July 31, 1934. D. E. CHAMBERS ET AL 1,968,634

CONTROL SYSTEM

Filed July 21, 1932

Fig. 1.

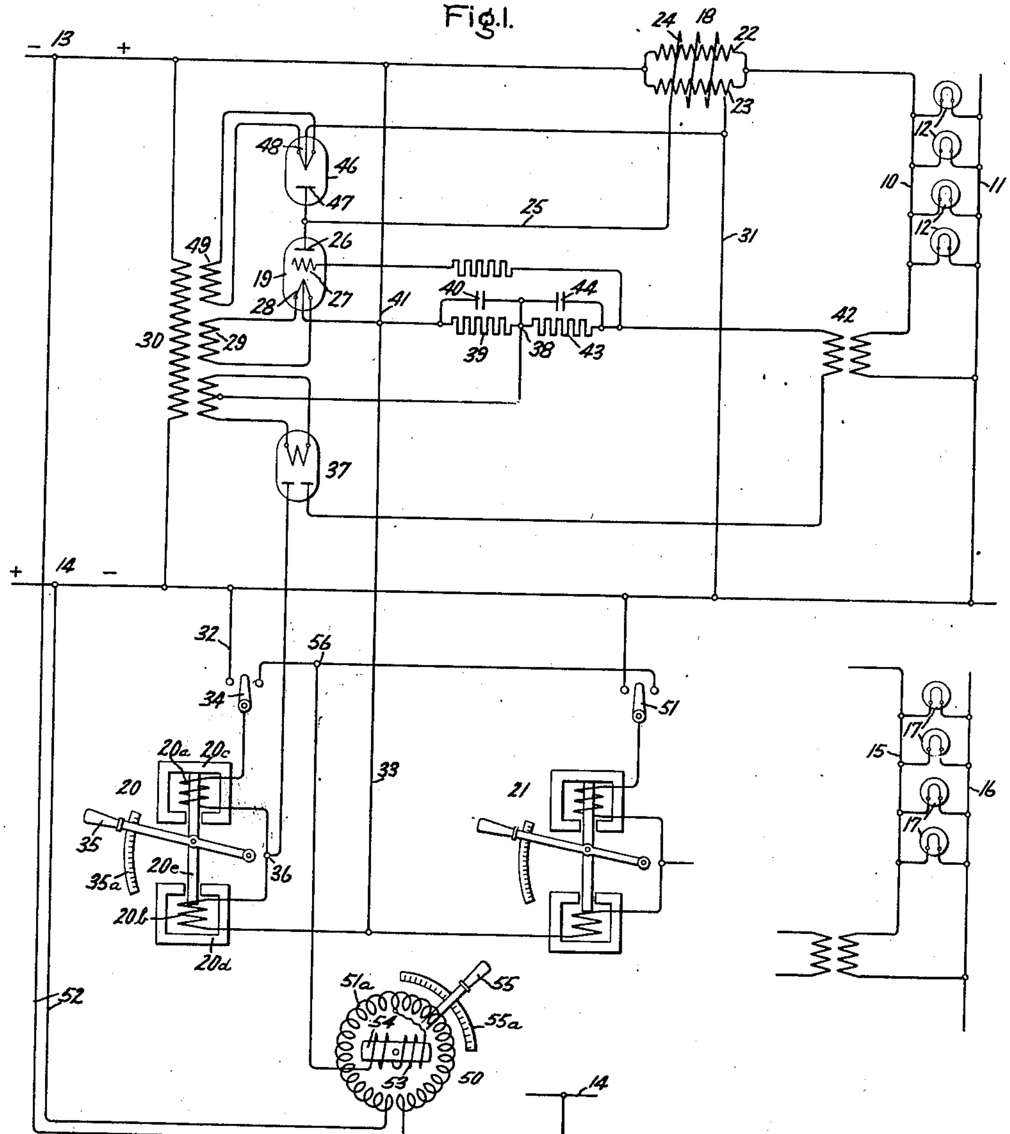


Fig. 3.

