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S. C. MILLER

2,064,485

ELECTRODE CONSTRUCTION

Filed July 17, 1934

Fig. 1.

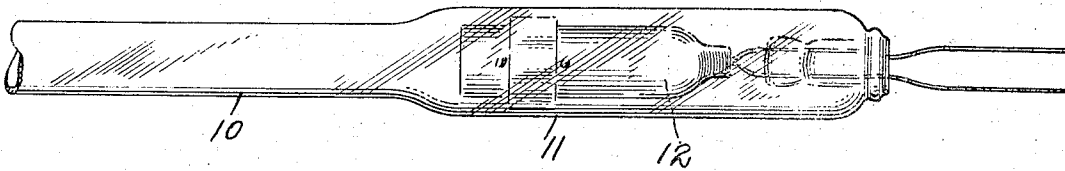


Fig. 2.

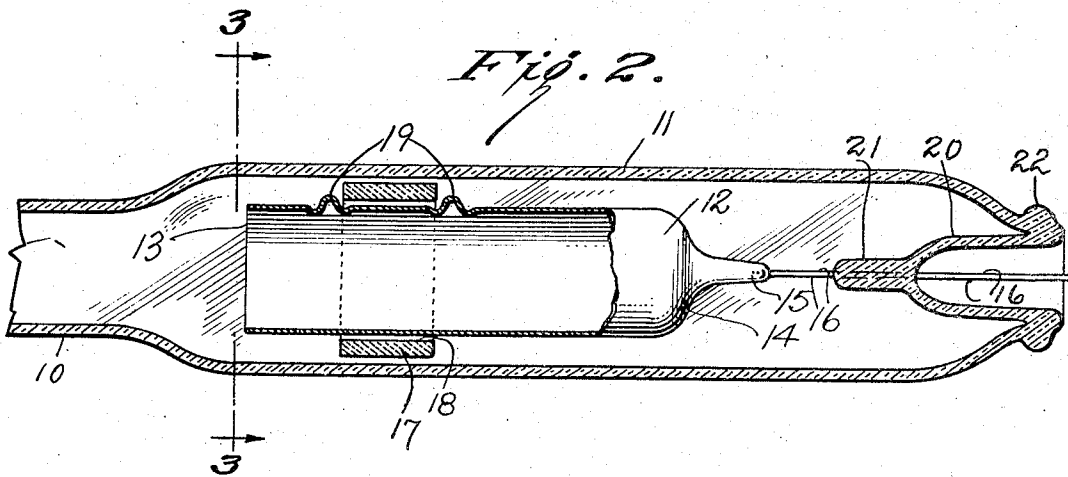


Fig. 3.

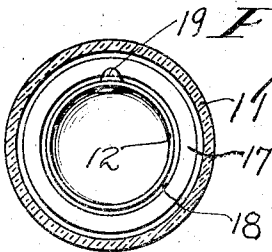
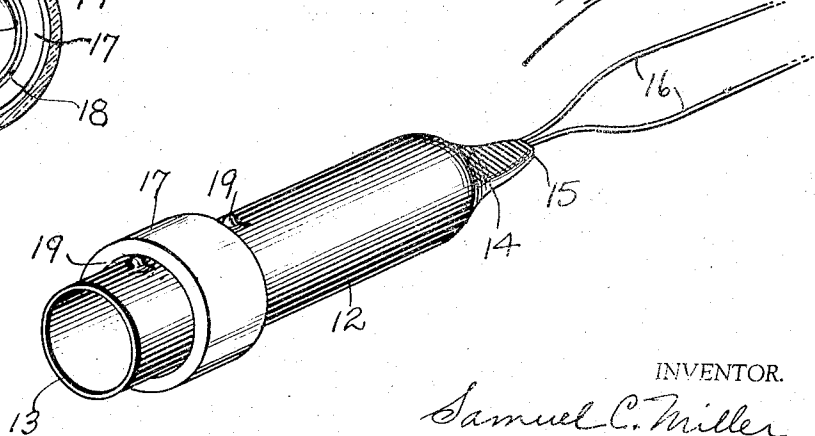


Fig. 4.



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UNITED STATES PATENT OFFICE

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ELECTRODE CONSTRUCTION

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1 Claim. (Cl. 176—126)

This invention relates to improvements in electrode constructions utilized particularly upon the neon type of luminous tubes and to a method of constructing the same.

5 In the preferred embodiment of my invention, it is an object thereof to provide an electrode constructed to be utilized in the neon type of luminous tube or similar contrivances, in which such gases as neon, argon, helium and other rare
10 gases are employed to obtain colored lighting effects.

