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AUXILIARY EQUIPMENT FOR LUMINESCENT TUBES

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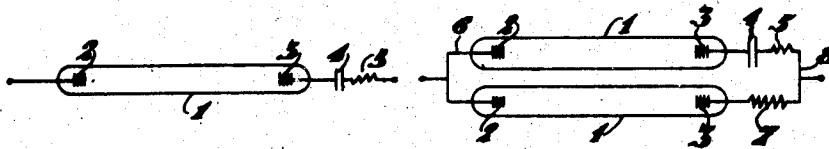


Fig. 1

Fig. 2

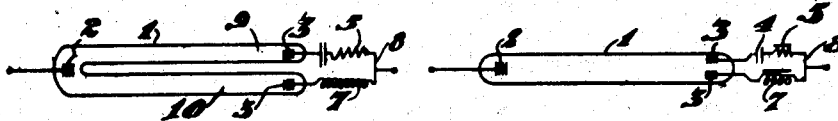


Fig. 3

Fig. 4

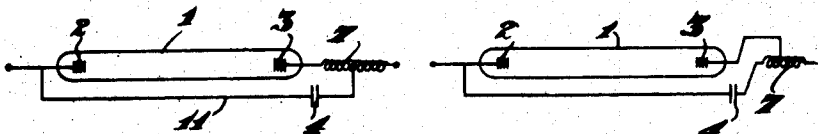


Fig. 5

Fig. 6

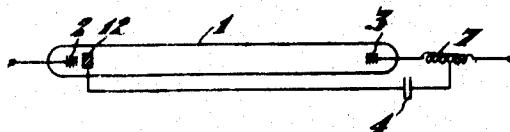


Fig. 7

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AUXILIARY EQUIPMENT FOR LUMINESCENT
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1 Claim. (Cl. 176—124)

This invention relates to luminescent tubes and lamps.

The tubes are comprised, generally, of a transparent envelope filled with gas, and a pair of electrodes. When the electrodes of such tubes are energized the gas becomes ionized accumulatively. That is, as the ionization increases the conductivity of the gas increases. The increased conductivity permits a greater current to flow and the gas is ionized still more by the greater current. This characteristic is known as a negative resistance characteristic. Choke coils have been employed for controlling this tendency, and for enabling the tubes to be operated upon alternating current.

When a choke is used the power factor of the tube is decreased to an undesirable extent. The use of a capacity instead of a choke improves the power factor, but the use of the capacity has a bad effect upon the electrodes. Under the sudden discharge from the capacity, the electrodes may be disintegrated quite rapidly and the tube may fail within a relatively short period of time after it has been put into operation.

The object of the present inventor has been to provide luminescent discharge tubes or lamps which do not exhibit these undesirable characteristics, that is, to provide tubes or lamps which exhibit high power factor characteristics without impairment of the electrodes during the periods in which they are operated.

Briefly, the present invention contemplates the coupling of a resistance or a choke with a capacity connected in series with the tube to provide high power factor without electrode impairment. By the conjoint use of a choke and a relatively low resistance, in conjunction with a capacity, the voltage at the poles of the capacity may be increased so that the size of the capacity can be relatively small, and the weight relatively light.

The next feature of the invention is predicated upon the concept of operating a plurality of the tubes simultaneously, with the plurality of tubes being divided into groups. The tubes of one group are equipped with a capacity and a resistance, and the tubes of the other groups are equipped with a choke, so that by operating both groups of tubes in unison a power factor approximating or equal to unity is obtained. It is preferable that the number of tubes be approximately equal for best results. The tubes of such groups may be operated upon alternating current without the usual stroboscopic effect, the tube or tubes of the one group being illuminated at each

half alternance while the tube or tubes of the other group are extinct.

The foregoing principle of the invention, of ballasting, by a choke coil, the instantaneous discharge from a capacitance, permits the utilization of resonant circuits for operating the tubes. The use of such circuits has not been feasible up to the present.

Other features of the invention are disclosed in the following description, and in the accompanying drawing in which:

Figure 1 shows the use of a capacitance in series with the resistance for the operation of a luminescent discharge tube or lamp.

Figure 2 shows the circuit including a plurality of tubes operable in unison, one of the tubes being operated through a resistance and a capacitance, and the other being operated through a choke.

Figure 3 shows an arrangement which is a modification of the arrangement shown in Figure 2.

Figures 4, 5, 6 and 7 are further modifications as explained in the following description.