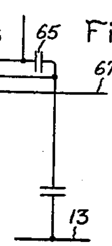
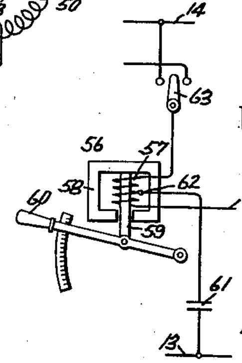


Fig. 2.



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UNITED STATES PATENT OFFICE

1,968,634

CONTROL SYSTEM

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Application July 21, 1932, Serial No. 623,780

12 Claims. (Cl. 175—312)

This invention relates to control systems, more particularly to illumination control systems; and it has for an object the provision of a simple reliable inexpensive and efficient system of this character.

More specifically the invention relates to systems utilizing electric valve apparatus for controlling the operation of theater dimmers and the like, and a more specific object of the invention is to improve systems of the type in which the lamp circuits are controlled by means of electric valve apparatus.

A more specific object of the invention is the provision of means for smoothly and gradually varying the control voltage of the electric valve apparatus while eliminating all moving and sliding commutating contacts usually employed in this connection.

In illustrating the invention in one form thereof, it is shown in connection with theater dimming apparatus in which the intensity of illumination of a lamp circuit is controlled by a saturable core reactor, the reactance of which in turn is controlled by a suitable electric valve apparatus.

In carrying the invention into effect in one form thereof a continuously variable reactance device is connected between the control grid of the electric valve apparatus and a supply source for varying the grid voltage. In a specific form the reactance device is connected to the supply source and has an intermediate tap connected to the grid of the electric valve apparatus, and it comprises an inductive winding together with a cooperating movable core member for varying the reactive voltage drops on opposite sides of the intermediate tap and consequently varying the voltage of the tap itself.

For a better and more complete understanding of the invention, reference should now be had to the following specification and to the accompanying drawing in which Fig. 1 is a simple diagrammatical representation of an embodiment of the invention and Figs. 2 and 3 are simple diagrammatical representations of modifications.

Referring now to the drawing a lamp circuit represented by the conductors 10, 11 to which are connected a plurality of lamps 12 is supplied from any suitable source such for example as the alternating current source represented by the conductors 13, 14. A similar lamp circuit represented by the conductors 15, 16 and lamps 17 is likewise supplied from a suitable source which may be and preferably is the same source as that represented by the conductors 13, 14. Connections between the last mentioned lamp circuit and the source 13, 14, are omitted for the purpose of simplifying the drawing.

The voltage applied to the lamps 12 and consequently the degree of illumination thereof is controlled by means of an impedance device illustrated in the drawing as a saturable core reactor 18, the reactance of which and likewise the reactive voltage drop across which is controlled by suitable electric valve apparatus 19, the operation of which in turn is controlled by means of a control device shown as comprising a variable reactance 20. Similarly the voltage supplied to the lamps 17 is controlled by a saturable core reactor, the reactance of which is controlled by suitable electric valve apparatus, the operation of which in turn is controlled by the reactance device 21. The saturable core reactor and the electric valve apparatus for controlling the lamps 17 have been omitted for the purpose of simplifying the drawing since they are in all respects identical with the saturable core reactor 18 and the electric valve apparatus 19 utilized to control the intensity of illumination of the lamp 12.

