Nov. 10, 1942. J. B. J. M. ABADIE 2,301,670

LOW TENSION LAMP TUBE

Filed Jan. 22, 1940 2 Sheets-Sheet 1

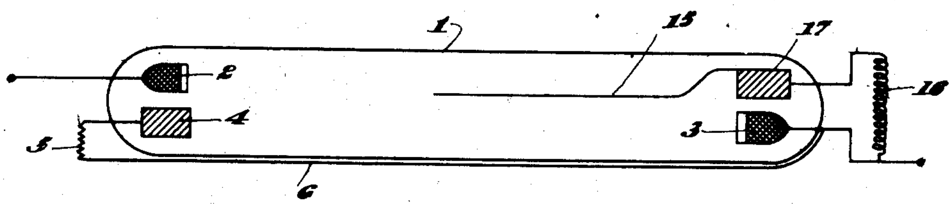

Fig. 1

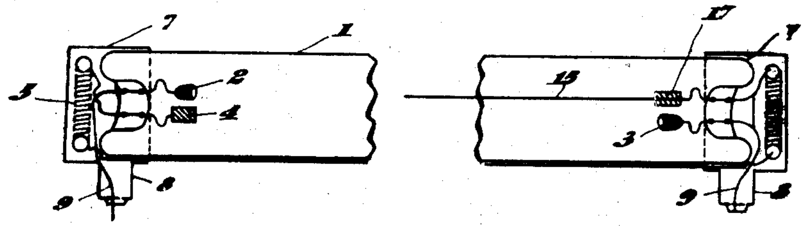

Fig. 2

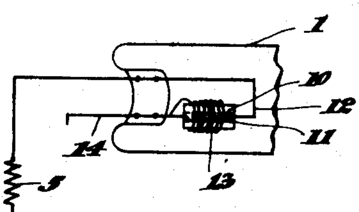

Fig. 3

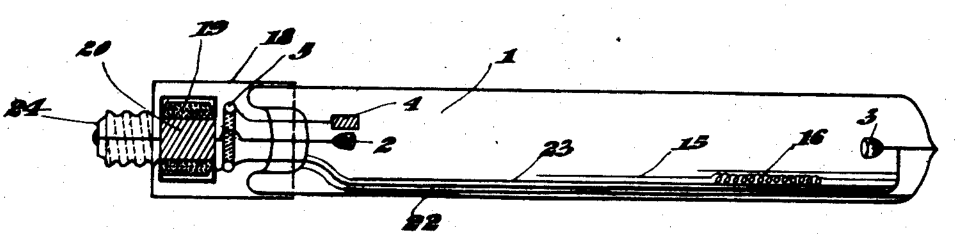

Fig. 4

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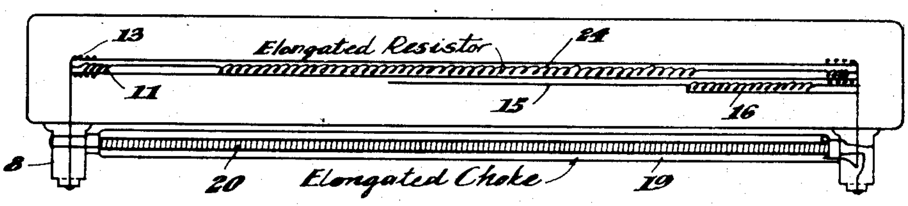