The tube or lamp of Figure 1 is comprised of a transparent envelope 1 which is filled with a gas capable of becoming luminescent when it is ionized. Those skilled in the art readily will understand the principle of filling the tube with gas for ionization of it, and will understand the various types and kinds of gases to be used for the purpose. These matters, therefore, need not be described here in detail.

The transparent envelope 1 is equipped with a pair of electrodes 2 and 3 arranged for the reception of energy from a suitable source. In series with one of the electrodes, 3, a capacitance 4 and a resistance 5 are connected. A resistance of several ohms is suitable in conjunction with the capacity of the general type.

In the structure shown in Figure 2 a pair of transparent envelopes 1 is employed. Each of these envelopes contains an electrode 2 at the one end and these electrodes are interconnected through the lead 6. The envelopes also contain electrodes 3—3. In series with one of these a choke 7 of low capacity is connected and in series with the other electrode 3, a capacitance 4 and a resistance 5 are connected. The choke 7, the capacitance 4 and resistance 5 are interconnected through the lead 8.

In the structure shown in Figure 2 the one tube is extinguished while the other tube is luminescent. The usual stroboscopic effect which is ob-

tained when a single tube is operated upon alternating current is not exhibited.

The tubes 1, which are shown in Figure 2, may be integrated into a single tube or envelope, as shown in Figure 3, or as shown in Figure 4. In the lamp of Figure 3, the envelope 1 consists of a pair of legs 9 and 10 having individual electrodes 3, 3 which are interconnected as in Figure 2. The lamp also contains an electrode 2 which is common to both legs.

As a further modification, the legs 9 and 10 of Figure 3 are integrated with one another, according to Figure 4, to obtain a single envelope 1 containing an electrode 2 and a pair of electrodes 3—3. One of the electrodes 3 is connected in series with capacitance 4 and resistance 5, while the other electrode 3 is connected in series with choke 7. The choke and the capacitance resistance 4, 5 are interconnected as at 8.

In these various circuit arrangements it will be understood that the resultant values of the choke and the series connected resistance, or capacitance and choke, may be coordinated so that the power factor of the tube will be equal to or will approach unity, as desired, when the tube is operated.

An auto-transformer effect is provided by choke 7 of Figure 5. One terminal of this choke is connected to electrode 3 extending within the gas filled envelope 1. A lead 11 containing condenser 4 is tapped from the choke and extends to the other electrode 2 of the tube. The tension or voltage overload due to the resonant circuit produced is not lowered by the connection of the capacity to a pole of the choke.

In Figure 6 choke 7 is connected in series with the capacitance 4 and also to one of the electrodes 2 of the tube, while the other electrode 3 is connected to a tapped pole of the choke, as shown.

The structure of Figure 7 comprises a transparent envelope 1 containing an electrode 2, an electrode 3 and a supplementary electrode 12. The electrode 3 is connected to one pole of choke 7, and, from a tapped connection on the choke,

a lead containing condenser 4 is taken to the electrode 12. The electrode 12 is adjacent the electrode 2. If both electrodes are of the emissive type an auxiliary arc is formed between these two electrodes. When energy is supplied to the electrode 12, and the auxiliary arc formed causes the electrode 2 to become emissive so that an appreciable gain in the voltage, for instance, a gain of about 60 volts for the lighting of the tube is obtained. Due to this increase in voltage, the illumination from the tube is increased. The choke 7, as previously described in connection with Figures 5 and 6, acts as an auto-transformer, and the negative characteristic of the arc between the electrodes 2 and 12 provides overload voltages at the two poles of the tube.

The illumination provided from the tube disclosed in the present invention may be modified or increased as desired by the employment of a metallic band extending along the wall of the envelope and connected to one of the electrodes.

Having described my invention, I claim:

The combination of a tube comprising a pair of legs which are in communication with one another at one end thereof, the said tube containing an ionizable gas, an electrode which is common to both legs of the tube disposed substantially at the point of communication between the legs, a second electrode disposed at an end of one of the legs which is remote from the point of communication, a third electrode likewise disposed in the other of the legs, a choke connected in series with the second of the electrodes, a condenser and a resistance connected in series with the third electrode, the said second electrode and choke and the third electrode condenser and resistance being connected to one terminal and the first mentioned electrode disposed at the point of communication between the tube being connected to another terminal, and the values of the said resistance and condenser being coordinated to prevent instantaneous discharges from the condenser which would tend to disintegrate one of the electrodes from the tube.

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