For the sake of simplicity the saturable core reactor 18 is conventionally shown in the drawing with the core member omitted. This reactor comprises a plurality of reactance windings 22, 23 each wound upon a separate leg of the iron core and connected in series relationship between the side 13 of the supply source and the lamp 12. In the specific arrangement illustrated in the drawing the reactance windings 22, 23 are connected in parallel relationship with each other and are wound in electrical opposition. The saturable reactor 18 is also provided with a control winding 24. Direct current of a variable magnitude is supplied to the control winding 24 by means of the electric valve apparatus 19 to the output circuit of which the control winding is connected, as shown, by means of the conductor 25. Any variation in the magnitude of the current flowing in the control winding 24 effects a corresponding change in the saturation of the reactor 18, and likewise in the reactive voltage drop across the reactance winding 22 and 23. Since the voltage of the source 13, 14 remains substantially constant the variation in the reactance drop across the windings 22 and 23 effects a corresponding change in the voltage applied to the lamps 12 and consequently in the intensity of their illumination. It will thus be seen that a variation in the current flowing in the control winding 24 effects a corresponding change in the voltage applied to the lamps 12; an increase in the current results in a decrease in the reactive voltage drop across the reactance windings 22, 23, in turn resulting in an increase in the voltage applied to the lamps 12; whilst a decrease in the direct current flowing in the control winding 24 results in an increase in the reactive drops across the windings 22, 23 which is followed by a decrease in the voltage supplied to the lamps 12 and a corresponding decrease in the intensity of illumination.

Although the electric valve apparatus 19 may be of any suitable type, it is illustrated in the drawing as an electric discharge device; preferably of the three electrode type into the envelope of which a small quantity of an inert gas, such for example as mercury vapor, is introduced after exhaust, the presence of the gas within the tube serving to change the usual pure electron discharge into an arc stream constituting the tube an electrostatically or grid controlled arc rectifier.

The electric valve apparatus 19 may be arranged either for full wave or half wave rectification. In the drawing, the electric discharge device is shown as a half-wave rectifying device for the purpose of illustration because of the relative simplicity of the necessary controlling circuit. As shown, the electric valve device 19 is provided with an output electrode or anode 26, a control electrode grid 27 and a cathode 28, shown as being of the filamentary type and heated to the necessary degree of incandescence by energy supplied thereto from a secondary winding 29 of a supply transformer, the primary winding 30 of which is supplied with energy from any suitable source such as the alternating current source 13, 14 to which it is connected in the manner illustrated in the drawing. The anode 26 is connected to the side 14 of the supply source over a circuit that is readily traced through the conductor 25, the direct current control winding 24 and the conductor 31.

Persons skilled in the art will understand that the grid 27 of the electric valve apparatus 19 is able to control the time during the positive half cycle of the voltage applied to the anode at which current starts to flow in the anode circuit. The grid has no control of the instantaneous value of the current in the output circuit but only has control over the time or instant in the positive half cycle of anode voltage at which current starts to flow and it will thus be seen that if the voltage applied to the grid is either an alternating or an undulating voltage that the average value of the output current may be controlled by shifting the phase relationship of this grid voltage with respect to the voltage of the anode. When the grid voltage is exactly in phase with the anode voltage the current begins to flow in the output circuit at the beginning of the positive half cycle of anode voltage and will continue until the anode voltage again passes through zero which is the condition of maximum current in the output circuit whilst if the grid voltage is 180° out of phase with the anode voltage, current will not start to flow in the output circuit at any time during the positive half cycle of the anode voltage which is the condition of zero or minimum current flow in the output circuit. For intermediate phase relationships, current will start flowing at proportionate intermediate points in the half cycle of anode voltage and the current will have an average value proportional to the length of time which it flows during the half cycle.

The grid bias voltage is derived from the source 13, 14 and is suitably controlled by the variable reactance device 20, shown in Fig. 1 as comprising an inductive winding having two portions 20_a and 20_b connected in series relationship with each other and to the source of alternating voltage 13, 14 by means of the conductors 32 and 33. The portions of the windings 20_a and 20_b are respectively provided with yoke members 20_c and 20_d mechanically arranged in opposition to each other, as shown in the drawing. In addition, the reactance device 20 is provided with a movable iron core 20_e arranged in cooperative relationship with the winding portions 20_a and 20_b. A suitable switching device 34 serves when operated to the left-hand position to connect the terminal of the winding portion 20_a to the side 14 of the supply source. It will be observed that the length of the movable core 20_e is considerably less than the distance between the respective horizontal portions of the yoke members 20_c and 20_d, thus providing for vertical movement of the core member 20_e. As shown the core member 20_e is pivotally connected to a manually operable lever 35 which as shown, is arranged for pivotal movement about the pivot 35_a.

