106/84

106. COMPOSITIONS, COATING OR PLASTIC

84 - M

CROSS REFERENCE EXAMINER

March 24, 1931. J. E. GROSS 1,797,683

LUMINOUS TUBE.

Filed June 28, 1929

Fig. 1.

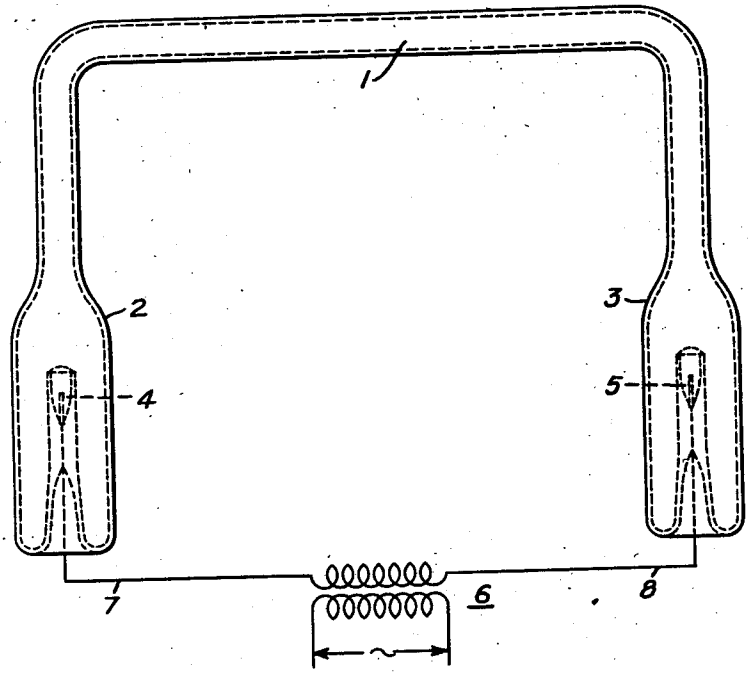
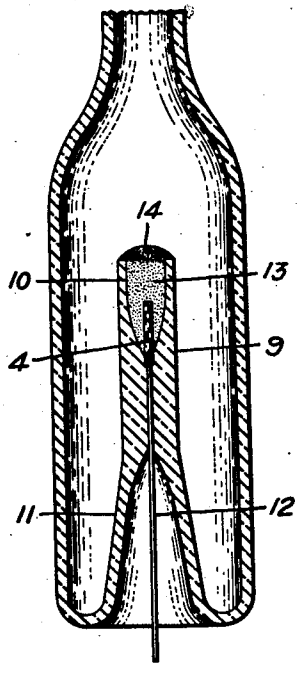


Fig. 2.



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JOSEPH E. GROSS, OF SWISSVALE, PENNSYLVANIA

LUMINOUS TUBE

Application filed June 28, 1929. Serial No. 374,362.

My invention relates to electrically operated gas filled luminous tubes and more particularly to the electrodes used in such tubes.

It is the object of my invention, in general, to provide a luminous tube with electrodes that shall be simple and efficient in operation and capable of being readily and economically manufactured, installed and operated.

A more specific object of my invention is to provide a luminous tube with electrodes that will operate effectively with a minimum amount of sputtering.

Another object of my invention is to provide a gas filled luminous tube that will operate with a low energy loss at the electrode, thereby resulting in cool running electrodes and thus causing the tube to have a long life.

A further object of my invention is to provide a gas filled luminous tube with electrodes that may be constructed without the necessity of sintering them prior to placing them in the tube.

It is also an object of my invention to provide a gas filled luminous tube with electrodes that do not have to be cured in the usual manner and which are easily commercially outgassed.

Other objects of my invention will, in part, be obvious and will, in part, appear hereinafter.

For a better understanding of my invention, reference may be had to the accompanying drawing illustrating one of the various forms my invention may take, in which—

Figure 1 is a view, in side elevation, of a luminous tube provided with electrodes constructed in accordance with my invention;

Fig. 2 is an enlarged view, in section of one of the electrodes embodied in the tube illustrated in Fig. 1.

In the drawing, I have illustrated a luminous tube as comprising an elongated sealed glass envelope 1 that is adapted to be exhausted of air and gases to a predetermined value and then filled with a monatomic gas, such as neon, argon or helium.

The glass envelope 1 is shown as having enlarged end portions 2 and 3 in which are disposed, respectively, electrodes 4 and 5 that may be connected to a suitable source of power such as the secondary circuit of a transformer 6 by a pair of lead-in wires 7 and 8.

Inasmuch as each of the electrodes 4 and 5 is constructed in the same manner, a detailed description of only one of them will be given.

The electrode 4 is disposed on a supporting member 9 of a suitable insulating material such as glass. The upper part of the supporting member 9 is provided with a cup shaped portion 10 for holding the electrode in position and its lower part is mounted on and fused to a glass press 11 that constitutes a part of the glass envelope 1. Connected to the electrode is a conductor 12 that passes downwardly through the stem of the supporting member 9 and serves to connect the electrode to its lead-in wire in the press 11.

