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CONTROL FOR DISCHARGE ILLUMINATION

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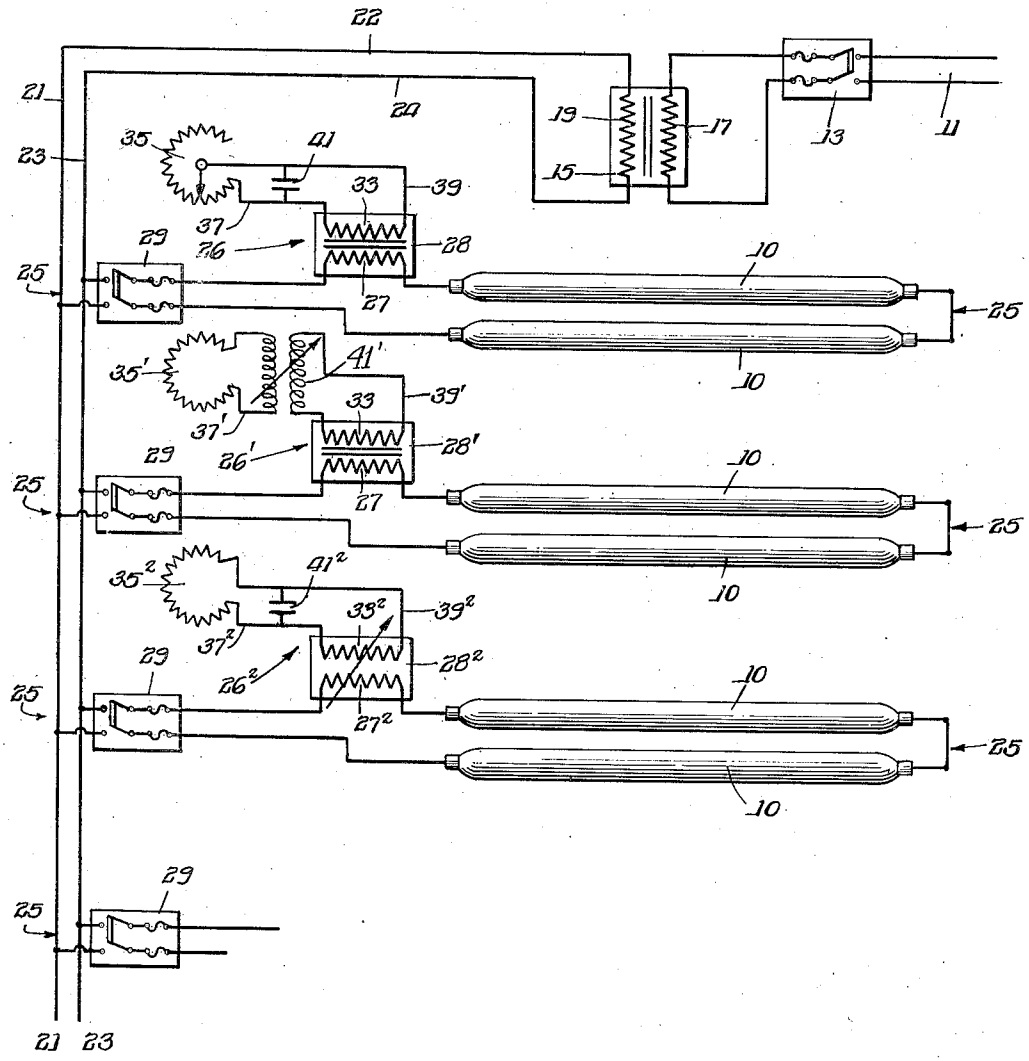

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CONTROL FOR DISCHARGE ILLUMINATION

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My invention relates in general to the art of illumination and has more particular reference to illumination produced by electrical discharges in an ionized field, of which perhaps the best known embodiment is the recently popularized neon tube.