The variable reactance device 20 is provided with an intermediate tap 36 between the winding portions 20_a and 20_b and this intermediate tap 36 is connected to the control or grid circuit of the electric valve apparatus 19.

When the core member 20_e is in a central position such that equal portions of its length are included in the respective winding portions 20_a and 20_b, the reactive drops across these winding portions are substantially equal and consequently the voltage at the tap 36, which is applied to the grid of the electric valve apparatus 19 is equal to half of the voltage drop between the opposite sides of the supply lines 13, 14. When the core member 20_e is in an extreme position such that a large portion of its length is surrounded by the winding portion 20_a and substantially none of its length is surrounded by the winding portion 20_b as illustrated in Fig. 1 of the drawing, the relative reactive voltage drops on opposite sides of the intermediate tap 36 are varied in inverse proportion; that is to say, the voltage drop across the winding portion 20_a is greatly increased due to the increase in reactance by movement of the core 20_e within its turns and the reactive voltage drop across the winding portion 20_b is greatly decreased by movement of the core 20_e out of inductive relationship with the turns of the winding portion 20_b. It will thus be clear that in the position of the core member 20_e illustrated in the drawing, the voltage at the intermediate tap 36 is substantially that of the side 13 of the supply line, whilst in the opposite extreme position of the core member 20_e the voltage at the intermediate tap 36 will be substantially that of the opposite side 14 of the supply line. For intermediate positions of the movable core member 20_e the voltage at the tap 36 and consequently the voltage applied to the grid circuit of the electric valve apparatus will have proportionate intermediate values. It will also be observed that changes in this voltage are accomplished smoothly and gradually, simply by movement of the lever 35 and the attached core member 20_e, and it will furthermore be observed that such changes are accomplished without sliding or moving commutating contacts.

A rectifying device 37 of any suitable type is included in the connections between the intermediate tap 36 and a point 38 of the grid circuit for the purpose of rectifying and applying a direct current controlling voltage to the grid. It will be seen, however, that the rectifying device 37 only rectifies one-half cycle of the voltage across the winding portions 20_a and 20_b of the reactance device 20. In order that this half wave rectified voltage may be converted into a voltage of substantially constant magnitude a suitable filtering device comprising a resistance 39 and a condenser 40 in parallel therewith are included in the grid circuit between the cathode 28 and the point 38. It will be observed that the cathode 28 is connected to the side 13 of the supply source by means of the conductor 41, and since the rectifying device 37 only rectifies the positive half-cycle of the wave, the voltage applied to the grid 27 is positive with respect to the cathode voltage.

A regulating voltage is derived from the voltage of the lamp circuit 10, 11 by means of the transformer 42 and is supplied to the grid 27 to which one terminal of the secondary winding of the transformer 42 is connected as illustrated. The opposite terminal of the secondary winding of the transformer 42 is connected to the second electrode of the rectifying device 37, and the polarities of the windings of the transformer 42 are so chosen that the rectifying device 37 rectifies the inverse half cycle of the lamp voltage wave, i. e., the half cycle that is opposite from that rectified by the electric valve apparatus 19. A suitable filter device comprising a resistance 43 and a condenser 44 connected in parallel therewith is connected in the grid circuit, one terminal of the resistance 43 being connected to the terminal 38 of the resistance terminal 39 and the opposite terminal of the resistance 43 being connected to one terminal of the secondary winding of the transformer 42. The electrical constants of the resistance 43 and the condenser 44 are so chosen that the rectified voltage supplied to the grid circuit by the transformer 42 and the rectifying device 37 is not completely smoothed out but on the other hand is slightly rippling or undulating. The connections between the transformer 42, the rectifying device 37 and the resistance 43 are so chosen that the terminal of the resistance 43 to which the grid 27 is connected is negative with respect to the point 38.