Fig. 5

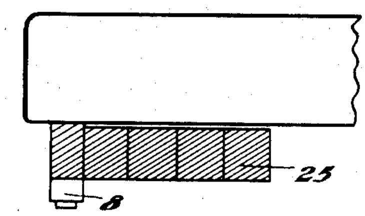

Fig. 6

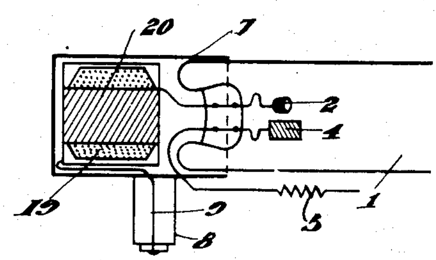

Fig. 7

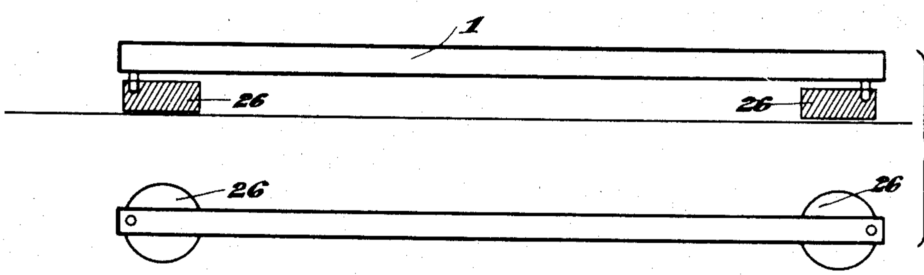

Fig. 8

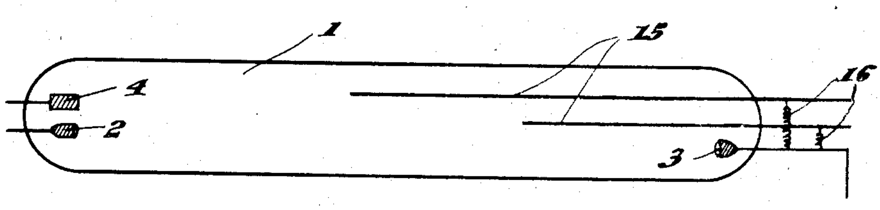

Fig. 9

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LOW TENSION LAMP TUBE

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Puteaux, France

Application January 22, 1940, Serial No. 315,013

2 Claims. (Cl. 176—124)

The present inventicn relates to luminous discharge tubes. The primary object of the inventor has been to provide luminous discharge devices which are capable of being operated upon low voltages.

At the present time, there is a variety of electrical appliances, heating circuits, resonant circuits, and circuit breakers and the like which have been proposed to provoke the lighting of low voltage luminescent lamps. However, none of these devices is capable of producing an instantaneous lighting of the luminescent lamp when it is hot. Most of the devices are cumbersome and complex, and none of the devices can be used with direct current.

The purpose of the present invention has been to provide tubes or lamps of high lighting efficiency which are capable of being illuminated and relit instantaneously, and which are capable of operating indifferently upon alternating or direct current. The lamps may contain fluorescent or phosphorescent bodies either incorporated in the walls of the lamps or provided upon the interior surfaces of them.

A further objective has been to provide lamps displaying a high ratio between the operating voltage (or what might be conveniently called the cruising voltage) and the starting or "striking" voltage (the voltage of the distribution line from which the lamps are energized).

Briefly, the present invention is predicated upon the concept of employing thermo-ionic electrodes for producing electronic discharges when they are energized, and of providing means for heating these electrodes within the tube, either directly or indirectly, to bring them to thermoionic emissive condition.

The invention further contemplates the employment of means for propagating the discharge of electrons from one end of the tube to the other.

Typical embodiments of the present invention and the modifications to which it is susceptible are shown in the drawings, in which:

Figure 1 is a diagrammatic view showing an arrangement for heating the electrodes through an auxiliary arc.

Figure 2 is a means for heating the electrodes indirectly.

Figure 3 is a fragmentary view showing another type of indirect electrode heater.

Figures 4 and 5 are further modifications.

Figure 6 is a detail view in a lamp arranged for use in conjunction with alternating current.

Figure 7 illustrates the employment of a choke coil controller, at an end of a tube.

Figure 8 shows an arrangement for using choke coils in elongated tubes.

Figure 9 is a further modification showing means for effecting the propagation of ionization of the gas within the tube, as illustrated in Figures 1, 2, 4 and 5.

In the drawings, the tube of Figure 1 is comprised of a transparent envelope 1 of glass or the like, sealed at both ends and containing electrodes 2 and 3. A non-emissive electrode or anode 4 is installed within the tube adjacent the electrode 2. This anode, or auxiliary electrode, preferably is comprised of carbon so as to cut the half alternations of the current and exert a "straightening" effect upon the alternating current, and, therefore, reduce to a minimum the loss at the same time bringing the cathode electrode to emissive state. The auxiliary electrode 4 is connected through a resistance 5, to a band or metallic conductor 6 extending along the length of the tube, preferably adjacent the wall. The conductor 6 is connected to the electrode 3. As a practical matter, the resistance 5 may be set within the metallic cap of the tube, as shown in Figure 2, or the resistance may be wrapped around the glass tube in the base of the electrode support which is employed during the pumping of the tube.

In Figure 2 the cap, illustrated at 7, surrounds the base of the tube and it contains the resistance 5, as shown. It also contains the nipple 8, through which a lead 9 to the electrode 2 is taken.

The electrodes 2 and 3 may be constituted by an emissive spiral, that is, for instance, a spiral of tungsten or molybdenum containing an emissive coating. It is preferable, however, that the electrode be constituted in the form of a small cup of nickel or molybdenum filled with a quantity of emissive material. For instance, a suitable electrode may be made by forming a cup from a sheet of molybdenum of approximately one one-hundredth to one-tenth millimeter in thickness. The emissive filler for the cup may be comprised of approximately seventy-five per cent barium salts and twenty-five per cent calcium salts.

When energy is applied to the terminals of the electrodes 2 and 3, the anode, or auxiliary electrode 4, is also energized through the resistance 5, so that an auxiliary arc is established intermediate the electrode 2 and the electrode 4. The electrode 2 is brought to emissive condition by the heat of the arc.

However, in place of the heating of the electrode in this manner, the electrode may be heated by means of a suitable heating element installed relative to the electrode, to elevate its temperature when the element is energized. A typical element for performing this service is shown in Figure 3. A tube or element of refractory material 10 is installed within the lamp. The heating element 11, which is operated through leads 12 and 13, is installed within the element, and around it an emissive wire 13, or spiral type electrode, is wrapped. This electrode 13 performs the same function as the electrodes 2 and 3 of Figure 1. One of the leads 12 is connected to the resistance 5, as shown in Figure 1. The electrode is connected to one of the leads 14 leading to the heating element 11 and to the other lead 12, which is connected to a resistance 5, as shown in Figure 1. When the heating element is energized, the temperature of the refractory material is elevated and the electrode 13 is brought to emissive condition.

