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ILLUMINATING APPARATUS OF THE GASEOUS GLOW TUBE TYPE

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FIG. 1

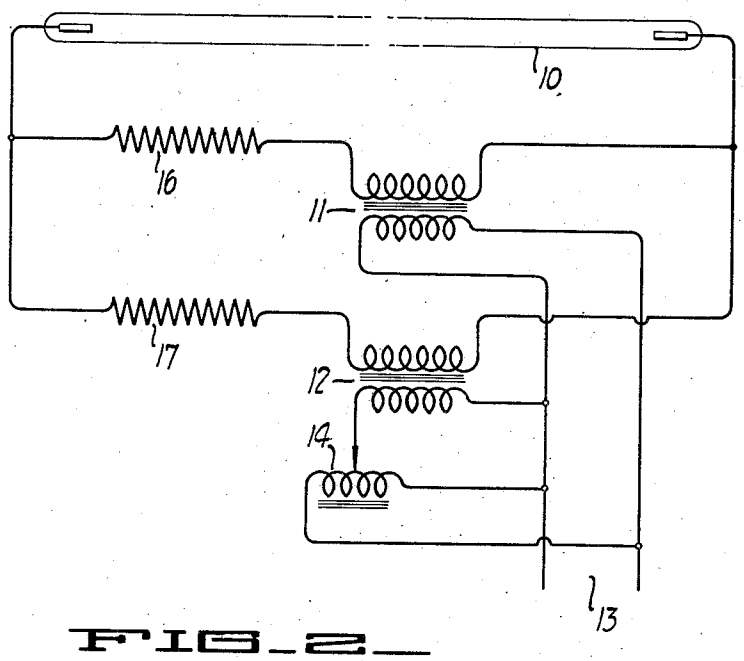
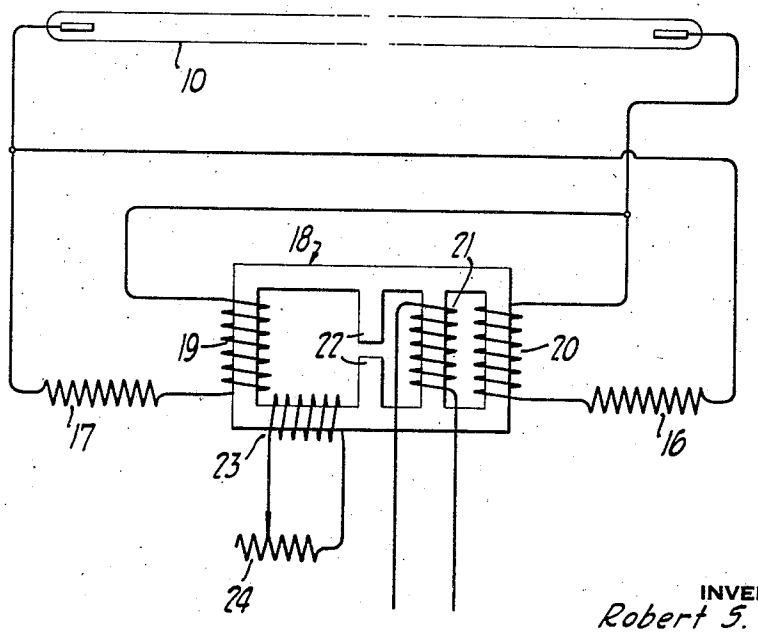


FIG. 2



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ILLUMINATING APPARATUS OF THE GASEOUS GLOW TUBE TYPE

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4 Claims. (Cl. 176—124)

This invention relates generally to electrical illuminating apparatus making use of one or more gaseous glow discharge tubes. Such tubes are commonly used for display signs and contain gases such as neon, helium, argon, or mercury vapor.

It is an object of the invention to provide apparatus of the above character which will make possible a wide adjustment in the degree of illumination afforded by a tube. For example, by the use of my apparatus the degree of illumination afforded by a single tube can be varied from a maximum value to a value such that the illumination is practically imperceptible.