It will thus be seen that the controlling voltage supplied from the variable reactance device 20 and the regulating voltage supplied from the transformer 42 are opposite in polarity with respect to the grid 27 and the actual or resultant grid voltage is the difference between these two voltages. Furthermore, it will be clear that by varying the magnitude of the control voltage supplied from the variable reactance device 20 the phase relationship of the grid voltage is altered with respect to the anode voltage with the result that current flowing in the output circuit and the direct current control winding of the variable reactor 18 is correspondingly varied.

Since the saturable reactor 18 is highly inductive and since the electric valve apparatus 19 is preferably a half wave rectifying device, it will be clear that very little if any current will flow in the output circuit through the direct current control winding 18 in the absence of some special means because during the inverse half cycle which the electric discharge device is not rectifying the inductance of the saturable reactor 18 would force current back into the supply source 13, 14, the result of which would be that practically no direct current would flow in the control winding 24 and the reactive drop across the saturable reactor 18 could not be varied or controlled, or varied as desired.

For the purpose therefore of maintaining the current flow in the control winding during the inverse half cycle, a suitable half wave rectifying device 46 is connected in parallel with the control winding; the anode 47 being connected to the anode 26 of the electric valve apparatus 19 and the filamentary cathode 48 being connected to the terminal of the control winding 24 that is opposite to the terminal to which the anode 26 is connected. As shown, the cathode of the half wave rectifying device 46 is of the filamentary type which is heated to the necessary degree of incandescence by current supplied to it from the secondary winding 49 of the supply transformer. It will be seen that when the voltage applied to the anode 26 of the electric valve 19 becomes negative the terminal of the control winding 24 which is connected to the anode tends to remain positive due to the inductance of the reactor 18, and consequently will continue to flow from the anode 47 to the cathode 48 and to the opposite terminal of the control winding 24 until the voltage applied to the anode 26 from the line again becomes positive. As a result of sustaining the current flow in the winding during the inverse half cycle this current is substantially a direct current of constant adjustable magnitude.

The electric valve and controlling apparatus for the lamp circuit 15, 16 is in all respects identical with that just described in connection with the lamp circuit 10, 11, and is purposely omitted from the drawing in the interest of simplification. Likewise the variable reactance device 21 for controlling the electric valve apparatus and saturable core reactor associated with the lamp circuit 15, 16, is in all respects identical with the variable reactance device 20, and consequently a repetition of the structure and operation of this device is believed to be unnecessary. In order to provide control of both the lamp circuits 10, 11 and 15, 16 in unison with each other a suitable master control device 50 is arranged to be included in the connections between the supply source 13, 14, and the upper portion of the inductive winding of the variable reactance devices 20 and 21 when the selective switches 34 and 51 are operated to the right-hand position. The master control device 50 is illustrated as an induction type voltage regulator having a stator winding 51_a, the opposite terminals of which are respectively connected to the sides 13, 14, of the supply source by means of conductor 52, and also having a rotor winding 53 mounted for rotation upon a suitable rotor structure 54 responsive to movement of the manually operated lever 55. As shown, one terminal of the rotor winding 53 is connected to a mid-point of the stator winding 51_a whilst the opposite terminal of the rotor winding is connected to the point 56 between the switches 34 and 51. When the stator winding 51 is connected to a source of alternating voltage and an alternating current flows in the winding, an alternating magnetic field is produced that links the turns of the rotor winding 53. If the rotor winding 53 occupies a position such that its axis is parallel to the axis of this magnetic field, an alternating voltage of maximum value is induced in the winding 53 whilst if the latter winding occupies a position such that its axis is at right angles to the axis of the alternating magnetic field substantially no voltage is induced in the winding 53. The rotor 54 is rotated to any desired position between the above mentioned parallel and 90° position with the result that a voltage proportional to such intermediate position is induced in the winding 53, the value of which voltage is indicated by a suitable means such for example as the position of the lever 55 with respect to the calibrated scale 55_a.

