is provided with a coil, as shown, which may be energized from the phase 13—14 of the three-phase supply line by operating either of the switches 71, 72, to either of its two operative positions. For instance, if direction switch 71 is operated to its left hand position the coil for spool 68 will be energized, whereas if the switch is operated to its right hand position the coil for magnetic spool 70 will be energized. Although not shown, the coils of these spools are provided with supports so that they will remain fixed in space while permitting the spools to rotate.

If the shaft 64 is rotated by the motion receiving device 62 and if the coil of spool 68 is energized, spool 68, due to the magnetic attraction between it and the disc 63 will rotate exactly as if the spool and disc were two gears in mesh with each other. If the coil of spool 70 is energized, motion will be imparted to the spool 70 by the rotation of disc 65, and due to the reversing gearing 66 between the shaft 64 and the disc 65, the direction of rotation of the spool 70 will be the opposite of that described for spool 68, and thus it will be clear that uni-directional motion of shaft 64 will effect opposite rotations of the secondary winding 40 of the grid phase shifting transformer, depending upon which of the two coils of the magnetic gearing is energized. The same is obviously true for the magnetic spools 67 and 69 which are connected to the shaft 52*a* upon which secondary 39 is mounted.

With the above understanding of the various elements and controlling devices comprised in a system embodying my invention, the operation of the system itself will readily be grasped and easily understood.

It will be clear from what has already been described of the operation of the system that manual operation of a knob 53 (assuming the scene change switch 44 to be operated to the closed position) will vary the intensity of illumination of lamps 11 connected across an individual circuit 10, either from full brilliancy to complete darkness, or from complete darkness to full brilliancy, by one half turn of the knob. If it be desired to vary the intensity of illumination of all of the lamp circuits in a sub-group simultaneously, this may be done by rotating the knob of one of the group masters. For example, by turning the knob of group master 59, the rotors of all of the motion receiving devices 62 connected thereto will be rotated and will vary the brilliancy of all of the lamp circuits in that particular sub-group. Should it be desired to vary the intensity of illumination of an entire color group, this may be done by rotation of the knobs of one of the color masters. For example, assuming the color master 56 to be the red color master, the brilliancy of all of the red lamps in the theater may be simultaneously varied by rotating the knob of this color master, which will cause all of the motion receiving devices which are connected to all of the group masters connected to this particular color master, to rotate and to vary the brilliancy of all the individual lamp circuits in this color group. Quite obviously, rotation of the knob of the grand master 54 will be effective to vary the intensity of illumination of all the individual circuits in the system simultaneously.

Very often, it is necessary, for instance in the production of sunrise and sunset scenes, to cause the brilliance of certain of the circuits to decrease simultaneously with increasing brilliance of certain other circuits. This may easily be accomplished in my system as follows: First, all of the knobs 53 for all of the individual circuits of an entire color group, for instance the red color group, will be pre-set dark, i. e. for maximum dimness, and all of the knobs 53 of the individual circuits of the remaining color groups will be pre-set for maximum brilliance. Then by operating all of the switches 71 (or 72, as the case may be) for all of the individual circuits in the red color group to the right hand position for reverse rotation of the shafts 52 (or 52*a*), rotation of the knob of the grand master 54 will effect increasing intensity of illumination of all the individual circuits of the red color group, and decreasing intensity of illumination of all the individual circuits of the remaining color groups.

It will be appreciated by persons skilled in this art that various combinations can be worked by switching similar to that just described.

Pre-setting of the "next scene" may be accomplished by rotating the secondaries of the phase shifting transformers, which are not at that time in use such as the secondary 39, for the desired degree of brilliance of each individual lamp circuit, as indicated by the pointer 73, which cooperates with a suitably graduated scale 74, while the "present scene" is on. When the scene change is to be made, the scene change switch 46, i. e. the "present scene" switch is operated to the open position thereby deenergizing and opening all of the scene-changing contactors 44, in the system, whilst the scene-change switch 47 is operated to the closed position, thereby energizing and operating all of the scene change contactors 45 to the closed position and connecting the secondaries 39 of all the grid phase-shifting transformers to the primaries 38 of their respective grid transformers for all of the individual circuits in the system. Thereafter the desired remote control of subgroups, groups individually or groups in unison may be effected by manipulation of the group masters, color masters, or grand master as explained above.

Although in accordance with the provisions of the patent statutes I have disclosed and explained the best forms of the invention now known to me, I would have it understood that the invention is not limited to the exact forms illustrated, since modifications, alterations and equivalent arrangements will readily suggest themselves to persons skilled in the art without departing from the true spirit of this invention or from the scope of the annexed claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The combination in an illumination control system having a plurality of lamp circuits, of means for controlling said circuits comprising illumination intensity control means connected to each of said circuits, a separate electric discharge device provided with an input circuit and an output circuit connected to each of said illumination intensity control means, a plurality of individual control devices associated with each of said discharge devices, means for selectively connecting a corresponding one of each of said pluralities of control devices to the input circuit of its associated electric discharge de-

vice, and a master control device for controlling said circuits in unison.