A neon tube consists of a glass tubing, sealed, air evacuated and filled with neon gas and provided with spaced electrodes so that by applying high electrical potential between the spaced electrodes an electrical discharge is created between the electrodes. This discharge produces various colors in accordance with the gas contained in the tube. In the case of a neon gas-filled tube, the discharge creates a brilliant red colored light. If the tube contains mercury vapor, the light produced has a characteristic blue color.

Discharge illumination lends itself particularly well to the creation of architectural effects, for outlining buildings, and, on account of the diversity of colors which can be produced and the possibility of creating combinations of primary colors to produce modified or secondary shades as associating tubes of different colors, discharge illumination would readily lend itself to the production of so-called "color organ" effects, that is to say, in the creation of effects wherein the colors are made to change and shift from one color combination to another in order to produce symphonies in kaleidoscopic color but for the fact that so far there has been no commercially practical way of controlling the intensity of the illumination produced by the electrical discharge.

One of the few disadvantages, or rather problems, encountered heretofore in discharge illumination, has been the difficulty met with in attempting to regulate the intensity of the illumination produced by the discharge. As far as I am aware, no adequate method of "dimming" has as yet been suggested although a practical way of regulating the intensity of the illumination would greatly enhance the general utility of the system as a whole and would make possible the practical application of discharge illumination in the creation of color organ effects.

One of the important objects of my invention, therefore, is to provide a means for and method of satisfactorily dimming, that is to say, varying the intensity of the form of illumination under discussion.

Another object of this invention is to control the intensity of illumination produced in an electrical discharge of the class described by controlling the amount of energy supplied to the luminescent element or tube by absorbing a variable amount of the total energy supplied to the tube circuits without affecting the electrical potentials applied between the spaced electrodes of the tube sufficiently to impair the operation of the luminescent element whereby to operate same at reduced intensity with the same uniformity as at maximum intensity, it being understood of course that when the voltage, at which the tube normally operates, is reduced the discharge is intermittently destroyed because the voltage is not quite sufficient to sustain same uniformity. This intermittent disconnection and recreation of the discharge is commonly referred to as "flickering" and spoils the effect of the luminiscent element.

A further important object of my invention is to provide a method for dimming an electrical discharge illuminating element without causing the device to flicker, or otherwise operate improperly.

Another important object of my invention is to provide means for varying the intensity of individual members of an associated group of discharge elements whereby to create a color organ.

Another important object of my invention is to produce a simple, inexpensive means to dim an electrical discharge arc illumination element.

Another important object resides in providing a method of varying the intensity of an electrical discharge lamp without impairing its operating characteristics, which method involves the variation of the reactive characteristics of the lamp circuit.

Numerous other objects and advantages of the invention will appear as the same is more fully understood from the following description, which taken in connection with the accompanying drawing discloses a preferred embodiment of the invention.

Referring to the drawing:

The single figure illustrates an electric system including means for accomplishing the dimming of the light produced by a discharge illuminating element without reducing the electric potential of the power supplied to the element and thus causing the element to flicker.

To illustrate my invention, I have shown on the drawing, an electrical discharge illuminating system comprising a plurality of elongated luminescent elements 10, of a type well known in the art and which are powered from a suitable source of electrical energy 11 through switching apparatus 13 and a transformer 15, the primary winding 17 of which is connected through the switching apparatus to the source of power supply 11. The secondary winding of the transformer 15 is or may be connected as by the conductors 22

and 24 to spaced bus bars 21 and 23. It is between these bus bars that the several illuminating elements 10 are preferably connected in parallel circuits 25 as shown, although, of course, separate transformers, each powered in parallel from the power source 11, may be employed to energize each circuit 25 separately. Obviously also each circuit 25 may, if desired, contain one or several illuminating elements 10 arranged in series, as is well known in the art and the circuits 25 also are preferably connected to the power buses 21 and 23 through suitable switching and circuit protecting apparatus 29.