In the modification of Fig. 2, the system is identical with that of Fig. 1 with the sole exception of the variable reactance device for controlling the intensity of illumination of the lamp circuit. For this reason the remainder of the system is omitted from the drawing, but the connection from the reactance device to the remainder of the system is suitably indicated. The form of the variable reactance device illustrated in this modification is shown as comprising one portion 56 having an inductive reactive winding 57 enclosed within a yoke 58 and a cooperating movable iron core member 59, the position of which within the turns of the inductive winding 57 is varied as desired by movement of the manually operated control lever 60, and further comprising a capacitative device illustrated as a condenser 61 connected in series relationship to an intermediate tap 62 of the inductive winding 57. A suitable switch 63 serves when operated to its left-hand position to connect the upper terminal of the inductive winding 57 to the side 14 of the supply source, and when operated to the right hand position serves to connect this terminal of the winding to the control winding of a master controller in the manner already described in connection with Fig. 1. The remaining terminal of the condenser 61 is connected to the side 13 of the supply source, as shown, whilst the free end of the inductive winding 57 is connected by means of the conductor 64 to an electrode of the rectifying device 37 in the grid circuit of the electric valve apparatus in the manner already described in connection with Fig. 1. Due to the fact that the condenser 61 and the inductive winding 57, together form a resonant circuit, and due to the fact that the reactive voltage drop across the condenser 61 and the inductance 57 differ in time phase by substantially 180° it is possible for the voltage drop across either or both to be of a very large value; even in excess of the voltage drop across the sides of the line 13, 14. It will thus be seen that even with the core member 59 in the extreme position for maximum reactive voltage drop across the winding 57, as illustrated in Fig. 2, it is still possible for a very large voltage drop to exist across the condenser 61 with the result that the voltage applied to the grid circuit of the electric valve apparatus would not be zero or substantially zero as is desired when the control lever 60 is in the extreme position shown. By connecting the upper terminal of the condenser 61 to the intermediate point 62 of the inductive winding 57 the voltage drop between the point 62 and the conductor 64 is made equal to the voltage drop across the condenser 61 and since it is in opposition thereto i. e. 180° out of phase therewith, the voltage of the connection 64 and consequently the voltage applied to the grid circuit of the electric valve apparatus can be made zero or substantially zero as is desired.

With the above understanding of the apparatus and its organization, the operation of the system shown in Fig. 1 will readily be understood from the following description:

In order to control the intensity of illumination of the respective lamp circuits selectively and independently of each other by means of respectively associated variable reactance devices 20 and 21, the switches 34 and 51 are operated to the left-hand position. With the manually operated lever 35 in the position illustrated in the drawing and the upper portion of the core member 20_e in its extreme position inside the turns of the winding portion 20_a the reactive drop across this winding is maximum with the result that the voltage at the intermediate tap 36 which is also the voltage applied to the grid 27 of the electric valve apparatus is substantially the voltage of the side of the line 13. That is to say, the voltage of the capacitor 40 is thus substantially zero with the result that the undulating voltage on the grid which is due to the additional regulating voltage supplied thereto through the transformer 42 is substantially out of phase with the voltage of the anode 26 and minimum current is delivered through the control winding 24 of the reactance device 18. As previously pointed out the condition of minimum current in the control winding of the reactance device produces a maximum reactive drop across the reactive winding 22 and 23 with the result that substantially zero line voltage is impressed upon the lamps 12 which consequently give substantially zero light intensity.

Movement of the control lever 35 from its extreme upper position to its extreme lower position varies the reactive voltage drop across the winding portions 20_a and 20_b in inverse relationship, i. e. decreases the reactive drop across the portion 20_a and increases the reactive drop across the portion 20_b with the result that the voltage of the intermediate tap 36, the capacitor 40 and the voltage of the grid 27 have a maximum positive value which causes the resultant undulating grid voltage to be displaced the maximum amount, i. e. substantially 0° from the voltage of the anode 26 which results in increasing the current supplied to the reactance winding, decreasing the reactance drop across the windings 23 and 24 and increasing the voltage impressed upon the lamps 12, which in consequence are raised to the point of maximum brilliancy. For intermediate positions of the control lever 35 the lamps 12 will burn with a brilliancy dependent upon the position of the lever 35, as indicated, upon the cooperating calibrated scale 35_a.