In the production of the neon type luminous tubes, as contemplated by me, a sealed glass tubing is provided which may be formed into letters
15 or other graphic representations and provided with sealed-in-electrodes, generally tubular in shape, sealed in the tubing and having outwardly directed leads for finally energizing the assembly into luminosity from some source of electrical
20 current.

At some stage of the process, it is essential that the electrodes of the tube assembly be thoroughly treated for the removal of occluded gases, in order that proper illuminating efficiency and life of the assembly in operation may be assured.

25 As such process involves high temperatures, these conditions of operation may result in a sagging or warping of the electrodes or the leads supporting the electrodes, with the consequence of danger of the electrodes touching the enveloping tube or providing an inadequate insulating gap between the electrode and the enveloping glass tube.

Furthermore, in the processing of the tube assembly involving, as incidents thereof, the heating of the electrode as hereinbefore mentioned, the possibility of sagging of the electrode at the temperature required for processing, necessitates that means be provided to positively space the
35 electrodes from the walls of the enveloping glass tube, to avoid accidental displacement from the coaxial position which may cause the electrode to touch the walls of the glass tubing, serving to crack the glass of the neon tube, in addition
40 to diminishing the electrical efficiency of the installation by reduction of the air-gap surrounding the electrode, and between the same and the enveloping walls of the glass tube.

Accordingly, it is an object of my invention to provide an electrode construction in an assembly
45 forming part of a luminous tube of the neon type, heretofore mentioned, whereby a high efficiency of an insulation may be achieved, throughout operating conditions, with the minimum care
50 and simplicity of assembly of the electrode struc-

ture in relation to the enveloping tube, and whereby such efficiency of operation may be obtained after submitting the assembly to the necessary processing, in achieving proper working conditions incident to completion of the assembly.

A still further object of my invention resides in the provision of a novel, simple and inexpensive electrode construction and spacing means therefor, whereby the electrode, in relation to the spacer and the enveloping tube of glass, will minimize any tendency to cause breakage, by reason of the processing to which the assembly is submitted before the installation and to obtain efficient operation in use of the entire assembly.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, I make reference to the accompanying drawing forming a part hereof, in which—

Figure 1 is a plan view of a fragment of a neon tube, at the electrode end;

Figure 2 is an enlarged longitudinal sectional view thereof;

Figure 3 is a section taken on the line 3—3 of Figure 2;

Figure 4 is a perspective view of the electrode of the prior views, and showing the spacer collar attached.

Referring to the drawing, as a preferred embodiment of my invention, there is illustrated a glass tube 10 forming part of a luminous tube of the type generally referred to as neon tubes.

As my invention is primarily concerned with the electrode assembly of this type of luminous tube, in that the electrode tube assembly may form a separate article of manufacture to be sold to glass workers engaged in forming the tube into letters or other graphic representation, I will confine the description to my electrode assembly and envelope therefor.

Accordingly, it will be observed that, to the tube 10 there may be affixed an electrode assembly comprising an envelope 11, of soft glass or heat resisting glass, which is made of slightly larger diameter and connected in the usual way through the tubing 10 by tapering shoulders.

Within the envelope there is positioned an electrode 12, formed of tubular construction generally of uniform diameter, open at one end 13 and closed at the opposite end 14, by spinning the same to a rapidly tapering tip 15, which is orificed to receive lead wires 16. These lead wires are directed within the orifice of the tip 15 by suitable operations, such as spot welding, crimp-

ing and other effective means to obtain good contact between the lead wires and the electrode.

With an electrode thus provided, I assemble therewith a loose collar 17, whose outer diameter is of dimensions calculated to slide freely within the envelope 11, preferably with an appreciable amount of clearance. The inner diameter 18 of the collar is calculated to receive the electrode 12 therein, with sufficient clearance not only to readily slide the collar over the electrode 12 but to permit expansion for the tube during heat treatment to high temperatures sufficient to bring the tube to red heat, as will appear more clearly as this description proceeds.

It is preferred to locate the collar along the length of the electrode 12 nearer the forward end of the electrode tube so that it is located between the forward end and the medial point along the length of the tube.

In this position, the collar 17 is held against displacement by forcing up from the body of the metal constituting the electrode 12, a pair of lugs 19—19, spaced to either side of the collar to provide relatively loose engagement, and without binding the collar. It is preferred by me to displace the lugs 19—19 upwardly for a sufficient distance without materially increasing the outer diameter of the electrode 12 at these points, but sufficient to prevent ready displacement of the collar to either side of the lugs 19—19. Care is further exercised, in the preferred embodiment of my invention, to strike up these lugs without piercing the metal tubing forming the electrode 12, for reasons readily apparent to those skilled in the art.

