Aug. 16, 1932. D. D. KNOWLES 1,872,302

GLOW DISCHARGE DEVICE

Filed Aug. 8, 1930

Fig. 1.

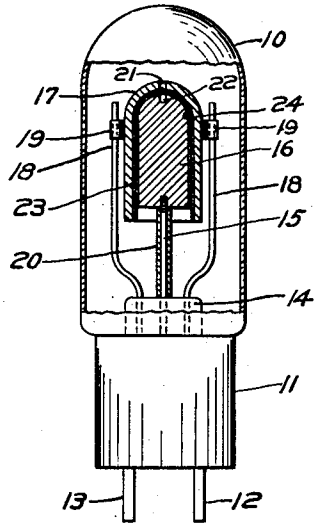


Fig. 2.

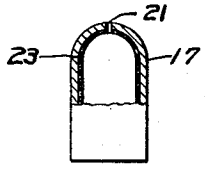
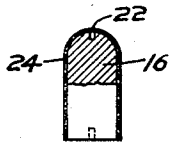


Fig. 3.



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UNITED STATES PATENT OFFICE

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GLOW DISCHARGE DEVICE

Application filed August 8, 1930. Serial No. 473,846.

This invention relates to glow discharge devices and especially to television tubes providing a point source of light.

An object of the invention is to provide an economical and easily assembled point source of light.

Another object of the invention is to provide a tube structure having very closely spaced electrodes insulated from one another by an insulating layer on the surface of one or each of said electrodes.

More specifically, it is an object of the invention to provide interfitting electrodes which are insulated from each other by an integral insulating compound on their adjacent surfaces.

In order to provide an intense point-source of light, such as that used for television-receiving tubes, it is necessary to have the two main electrodes adjacent to each other. There has been considerable difficulty in securing a sufficiently accurately designed insulator for spacing the electrodes.

According to my invention, I dispense with a separate third element and form the insulation on one or both of the adjacent surfaces of the electrode. As I also prefer to have my electrodes fit within each other, my invention has the further advantage of not only having closely spaced electrodes but also the advantage of being very easily and economically assembled in the tube.

Other objects of my invention will become evident from the following detailed description, taken in conjunction with the accompanying drawing in which:

Figure 1 is a front elevation with parts in cross section, of a tube embodying the invention,

Fig. 2 is a view, partly in elevation and partly in section, of a preferred form of outer electrode,

Fig. 3 is a view, partly in elevation and partly in section, of a preferred form of inner electrode.

The apparatus disclosed in Fig. 1 comprises the usual glass tube 10, supported on a base 11, and having the usual contact points 12 and 13 projecting therefrom. The glass seal 14 has two or more connections extending therethrough from the two or more contact points in the base.

It is preferred to have a central connection 15 extend upward to the electrode 16. It is also preferred to have the connection 15 act as a support for the electrode 16 and to be connected thereto by a screw connection, as disclosed in the drawing. Over the top of the electrode 16 is placed another electrode 17 having its inner surface conforming to the outer surface of the inner electrode.

Connections 18 preferably extended from one of the contact points through the press 14 and adjacent the outer surface of the electrode 17. A firm contact is made by having a band or wire 19 surround the electrode 17 at any convenient horizontal plane and having the connections 18 connected thereto on opposite sides of the electrode, as disclosed in the drawing. It is also preferred to have a glass sleeve 20 about the central connection 15 to insulate it from the adjacent connections 18. This sleeve may also aid in supporting the central electrode 16.

The preferred form of these interfitting electrodes is disclosed in Figs. 2 and 3. The female member 17, as disclosed in Fig. 2, is preferably of a hollow cylindrical shape with a rounded closed end, except for a perforation 21. The male member 16 is also of the same shape as the interior of the electrode 17 and has a hole or slot 22 in its curved end corresponding to the perforation 21 in the electrode 17.

These electrodes are preferably first formed in the shape disclosed but without the perforations 21 and 22. The preferred material of these electrodes is aluminum, although other material, such as magnesium may be utilized. The outer surface of the electrode 16 and the inner surface of the electrode 17 are so shaped that they fit the one within the other, with preferably about a .001″ clearance.

Before these electrodes are assembled together, an insulating or film layer 23 is formed on the inner surface of the electrode 17 or, an insulating layer or film 24 is formed on the outer surface of the electrode 16 and, preferably, on both of these surfaces. This

insulating layer is preferably formed by heavily oxidizing the surface of the aluminum. If desired, a nitride or hydride compound of the material may be formed instead of the oxide. This insulating layer is preferably a thin film integral with the electrode. The perforations 21 and 22 can be made in one operation by drilling through the assembled electrodes to the desired depth to pierce the insulating layers or films on both electrodes.

The interior of the tube 10 in Fig. 1 is filled with a noble gas, such as neon or argon, or a mixture of these gases or with mercury vapor at a low gas pressure of one to fifteen millimeters of mercury. The insulating film on the adjacent surfaces of these electrodes forms a good insulator at this low gas pressure and also very closely and accurately spaces the two insulators.

A sufficient difference of potential or phase relation applied between the two electrodes 16 and 17 will start the discharge from the one to the other. It is preferred to have the female member 17 act as an anode and the male member 16 act as the cathode. The discharge will, accordingly, take place between the anode member 17 where the perforation 21 pierces the insulation and the cathode 16 where the hole 22 pierces the insulating surface layer. A cathode glow is accordingly created in the hole 22 and projects an intense light upward through the perforation 21. This intense light acts, accordingly, as a point source of light through the hole 22 and the perforation 21.

The invention of course is not limited to the specific shape or materials disclosed in connection with the preferred form. It is obvious that other shapes may be adopted and, in fact, the electrodes may merely have surfaces contacting at a very small area upon which the insulating layer or film is formed.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. A tube comprising two electrode members, one of said electrodes being a female member and the other being a male member and an integral layer of insulation on the surface of one of said members adjacent to the other member.

2. A tube comprising two electrode members, one of said electrodes being a female member and the other being a male member, and an integral layer of insulation on the surface of said female member adjacent to said male member.

3. A tube comprising two electrode members, one of said electrodes being a female member and the other being a male member and an integral layer of insulation on the surface of said male member adjacent to said female member.

4. A tube comprising two electrode members, one of said electrodes being a female member and the other being a male member and an integral layer of insulation on the surface of each of said members adjacent to the other member.

5. An electrode element having an integral insulation layer formed on one of its surfaces, said insulation layer having an opening therethrough.

6. An electrode element having an integral insulation layer formed on one of its surfaces, said layer being an oxide of the substance forming said element and having a discharge opening therethrough.

In testimony whereof, I have hereunto subscribed my name this 30th day of July, 1930.

DEWEY D. KNOWLES.