Another object of the invention is to provide apparatus particularly adapted for gaseous discharge tubes such as are used in the electric sign industry, whereby the intensity of illumination can be adjusted to desired values, or may be varied intermittently or periodically to secure certain desired effects.

Further objects and features of the invention will appear from the following description in which certain embodiments of the invention have been set forth in detail in conjunuction with the accompanying drawing.

Referring to the drawing:

Figure 1 is a circuit diagram illustrating one embodiment of the invention; and

Figure 2 is a circuit diagram illustrating a second embodiment in which a single transformer is employed.

Referring first to Figure 1 of the drawing, I have shown a gaseous glow discharge tube 10 which may be of conventional construction. As is well known, such tubes have a definite break-down potential, and it is customary to operate them by connecting the terminals to the secondary of an alternating current transformer, so that a potential is applied to the tube terminals substantially in excess of the break-down potential. If an effort is made to vary the intensity of illumination produced by the tube, simply by varying the voltage supplied from the secondary of the transformer, the range of variation is quite limited, because when the potential applied to the terminals of the tube falls below a certain critical value, the tube starts to flicker, or ceases to function entirely.

In carrying out the present invention, I apply potentials to the terminals of the tube 10 from two different sources, which in this instance are represented by the secondaries of the two transformers 11 and 12. Transformer 11 has its primary directly connected to the current supply lines 13. The primary of transformer 12 is connected to the same current supply lines, but in conjunction with the variable reactor 14. By means of this reactor, the potential applied to transformer 12 can be adjusted, thereby adjusting the potential across the terminals of the transformer secondary over a relatively wide range.

The secondary of transformer 11 is shown connected directly across the terminals of tube 10, in series with the resistor 16. The secondary of transformer 12 is also connected across the terminals of tube 10 in series with another resistor 17.

Transformer 11 is such that the potential across its secondary is relatively high compared to the break-down potential of tube 10. For example, with a tube having a break-down potential of the order of 2500 volts, the secondary of transformer 11 can supply a potential of the order of 5 000 volts. Resistor 16 has a relatively high value of resistance, as for example of the order of 50 to 100 megohms. Irrespective of the particular resistor values employed, the circuit formed by the secondary of transformer 11 and whatever additional resistance or impedance is employed, should be such that the circuit cannot supply of itself sufficient current to the tube 10 to produce a substantial amount of illumination of the tube. However, the potential applied by this circuit is such that the gas within the tube is continuously maintained in ionized condition.

The transformer 12 (or the circuit in which the secondary is included) serves to supply illuminating current to the tube 10. For the values stated above by way of example, the power transformer 12 can have a maximum secondary potential of the order of 1,200 volts, and the resistor 17 can be of the order of 100,000 ohms. Resistor 17 serves the purpose of preventing the circuit which includes the secondary of transformer 12, from absorbing or short circuiting the ionizing potential supplied by transformer 11.

Operation of the apparatus described above is as follows: Assuming that the transformers 11 and 12 are being supplied with current from the lines 13, potential supplied by transformer 11 maintains the gas within tube 10 continuously ionized. However, the current from this source is insufficient to illuminate the tube to a substantial degree. Current supplied from transformer 12 does, however, illuminate the tube, and the degree of illumination can be varied by ad-

justing the setting of the variable reactance 14. Assuming that this reactance enables variation of the secondary potential of transformer 12 between virtually zero and maximum, the illumination of the tube 10 can also be varied between a minimum value at which illumination is virtually imperceptible, and maximum illumination.

