April 5, 1932. H. E. METCALF 1,852,020

ELECTRODE FOR LUMINOUS TUBES

Filed Dec. 17, 1928

Fig. 1

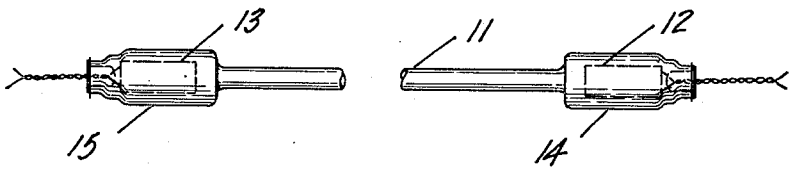
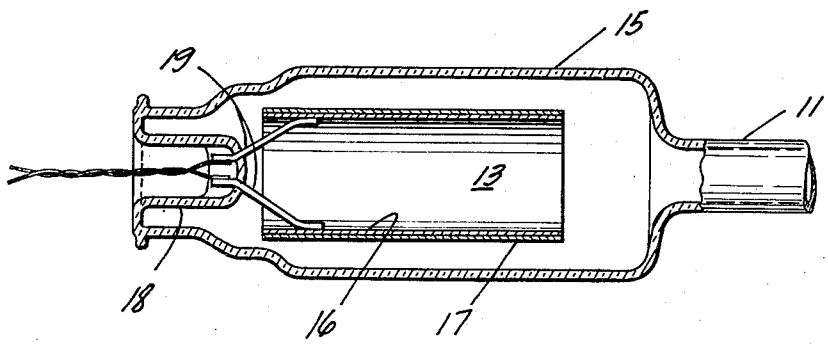


Fig. 2



INVENTOR.
Herbert E. Metcalf
BY John Flam
ATTORNEY

Patented Apr. 5, 1932 1,852,020

UNITED STATES PATENT OFFICE

HERBERT E. METCALF, OF OAKLAND, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WONDERLITE NEON PRODUCTS CO. LTD.

ELECTRODE FOR LUMINOUS TUBES

Application filed December 17, 1928. Serial No. 326,480.

This invention relates to luminous tubes, such as are caused to emit light when excited by an electric potential difference applied across points in the tube by the aid of electrodes.

Such tubes are now well known. They usually include a filling of a noble gas of the rare monatomic series (helium, neon, argon, etc.) or combinations of these gases, or with other gases outside of this group, such as mercury vapor. The tubes are usually filled to a pressure of about 6 mm. of mercury. It has been found that if no special precautions be taken, the gases in the tube rapidly clean up and the tube cannot be illuminated without a new charge of gas.

This clean-up action is due mainly to a penomenon known as sputtering of the electrodes. As the current passes through the tube, it heats the electrodes, and particles of metal are thrown off from the electrodes to the adjacent tube walls. These sputtered particles carry occluded gases, and the walls of the tube thus ultimately take up by occlusion a large part of the gaseous filling.

It is one of the objects of my invention to prevent this sputtering action, and especially by appropriate choice of electrode structure.

I find that I can confine the activity of the electrode wholly to an interior surface (such as the interior of a hollow cylindrical electrode), by making the electrode exterior of material that is a poorer conductor than the interior. Under such circumstances, although the exterior layer is nevertheless conductive, yet the gas molecules prefer contact with the interior, more conductive surface, to the substantially entire neglect of the exterior surface. Therefore, whatever sputtering takes place is confined to the inside of the electrode. Although the sputtered particles carry gases from one part of the interior surface to another, yet due to the heat conditions, these gases are not permanently occluded, and the tube has a long life.

Accordingly, it is another object of my invention to provide an electrode built up of a plurality of layers of material having different conductivities, the lower conductivity material being on the exterior side.

My invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of my invention. For this purpose I have shown a form in the drawings accompanying and forming part of the present specification. I shall now proceed to describe this form in detail, which illustrates the general principles of my invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of my invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a diagram of a luminous tube, shown of indefinite length, in which my new electrodes can be incorporated; and

Fig. 2 is an enlarged sectional view of one end of the tube and of the electrode therein disposed.

In Fig. 1, there is indicated a tube 11 of indefinite length, which can be made from glass or other translucent material. This tube can be filled with any gas or mixture of gases that can be ionized to a luminescent stage; for example, helium or neon or mixtures thereof. The tube of course must be sealed. In order to impress an electromotive force on the column of gas in tube 11, there are shown the electrodes 12, 13, located in the enlarged ends 14, 15 of tube 11.

The electrode structure is best disclosed in Fig. 2. It includes a hollow inner cylinder 16 of good conducting material, so as to provide a low electrode drop on its inner surface. Encompassing this cylinder 16 is an outer cylinder 17 of poorer conductivity, to provide a large electrode drop on the outside surface. The two cylinders 16, 17 can be joined together in any appropriate manner.

The electrode structure 13 can be appropriately supported, as by the aid of a press or squash 18. Wires or rods 19 are sealed in the squash and extend out of the tube to form a terminal. Inside of the tube, they can be fastened to the inner surface of the electrode.

As an example of materials that can be

used for members 16 and 17, inner cylinder 16 can be aluminum, and the outer cylinder 17 can be iron or nickel. Another example is to make the inner cylinder out of any well known conducting metal, such as nickel, iron, or copper, and to coat this with a refractory oxide, such as of some of the rare earth metals, including cerium, as well as of strontium and thorium, which oxides have the property of becoming conductors when heated and have an electrode drop higher than most of the metals. If these oxides are powdered, they can be mixed with alcohol and applied as a paint. However, in all forms, the outer layer 17 has conducting properties but with a relatively larger electrode drop.

I claim:

1. In an electrode structure for luminescent tubes, an inner metallic cylinder, and a conducting cylinder superposed over the inner cylinder and having an external surface with a larger electrode drop than the inner cylinder.

2. In an electrode structure for luminescent tubes, an inner cylinder of aluminum and an outer cylinder encompassing and supported on said inner cylinder, made from metal of the iron group.

In testimony whereof I have hereunto set my hand.

HERBERT E. METCALF.