2. In an illumination control system, a plurality of lamp circuits, means for controlling the intensity of illumination of said circuits comprising a separate reactance device connected to each of said circuits, means for controlling said reactance devices comprising a separate electric discharge device having an input circuit and an output circuit connected to each of said reactance devices, a plurality of voltage regulating devices for controlling the input circuit voltage of each of said electric discharge devices, switching means for selectively connecting corresponding voltage regulating devices to the input circuits of the associated electric discharge device, and a master control device connected to all of said discharge devices for controlling said circuits in unison.

3. In a theatre lighting system the combination with a plurality of groups of lamps subdivided into a plurality of individual circuits, of means for controlling the intensity of illumination of each of said circuits, an electric discharge device electrically connected to each of said illumination control means, means for controlling said electric discharge device, electrical motion receiving devices connected to operate said electric discharge device controlling means, a plurality of groups of master electrical motion transmitting devices, one for each group, electrical connections between said group master transmitting devices and the receiving devices for the respective groups, and a grand master electrical motion transmitting device electrically connected to said receiving devices through said group master transmitting device for simultaneously controlling said groups of lamps.

4. In a theatre lighting system the combination with a plurality of groups of lamps each of which is divided into a plurality of circuits, of means for varying the intensity of illumination of each of said circuits, said means including a reactance in each of said circuits, control means comprising a separate electric discharge device connected to each of said reactances, a separate electrical motion receiving device connected to control each of said electric discharge devices, a group master electrical motion transmitting device for each of said groups electrically connected to the motion receiving devices in said group, a grand master electrical motion transmitting device and electrical connections between said grand master device and said group master transmitting devices whereby said grand master device is operative to vary the intensity of illumination of all of said groups simultaneously.

5. In an illumination control system, the combination with a plurality of lamp circuits, of means for controlling the intensity of illumination of each circuit comprising a variable reactance in said circuit, a master electrical motion transmitting control device, a motion receiving device electrically connected thereto, an electric discharge device for varying said reactance, and means driven by said motion receiving device for controlling said electric discharge device.

6. In an illumination control system, the combination with a plurality of lamp circuits of means for controlling the intensity of illumination of each circuit, said means comprising a separate variable reactance connected in each of said circuits, a control winding on each of said reactances, an electric discharge device connected in circuit with each of said control windings, an electrical master motion transmitting control device, an electrical motion receiving device for each of said circuits, electrical connections between said transmitting device and said receiving devices, and means driven by said receiving devices for controlling said electric discharge devices.

7. In an illumination control system the combination with a plurality of lamp groups each of which comprises a plurality of lamp circuits, of a control unit for each group, each of said units comprising a group master electrical motion transmitting control device, a separate electrical motion receiving device for each of said circuits, electrical connections between said group master transmitting device and said receiving devices, a separate variable reactance in each of said circuits, means driven by the motion receiving device for said circuit for varying said reactance to vary the intensity of illumination of each of said circuits; and a grand master motion transmitting device connected to said receiving devices through said group master transmitting devices for simultaneously varying the degree of illumination of said plurality of lamp groups.

8. The combination in an illumination control system of a plurality of groups of lamps, each divided into a plurality of lamp circuits, of a control unit for each of said circuits, each of said units comprising an electrical motion receiving device, a vapor-electric discharge device having an output circuit, a variable reactance connected in said lamp circuit for varying the intensity of illumination thereof, a control winding connected in the output circuit of said vapor-electric device in inductive relation with said reactance for varying said reactance, and means responsive to motion of said movement receiving device for controlling the output of said vapor electric device, an electrical group master motion transmitting control device for each of said groups connected to all of said receiving device in said group for simultaneously controlling said circuits in said group, and a grand master electrical mo-

tion transmitting control device electrically connected to all of said group master motion transmitting devices for simultaneously controlling all of the circuits in all of said groups.

9. The combination in an illumination control system having a plurality of lamp circuits, of means for controlling the intensity of illumination of each of said circuits, a separate electric discharge device provided with an input circuit and an output circuit connected to each of said illumination control means, a plurality of individual control devices operatively associated with the input circuit of each of said discharge devices for controlling the operation thereof, means for selectively actuating a corresponding one of each of said pluralities of individual control devices, a master control device connected to said individual control devices for controlling the illumination of said lamp circuits in unison, reversing means connected to each of said individual control devices, and means for selectively rendering said reversing means effective.

10. In an illumination control system the combination with a plurality of lamp circuits of an electrical master motion transmitting device, a plurality of electrical motion receiving devices electrically connected to said master device, means for controlling the intensity of illumination of said circuits comprising a separate variable reactance device connected in each of said circuits and a separate electric discharge device connected to control each of said reactance devices, means driven by each of said receiving devices for controlling a corresponding discharge device, and reversing driving means interposed between said receiving devices and said driven means affording increasing illumination of certain circuits and decreasing illumination of certain other circuits responsively to a movement of said master device.