Operation of the control of the variable reactance device 21 results in a similar control of the intensity of illumination of the lamps 17 of the lamp circuit 15, 16. In order to control both lamp circuits in unison the selective switches 34 and 51 are operated to the right hand position thereby connecting the rotor coil 53 of the master control device 50 in series relationship between the source 13, 14 and the upper portions of the inductive windings of the variable reactance devices 20 and 21. It will be clear that rotation of the rotor winding 53 varies the voltage induced by the magnetic field due to the stator winding 51 which voltage variation also varies the voltage at the intermediate taps 36 as well as the voltage applied to the grids of the electric valve apparatus with the result that the intensiy of illumination of the lamp circuit is varied in a manner similar to that already described in connection with the operation of the individual control devices 20 and 21.

The operation of the system shown in the modification of Fig. 2 is in all respects similar to that already described in connection with the operation of the individual control devices of the system of Fig. 1 and will be readily understood from the above detailed description.

The system shown in the modification of Fig. 3 differs from the system of Fig. 2 only in the addition of a condenser 65 in parallel with the variable reactance portion of the winding 66 which corresponds with the winding 57 of the individual control device of Fig. 2. This condenser is dimensioned so that its reactance is substantially equal to the maximum value of inductive reactance of the variable reactive winding 66. The addition of this condenser results in increasing the maximum impedance of the inductance element by means of parallel resonance and thereby increases the range of voltage that is provided at the tap 67 by this device considered as a potentiometer. The operation of this modification is otherwise identical with that of the modification of Fig. 2.

Although in accordance with the provision of the patent statutes the invention is described as embodied in concrete form, it is to be understood that the system shown in the drawing and described in the above specification is merely illustrative and that the invention is not limited thereto since alterations and modifications will readily suggest themselves to persons skilled in the art without departing from the true spirit of this invention or the scope of the annexed claims.

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

1. An illumination control system comprising a lamp circuit, control means for said circuit comprising electric valve apparatus provided with a control grid, means for supplying voltage to said grid, and means for varying said grid voltage comprising a reactance device having connections across a supply source and an intermediate tap connected to said grid, and means for varying the relative voltage drops on opposite sides of said tap.

2. An illumination control system comprising a lamp circuit, voltage control means for said circuit comprising electric valve apparatus provided with a control grid, means for supplying voltage to said grid, and means for varying said grid voltage comprising a reactance device having connections across an alternating current source and an intermediate tap connected to said grid, and a movable core member for varying the relative reactive voltage drops across the portions of said device on opposite sides of said intermediate tap.

3. An illumination control system comprising a lamp circuit, control means for said lamp circuit comprising electric valve apparatus provided with a control grid, means for supplying voltage to said grid, and means for varying said grid voltage comprising a reactance device having an inductive winding provided with connections across a supply source and an intermediate tap connection to said grid, and a movable core cooperating with said winding to vary the reactive voltage drops across the portions of said winding on opposite sides of said tap in inverse proportion.

4. An illumination control system comprising a lamp circuit, means for varying the voltage of said circuit comprising electric valve apparatus provided with a control grid, means for applying a voltage to said grid, and means for varying said grid voltage comprising a reactance device having at least two portions connected across a supply source in series relationship with each other and having an intermediate point connected to said grid, one of said portions comprising an inductive winding, and a movable core member cooperating with said winding for varying the reactive voltage drops on opposite sides of said intermediate point.

5. An illumination control system comprising a lamp circuit, means for controlling the voltage of said circuit comprising electric valve apparatus provided with a control grid, means for supplying voltage to said grid, and means for varying said grid voltage comprising an inductive reactance device and a capacitative reactance device connected across a supply source in series relationship with each other and having a tap intermediate the source terminals of said reactance devices connected to said grid, and a movable core member cooperating with said inductive reactance device for varying the voltage drops on opposite sides of said tap in inverse relationship to each other.