It will be evident that the apparatus described above is capable of certain modifications. For example, instead of providing the resistor 16, one can rely upon a small capacitance to complete the high potential ionizing circuit. In fact, in actual practice it has been found possible to simply connect one side of the transformer secondary to one terminal of the tube 10 with the other terminal of the secondary unconnected. The circuit in this instance is actually completed by virtue of capacitance through the transformer windings and connecting circuits. One can also dispense with the resistance 17 by using a transformer having sufficient resistance in its secondary winding. The variable reactor 14 is a convenient expedient for varying the degree of illumination. However, in place of such a reactor, one can utilize other means for securing similar results, as for example a transformer with one or more tops on its primary winding.

Usefulness of my apparatus will be apparent from the foregoing. In connection with display signs making use of a plurality of gaseous discharge tubes, my invention can be applied for the purpose of adjusting the level of illumination, or if desired periodic variations in light intensity can be had by means of suitable motor driven mechanism to attract utmost attention. In place of using the more conventional types of tubes, I can employ tubes which are provided with fluorescent coatings to modify the light spectrum produced.

In the embodiment of Figure 2, I make use of a single transformer 18 provided with two secondaries 19 and 20. A single primary winding 21 is connected to the current supply lines. Winding 19 serves to supply current to the tube 10 and is shown connected in series with the resistor 17. Winding 20 provides the ionizing potential and is connected in series with resistor 16. To control the current supplied by winding 19, the transformer is made to have a substantial magnetic leakage by virtue of the core legs 22, and one side leg of the transformer between the legs 22 and the leg upon which winding 19 is applied, is provided with the supplemental winding 23. Current flow through the winding 23 is controlled by the variable resistor 24. By adjusting the setting of resistor 24, the power supplied by the secondary 19 can be adjusted between maximum and minimum limits, thus varying the degree of illumination of the tube 10 accordingly.

I claim:

1. In electrical illuminating apparatus, a gaseous glow discharge tube having two terminals, and two sources of alternating potential of like frequency connected to the two terminals of the tube, one source serving to continuously supply a potential to maintain ionization of the gas within the tube without sufficient current flow to illuminate the tube to a substantial degree, and the other serving to supply sufficient current to the tube to illuminate the same and being of insufficient potential to of itself maintain the tube illuminated.

2. In electrical illuminating apparatus, a gaseous glow discharge tube having two terminals, and two sources of alternating potential of like frequency connected to the two terminals of the tube, one source serving to continuously supply potential to maintain ionization of the gas within the tube without sufficient current flow to illuminate the tube to a substantial degree, and the other serving to supply sufficient current to illuminate the tube, the last named source being adjustable to vary the degree of illumination and being of insufficient potential to of itself maintain the tube illuminated.

3. In electrical illuminating apparatus, a gaseous glow discharge tube having two terminals, two sources of alternating potential of like frequency connected to the two terminals of the tube, one serving to continuously supply potential sufficient to maintain ionization of the gas within the tube without sufficient current flow to illuminate the tube to a substantial degree, and the other source supplying sufficient current to the tube to illuminate the same, and being of insufficient potential to of itself maintain the tube illuminated, and means for adjusting the current flow from said last named source to vary illumination of the tube over a substantial range.

4. In electrical illuminating apparatus, a gaseous flow discharge tube having a pair of terminals, transformer means for exciting said tube, said transformer means including a primary winding adapted to be supplied with alternating current and a pair of secondaries, circuits serving to connect the two terminals of the tube in parallel with both said secondaries, one secondary being capable of continuously supplying a relatively high potential capable of maintaining the gas within the tube continuously ionized and having sufficient impedance so that current flow through the tube by virtue of such circuit is insufficient to illuminate the tube to a substantial degree, the circuit connecting the other secondary to the tube being capable of supplying current to the tube to illuminate the same at a potential insufficient of itself to maintain the gas in the tube continuously ionized, and means serving to adjust the effective current supplied to the tube from said second circuit, whereby illumination of the tube can be adjusted over a substantial range, both of said secondaries being adapted to apply alternating currents to the tube of the same frequency as that employed to excite the transformer primary.

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