In order to illustrate my invention, I have shown several banks or circuits 25 extending between the bus bars 21 and 23, each of these circuits includes one or more luminescent elements 10 and dimming means connected in series therewith between the bus bars. The dimming means comprises controllable apparatus for changing the reactive characteristics of the circuit 25 in order to apply a variable reactive load therein which will absorb a quantity of electrical energy from the circuit, energy which would otherwise intensify the illumination produced by the discharge, without reducing or materially affecting the discharge sustaining potential applied to the luminescent element. In order to illustrate my invention, I have shown three modifications of the dimming means at 26, 26′ and 26^2, and it should be understood that it is not essential to employ a different modification of the dimming means in the different circuits but any of the modifications shown may be used in all of the circuits 25. As shown at 26, the means which I prefer to employ in accomplishing my purpose comprises, a transformer 28, the primary winding 33 of which is connected by means of conductors 37 and 39 with a means 35 for varying the electrical characteristics of the primary circuit of the transformer 28. The secondary 27 of this transformer is connected in the circuit 25. In the embodiment illustrated at 26, the means 35 comprises a variable resistance and a condenser 41 is shunted across the opposite ends of the said resistance. Obviously other means may be employed to alter the characteristics of the arc circuit 25 and to apply a variable reactive load therein, and it is within the contemplation of my invention, however, to employ any other suitable or convenient means for varying the electrical characteristics of the primary circuit of the transformer 28. I more especially contemplate the use of a variable inductance, commonly called a variometer or vario-coupler in place of the variable resistance 35, said variometer to be employed either with or without the condenser 41.

It is thought that the secondary winding 27 of the transformer 28 acts as a reactance in series with the luminescent element 10 for the reason that the core of the transformer becomes highly saturated and induces a current in the primary in which the power faction approaches zero. By varying the resistance in series in the primary of the transformer 28, the current permitted to flow in the primary may be regulated and a determinate amount of reactive energy removed from the circuit 25 without affecting the voltage applied to the tube. If the resistance in the primary circuit of the transformers is increased to a maximum, less current will be permitted to flow in the primary circuit of the transformer 28 and consequently less reactive power will be withdrawn from the tube circuit and the tube will operate at maximum intensity. On the contrary, if the resistance is reduced to a minimum as by short-circuiting the primary of the transformer, a maximum amount of reactive power will be absorbed by the transformer and its secondary circuit and the tube will operate at minimum intensity, i. e. will be dimmed. It is also possible to employ the resistance without the condenser 41 in shunt therewith. I also contemplate the possibility of using other combinations of variable resistance or reactance, inductance and/or capacitance for the purpose of varying the electrical characteristics of the second circuit of the transformer 28.

At 26′ I have shown a modified arrangement of the reactive dimmer means in which the primary winding 33′ of the transformer is connected, by means of the conductors 39′, in series with one winding of the vario-coupler 41′, the other winding of which is connected, by means of the conductors 37′, in series with a resistor 35′. Under some conditions, it may be desirable to shunt a condenser across the primary winding 33′ of the transformer 28′, the secondary 27′ winding of which is connected in series with the illuminating elements to be controlled. By altering the inductive relationship of the coils of the vario-coupler, as by relatively twisting them, the reactive characteristics of the dimmer device 26′ are altered so that a variable reactive load is provided for controlling the power supplied to the illuminating elements.

At 26^2 I have shown still another mode of practicing my invention. In this embodiment, the primary and secondary windings of the transformer 28^2 are relatively shiftable so that this element itself forms a vario-coupler, the secondary winding 27^2 of which is connected in series with the illuminating elements, while the primary 33^2 is connected in series with a resistor 35^2 by means of the conductors 37^2 and 39^2. A condenser 41^2 also is shown in shunt relationship with the resistor 35^2 between the conductors 37^2 and 39^2 but it may be desirable, under certain conditions, to omit this condenser 41^2. By altering the inductive relationship of the coils 27^2 and 33^2, as by relatively shifting them, the reactive load on the circuit 25 provided by the dimmer device 26^2 may be varied in order to control the intensity of discharge illumination created in the elements 10.