6. An illumination control system comprising a lamp circuit, means for controlling the voltage of said circuit comprising electric valve apparatus provided with a control grid, means, for supplying voltage to said grid, and means for varying said grid voltage comprising an inductive reactance device and a capacitative reactance device connected across a source in series relationship with each other and having a tap intermediate the source terminals of said reactance devices connected to said grid, said capacitative reactance device being connected to an intermediate point of said inductance device and a movable core member cooperating with said inductive reactance device for varying the reactive voltage drops on opposite sides of said tap in inverse relationship to each other.

7. An illumination control system comprising a lamp circuit, control means for said circuit comprising electric valve apparatus provided with a control grid, means for supplying voltage to said grid, and means for varying said grid voltage comprising an inductive reactance device having one terminal connected to one side of a supply source and the other terminal connected to said grid, a capacitative reactance device having one terminal connected to the opposite side of said supply source and the other terminal connected to an intermediate point of said inductive reactance device, and a movable core member cooperating with said inductive reactance device for varying the voltage at the terminal connected to said grid.

8. An illumination control system comprising a lamp circuit, control means for said circuit comprising electric valve apparatus provided with a control grid, a source for supplying an alternating voltage to said grid, means for varying said grid voltage comprising an inductive reactance device having one terminal connected to said source and the other terminal connected to said grid, a capacitative reactance device having one terminal connected to the opposite side of said source and its other terminal connected to an intermediate tap of said inductive reactance device, an additional capacitative reactance device connected in parallel with a portion of said inductive device and dimensioned to have a reactance value substantially equal to the maximum reactance of said inductive device, and a movable core member cooperating with said inductive device for varying the voltage at the terminal connected to said grid.

9. An illumination control system comprising a plurality of lamp circuits control means for said lamp circuits comprising a separate electric

valve for each of said circuits, each of said valves being provided with a control grid, means for supplying voltage to said grids, means for selectively varying said grid voltages comprising a plurality of reactance devices, one for each of said valves and each having connections across a supply source and an intermediate tap connection to the grid of the corresponding valve, and means for controlling said grid voltages in unison comprising a voltage varying device included in the connections between said reactance devices and said source.

10. An illumination control system comprising a plurality of lamp circuits, control means for said circuits comprising electric valve apparatus, one valve for each of said circuits and each valve having a control grid, means for supplying voltage to said grids comprising connections to a supply source, means for selectively controlling the voltages of said grids comprising a plurality of variable reactance devices, one for each of said valves and each having connections to said supply source and an intermediate tap connected to the grid of the corresponding valve and means for controlling the voltages of said grids in unison comprising a master device included in the connections between said reactance devices and said source for simultaneously varying the voltage of said intermediate taps.

11. An illumination control system comprising a plurality of lamp circuits, control means for said lamp circuits comprising electric valve apparatus, one valve for each of said circuits and each valve provided with a control grid, means for supplying voltage to said grids comprising connections from said grids to a source of alternating voltage and a separate rectifying device included in the connections between each of said grids and the source, means for selectively varying the voltages of said grids comprising a plurality of variable reactance devices, one for each of said valves and each having connections to a source and an intermediate tap connected to the corresponding rectifying device, and means for simultaneously varying the voltages of all of said grids comprising an inductive voltage varying device included in the connections between each of said reactance devices and said source for simultaneously varying the voltage drops on opposite sides of said intermediate taps of each of said reactance devices.

12. An illumination control system comprising a lamp circuit, control means for said circuit comprising electric valve apparatus provided with a control grid, a source of supply voltage, means for supplying a voltage to said grid, means for varying said grid voltage comprising an inductive reactance device having one terminal connected to one side of said source and another terminal connected to said grid, and a capacitative reactance device having one terminal connected to the opposite side of said supply source and having its opposite terminal connected to an intermediate tap of said inductive reactance device to provide reduction of the voltage of said grid connections to the voltage of the terminal of the capacitative reactance device connected to said supply source and a movable core member cooperating with said inductive reactance device for varying the voltage drop on opposite sides of said tap.

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