In constructing the electrode, I take a suitable portion of barium nitrate, strontium nitrate or titanium nitrate, preferably titanium nitrate and add thereto a sufficiently conducting material such as a metal whose oxide is conducting or a conducting oxide, or a finely divided carbon, preferably graphite, (say from 5% to 50% by weight) to cause the mixture to be semi-conducting. This material is then placed in a mortar and worked until it is a thoroughly mixed powder.

The resulting mixture is now placed in the cup 10 to form the body 13 of the electrode.

I next take a suitable portion of a water soluble silicate, such as potassium silicate or sodium silicate, preferably sodium silicate, and dilute it with water to somewhere under 10% and then place a drop of the resulting solution upon the top of the mixture 13 to form a cover or top dressing 14 therefor. The drop 14 of the solution of silicate may be mixed into the top portion of the powder 13 by a wire or other suitable implement and in some cases it may be necessary to add another drop of the solution to the powder to insure a complete covering. When the solution of silicate 14 is placed on the powder 13, a chemical action takes place that causes the top dressing to form a highly insoluble and cementive silicate that retains the powder and the silicate in position on the supporting member 9. The electrode is now ready to be inserted in the glass envelope 1.

The electrodes 4 and 5 are now assembled in the lamp tube, the lamp is connected to the pumps (not shown) in the usual manner to be evacuated and the lead-in wires are connected to the transformer 6. When the lamp is connected to the transformer it is supplied with a low voltage of from 5000 to 9000 volts.

After sufficient gas is withdrawn from the tube by the pumps so that the pressure is in the neighborhood of one millimeter of mercury, a discharge takes place between the electrodes 4 and 5. This discharge heats both the glass tube 1 and the electrodes 4 and 5, thereby causing gasses to be evolved at the electrodes and also removed from the inner surface of the tube. As the evacuation proceeds, the electrodes become hotter and, finally, when the gasses are practically removed from them, they become red hot.

At this stage of the operation, practically all of the injurious gasses have been removed from the electrodes, a certain amount of sintering has also taken place in the electrodes, and the pressure has dropped to a value of less than one tenth of a millimeter of mercury, probably in the nature of one hundreth of a millimeter. When the tube reaches the condition just described, it is disconnected from its source of electrical energy and allowed to cool, but it is left on the pump while cooling for the purpose of removing the last traces of gas. After the gas is completely removed, a supply of a monatomic gas, such as neon is allowed to flow into the tube to a pressure of from two to three millimeters and the lamp is again connected to its source of electrical energy indicated by the transformer 6. Sufficient current is now caused to flow from the transformer to cause the electrodes 4 and 5 and the tube 1 to become quite hot.

After the lamp has become quite hot, the neon gas in the tube is completely evacuated and the lamp is allowed to cool slightly. As soon as the lamp becomes slightly cooled, a supply of fresh neon gas is allowed to flow into the tube to a pressure of from 6 to 8 millimeters and the tube is then sealed off the pump. Following this, the tube is placed on an ageing rack in the usual manner and allowed to age until all the harmful gasses are removed in the arc and the lamp is ready for use.

With a lamp constructed in this manner, it will be found that the discharge from the electrodes is centered at a comparatively small area, and that this area becomes so hot that practically all the electrical discharge takes place from that one spot, its action being comparable to that of an arc, thereby avoiding practically any discharge of the glow type and providing a tube that will form little or no film on its interior surface.

It will therefore be seen that I have provided a tube with electrodes that are easily constructed and placed in operation without encountering many of the difficulties that have heretofore occurred in manufacturing luminous tubes.

While I have illustrated and described only one specific embodiment of my invention, I realize that it is susceptible of wide application, and I do not desire to be limited to the precise construction illustrated and described.

I claim as my invention:

1. An electrode for luminous tubes comprising a body of a semi-conducting material covered with only a water soluble silicate.

2. An electrode for luminous tubes comprising a body of a semi-conducting material covered with only a sodium silicate.

3. An electrode for luminous tubes comprising a mixture of a metallic nitrate, a conducting material and a water soluble silicate.

4. An electrode for luminous tubes comprising a mixture of a metallic nitrate, a conducting material and sodium silicate.

5. An electrode for luminous tubes comprising a mixture of titanium nitrate, finely divided carbon and sodium silicate.

6. An electrode for luminous tubes comprising a mixture of a metallic nitrate and a conducting material covered with a water soluble silicate.

7. An electrode for luminous tubes comprising a mixture of a metallic nitrate and a conducting material covered with sodium silicate.

8. An electrode for luminous tubes comprising a mixture of titanium nitrate and graphite covered with sodium silicate.

9. An electrode for luminous tubes comprising a metallic nitrate, a conducting material and potassium silicate.

10. The method of making an electrode for a luminous tube comprising mixing a metallic nitrate powder with a conducting powder, placing the mixture on a supporting member, covering the mixture with a water soluble silicate, placing the supporting member with the material thereon in a tube, and treating the tube with electrical energy until the material on the supporting member becomes a solid mass.

In testimony whereof, I have hereunto subscribed my name this 25th day of June, 1929.

JOSEPH E. GROSS.