In place of the use of the refractory base 10 and the heating element, a resistance and conducting refractory material, constituted of an agglomerate of powder formed of carbon and tungsten, molybdenum, nickel, chromium, or the like may be employed as a carbon pile heater.

The next feature of the invention involves the employment of a lead wire 15 extending from a point adjacent one of the electrodes to the other, for the reception of ions. This wire serves as an antenna, or ionic "fishing rod." The antenna 15, as shown in Figure 1, is a highly resistant conductor. It is connected to the electrode 3 through a highly resistant element 16, or, a resistance of about 1,000 ohms. The element 15 may be comprised of filament of molybdenum, carbon, or the like.

When the electrode 2 has been brought to an emissive condition by virtue of the action of the auxiliary arc, provoked from electrode 4, current flows from the electrode 2 to the antenna 15 and this, in turn, conveys the current through the resistance 16 to the electrode 3. This electrode, now being heated by the bombardment with negative ions, is set in emission.

Figure 1 also discloses the use of an electrode element 17 in connection with the antenna 15. This electrode is of carbon and it is used primarily during the pumping of the tube, the electrode 4 being directly connected to it through a wire exterior of the tube. This carbon electrode permits the electrodes 2 and 3 to be purified very rapidly.

For operating a tube such as that disclosed, only a choke or capacity element is required. A tube constructed according to that shown in Figure 1 is capable of being operated upon a current intensity of 0.03 ampere for bringing the electrode to emissive condition. If it be presumed that the arc will be stabilized at a voltage of 60 volts or less as soon as it is lighted, the arc will operate at 60 volts or less. Under these circumstances, the loss in the resistance 4 approximates 75 watts, if the value of the resistance be approximately 800 ohms. The loss in the propagation of energy through the antenna 15 may be approximately 25 watts.

If desired, the tubes may contain fluorescent or phosphorescent materials, and the gas used for filling them may be comprised of mercury vapor with rare gases or admixtures with a conductability approximating that of the tube when the mercury has been volatilized—for instance, mixtures or argon and xenon, or of argon and krypton.

Figure 4 illustrates a tube of rectilinear form containing a typical socket cap 18 adapted to be inserted into an electrified receptacle of conventional form. An electrode 3 is placed at one end of the tube, and electrode 2 at the end adjacent the cap. A choke 19 is placed within the cap. This choke is comprised of an armature 20 surrounded by metal sheeting. In place of the choke a capacity may be used. For instance, it is preferable to use a choke in tubes designed for operation to 115 volts, and a capacity containing a small, or ballast, choke for tubes intended for operation upon 220 volts. The ballast choke is used in controlling the instantaneous discharges from it. In place of the choke, or capacity, an incandescent lamp may be employed.

In the lamp of Figure 4, the auxiliary electrode 4 is positioned adjacent the electrode 2. The auxiliary electrode is in connection through a lead 21 to one terminal of the resistance 5, as shown in Figure 2, and the other terminal of the resistance is in connection with the electrode 3 through lead wire 22. The lead wire 22 is imbedded in the wall of the tube, or is housed within a suitable insulator housing 23 carried by the tube. The electrode 2 is connected through the armature of the choke to a cap 24, one terminal of the choke being connected to one end, and the other terminal of the choke being connected to a terminal of the resistance 5.

The high resistance 16 in the antenna 15 of the tube of Figure 4 is installed adjacent the wall of the tube; for instance, it is superimposed within an insulation housing over lead wire 22.

In Figure 5, 24 shows the resistance placed outside the tube and connected to the opposite electrode.

In Figure 6 the tube is fitted with two flat capacities 25, each connected to a nipple and a principal electrode.

Figure 8 illustrates the use of boxes 26 for containing the capacities or chokes.

Having described my invention, I claim:

1. A gaseous discharge tube comprised of a pair of thermo electrodes in spaced relationship, an electrically conductive antenna extending from a point adjacent one of the electrodes toward the other, an impedance having a terminal connected in series with the antenna and having another terminal connected with the said electrode, and a non-emissive electrode adjacent the other electrode of the pair for heating the said adjacent thermo emissive electrode to emissive condition, said non-emissive electrode being connected to the emissive electrode from which it is remote through a resistance, the said non-emissive electrode being constructed of carbon to exert a straightening effect upon alternating current applied to the electrodes.

2. A luminescent gaseous discharge tube comprising a pair of thermo emissive electrodes which reside in spaced relationship to one another, a starting electrode adjacent one of the electrodes, a non-emissive anode adjacent the other of the electrodes, the non-emissive anode being connected to the remote electrode of the pair through a resistance, and the starting electrode being connected to the electrode to which it is adjacent through a choke, with an antenna extending from the starting electrode toward the electrode from which it is remote for collection of electrons discharged therefrom, the said non-emissive anode being a carbon body whereby it is capable of cutting the half alternations of current applied across the electrodes to exert a straightening effect upon the alternating current applied thereto.

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