11. In an illumination control system, a plurality of lamp circuits, a separate reactance device connected to each of said circuits for controlling the intensity of illumination thereof, a separate electric discharge device provided with an input circuit and having an output circuit connected to each of said reactance devices, a plurality of individual inductive voltage regulating devices associated with each of said electric discharge devices for controlling the input circuit voltage thereof, switching means for selectively connecting corresponding inductive voltage regulators to the input circuit of its associated electric discharge device, a master control device connected to all of said individual control devices for controlling said lamp circuits in unison, and group master control devices interposed in the connections between said master device and said individual control devices for controlling said lamp circuits selectively in groups.

12. In an illumination control system the combination with a plurality of lamp circuits, of an electrical master motion transmitting control device, a separate electrical motion receiving device electrically connected to said transmitting device for each of said circuits, a separate rotatable device driven by each of said receiving devices for controlling one of said circuits, and means for effecting forward and reverse rotation of said control device, said means comprising a shaft having a soft iron disc mounted for rotation therewith, a second soft iron disc connected to said shaft through reversing gearing, a driven shaft for said device provided with an electromagnetic gear engaging said first disc and a second electromagnetic gear engaging said second disc, and means for selectively energizing said electromagnetic gears.

13. In a theater lighting system, the combination with a plurality of lamp circuits of an electrical motion transmitting control device, and an electrical motion receiving device for each of said circuits electrically connected to said transmitting device, a plurality of control devices for each of said circuits, means for effecting forward and reverse rotation of said control devices in response to uni-directional movement of said transmitting device, said means comprising a shaft driven by said receiving device and having a magnetic disc mounted thereon, a second magnetic disc connected thereto through reversing gearing, a separate driven shaft for each of said control devices, each of said driven shafts being provided with an electromagnetic gear engaging said first disc and with a second electromagnetic gear engaging said second disc, and means for selectively energizing said electromagnetic gears; a plurality of connections between said control devices and said circuits, and a plurality of preset switching devices for selectively establishing said connections.

14. In an illumination control system, a lamp circuit, a variable reactance device connected in said circuit for controlling the intensity of illumination thereof, an electric discharge device for controlling said reactance device, said electric discharge device being provided with a control grid, means including a rotary phase shifting device for applying a voltage to said grid varying in phase in accordance with the angular movement of said rotary device, an electrical angular motion receiving device for driving said rotary phase shifting device, a grand master electrical motion transmitting device electrically connected to said receiving device, and an electrical group master control motion transmitting device interposed in said electrical connections for controlling said re-

ceiving device jointly with said grand master control device.

15. In an illumination control system, a lamp circuit, a variable reactance device connected in said circuit for controlling the intensity of illumination thereof, an electric discharge device connected to control said reactance device, said electric discharge device being provided with a control grid, means including a pair of rotary phase shifting devices for applying a voltage to said grid varying in phase in accordance with the angular movement of said rotary devices, means for selectively connecting said rotary phase shifting devices to said grid, an electrical angular motion receiving device, driving connections between said receiving device and said rotary phase shifting devices, means for reversing said driving connections, a grand master electrical motion transmitting device electrically connected to said receiving device, and an electrical group master control motion transmitting device interposed in said electrical connections for controlling said receiving device jointly with said grand master control device.

16. In an illumination control system, a lamp circuit, a reactance in said circuit, means for varying said reactance, an electric discharge device for controlling said reactance varying means, said electric discharge device being provided with a control grid, means including a pair of rotary phase shifting devices for applying a voltage to said grid varying in phase in accordance with the angular movement of said rotary devices, means for selectively connecting said rotary phase shifting devices to said grid, an electrical angular motion receiving device, driving connections between said receiving device and said rotary phase shifting devices, means for reversing said driving connections, a grand master electrical motion transmitting device electrically connected to said receiving device, and an electrical group master control motion transmitting device interposed in said electrical connection for controlling said receiving device jointly with said grand master control device.

17. In an illumination control system, a plurality of lamp circuits, a variable reactance device connected to each of said lamp circuits for controlling the intensity of illumination thereof, a separate electric discharge device for each of said reactance devices having an input circuit and an output circuit connected to its associated reactance device, a group of induction voltage regulators associated with each of said discharge devices for controlling the input circuit voltage thereof, switching devices for selectively connecting corresponding voltage regulators of each of said groups of regulators to the input circuit of the associated electric discharge device, reversing means for controlling the operation of each of said voltage regulators, switching means for selectively actuating said reversing means, and a master control device connected to all of said induction voltage regulators for controlling all of said lamp circuits in unison.

In witness whereof, I have hereunto set my hand this 27th day of June, 1929.

ALLEN E. BAILEY, Jr.