I have thus provided for the dimming of luminescent elements of the discharge type without reducing the operating voltage and without causing sputtering in the tube and I am able to produce any desired intensity by varying the electrical characteristics of the transformer 27, which in effect, creates a variable reactive load in series with the tube being regulated. This invention has particular application in the creation of shifting color effects and by employing, together, controlled luminescent elements or tubes producing light of different colors, and by varying the intensity of the different colored lights produced from adjacent discharge elements, I am able to effect a practical color organ capable of producing an infinite variety of intermediate colors which will have particular value in theatrical and similar lighting.

It is thought that the invention and numerous of its attendant advantages will be fully understood from the foregoing description and it will be understood that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the

spirit or scope of my invention or sacrificing any of its attendant advantages.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is as follows:

1. An electric system comprising a series circuit including a discharge illuminating element and one winding of a transformer, means to connect said series circuit to a source of electrical energy, the other winding of said transformer forming a portion of a variable circuit including means to alter the electrical characteristics of the circuit whereby to constitute the transformer as a variable reactive load capable of absorbing some of the power applied in said series circuit without changing the voltage applied to the discharge illuminating element.

2. An electric system comprising a series circuit including a discharge illuminating element and one winding of a transformer, means to connect said series circuit to a source of electrical power and a variable reactance connected in series with the other windings of the transformer.

3. An electric system comprising a series circuit including a discharge illuminating element and one winding of a transformer, means to connect said series circuit to a source of electrical power and a variable means connected to the other winding of said transformer for the purpose of changing the reactive load created by the transformer in said series circuit.

4. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit and reactive means in the regulator circuit.

5. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit and reactive means in the regulator circuit, and means to vary the reactive characteristics of the regulator circuit.

6. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit and capacity reactance in the regulator circuit.

7. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit and a condenser in the regulator circuit.

8. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit and a condenser in the regulator circuit and means to change the electrical characteristics of the regulator circuit.

9. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit, said regulator circuit comprising a condenser and resistance in shunt connection.

10. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit, said regulator circuit comprising a condenser and resistance in shunt connection, and means to vary the resistance in shunt with the condenser.

11. The method of controlling the intensity of illumination produced by an electrical discharge, which consists in inductively coupling a circuit, including a variable resistance and a shunted condenser, with the power supply circuit from which the discharge is energized in the inductively coupled circuit.

12. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit and a variometer in the regulator circuit.

13. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit and a rheostat in the regulator circuit.

14. An electric system comprising a discharge element, a power supply circuit for said element, and a regulator circuit inductively coupled with the supply circuit, said regulator circuit including a variable resistance.

15. In an electric system, a series circuit including a discharge element, and one winding of a transformer, means to energize said series circuit, and a regulator circuit, for said series circuit, comprising, in series, another winding of said transformer and means to produce a variable inductive load in the series circuit for the purpose of controlling the intensity of illumination produced by the discharge element.

16. An electric system comprising a discharge element, a power supply circuit for said element and a regulator circuit inductively coupled with the supply circuit, said regulator circuit including reactive means and a variable resistance.

17. An electric system comprising a discharge element, a power supply circuit for said element, a regulator circuit inductively coupled with the supply circuit and means to vary the reactance of the regulator circuit.

18. An electric system comprising a discharge element, a power circuit for said element, reactive means inductively associated with the power supply circuit and means to vary the reactive characteristics of the reactive means whereby to control the intensity of illumination produced by the discharge element.

19. An electric system comprising a plurality of controllable illuminating banks comprising discharge means, said banks being connected for parallel operation from a common power source and each bank including a discharge element, a power circuit for said element, reactive means inductively associated with the power supply circuit and means to vary the reactive characteristics of the reactive means whereby to control the intensity of illumination produced by the discharge means of the bank independently of the other banks.

20. The method of controlling the intensity of illumination produced by an electrical discharge, which consists in inductively coupling a circuit, including a variable reactance, with the power supply circuit from which the discharge is energized in the inductively coupled circuit.

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