While I have described as my preferred form of the invention, a striking up or displacement of metal of the electrode tube 12 to form the lugs 19—19, in that this method of attachment is extremely simple and economical and to permit such engagement between the collar and tubing of metal forming the electrode as to avoid breakage, in that this method of attachment and the form of the locating means avoids any objectionable interference with the proper operation of the electrode when used in the electrified system, other protuberances or stops may be provided, such as fused spottings or buttons of metal may be affixed and these are also preferably located to avoid binding the collar.

The complete assembly, in accordance with the description just made, is shown in Figure 4 and in this form, the electrode may be inserted into an envelope, such as 11, before the end is tapered, and while so properly located, the end of the envelope may be fused to seal the same over the lead wires 16. Preferably, however, the lead wires 16 are passed through a thimble or pedestal 20, to fuse the tips 21 thereof to the lead wires 16.

The electrode assembly and pedestal 20 affixed to the leads, are inserted within the envelope 11, while it is of uniform diameter, and the end of the tube 12 is fused to the pedestal 20 at the joint 22.

I have referred to a collar 17 serving as a spacer for the metallic electrode tube 12. This collar is preferably made of porcelain, a material which I have found has the requisite dielectric strength and insulation, as well as the property of withstanding the high temperatures incident to processing the complete assembly, to in any way fuse, spall or crack the same. A low coefficient of expansion tube or collar is made of porcelain of the characteristics mentioned and

without any glazing, and is preferably of high sillimanite content and free, or extremely low, in any fluxing agents. The essential characteristics of the collar are that it is non-compatible to the glass used in the tubing and will not fuse to the glass envelope 11, even at temperatures tending to melt, or approaching the melting point of the glass envelope 11. In general, the insulating material of which the collar is preferably made, is of a ceramic material which has undergone high temperature treatment and is substantially free or exceedingly low in the alkalis, so as to withstand the high temperatures employed in the processing of the assembly, as well as serving to exclude any contaminating volatile ingredients.

While some degree of success may be achieved by insulating materials which are capable of withstanding sudden changes in temperature and have a low coefficient of expansion under wide variations in thermal conditions, and for this reason a high grade porcelain of the character heretofore referred to by me is preferred, equivalent materials non-compatible to fusion with the glass envelope come within the contemplation of ingredients preferred by me and referred to in the claim as "an inert insulator". It will be further understood that some of the advantages structurally inherent in my construction may be obtained to some degree, utilizing other insulating materials, so far as their thermal and dielectric qualities are concerned, as may come within the spirit of the invention and the scope of the appended claim.

It will further be observed that though it is preferred to have the collar form a small fraction of the length of the electrode 12, which collar, as shown, is approximately one quarter of the length of the electrode, this collar may be extended for a substantial length or for the entire length of the electrode. Preferably, however, the collar corresponds to a length forming a small portion of the electrode and adding the minimum weight to the freely disposed electrode which may displace the electrode from the co-axial position. It is preferred that the collar be sufficiently extended to prevent canting or substantial disalignment of the electrode from the co-axial position. Therefore, it is preferred to dispose the collar away from the medial line longitudinally, to more or less balance the electrode in the co-axial position, considering that some slight support may be desirable at some stage of the processing of the complete assembly, by reason of the high temperatures employed during such processing, as between the point at which the collar is located and the suspension or support derived from the leads 16 in the pedestal or corresponding seal at the end of the tube. In this manner, any tendency for disalignment, either at the open end 13 or the closed end 14 of the electrode, is reduced to the minimum.

It will also be observed that though conditions may exist during the processing of the assembly whereby the leads 16 may serve to hold the electrode coaxially, the length of the collar, and the bearing surface it may supply, in relation to the glass envelope 11 and the electrode 12, minimizes any material displacement from the coaxial position of the electrode, even under processing temperatures which may cause the electrode assembly to sag by reason of softening of the lead wires 16 under more rigorous temperature treatment in the processing of the assembly.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent, is—

5 A luminous tube electrode assembly, comprising in combination a tubular glass envelope sealed at one end, a hollow cylindrical metallic electrode disposed coaxially in said envelope and spaced from the walls thereof, wire leads connected to one end of the electrode and sealed in
10 the sealed end of said envelope, said wire leads serving to support the electrode in the envelope,

and a relatively short porcelain cylindrical spacer collar having an internal diameter greater than the external diameter of the electrode and having an external diameter smaller than the internal diameter of the envelope loosely mounted 5 on said electrode and located intermediate the free end of the electrode and the medial portion thereof, the electrode having an outwardly displaced portion on each side of the collar to limit the longitudinal movement thereof. 10

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