

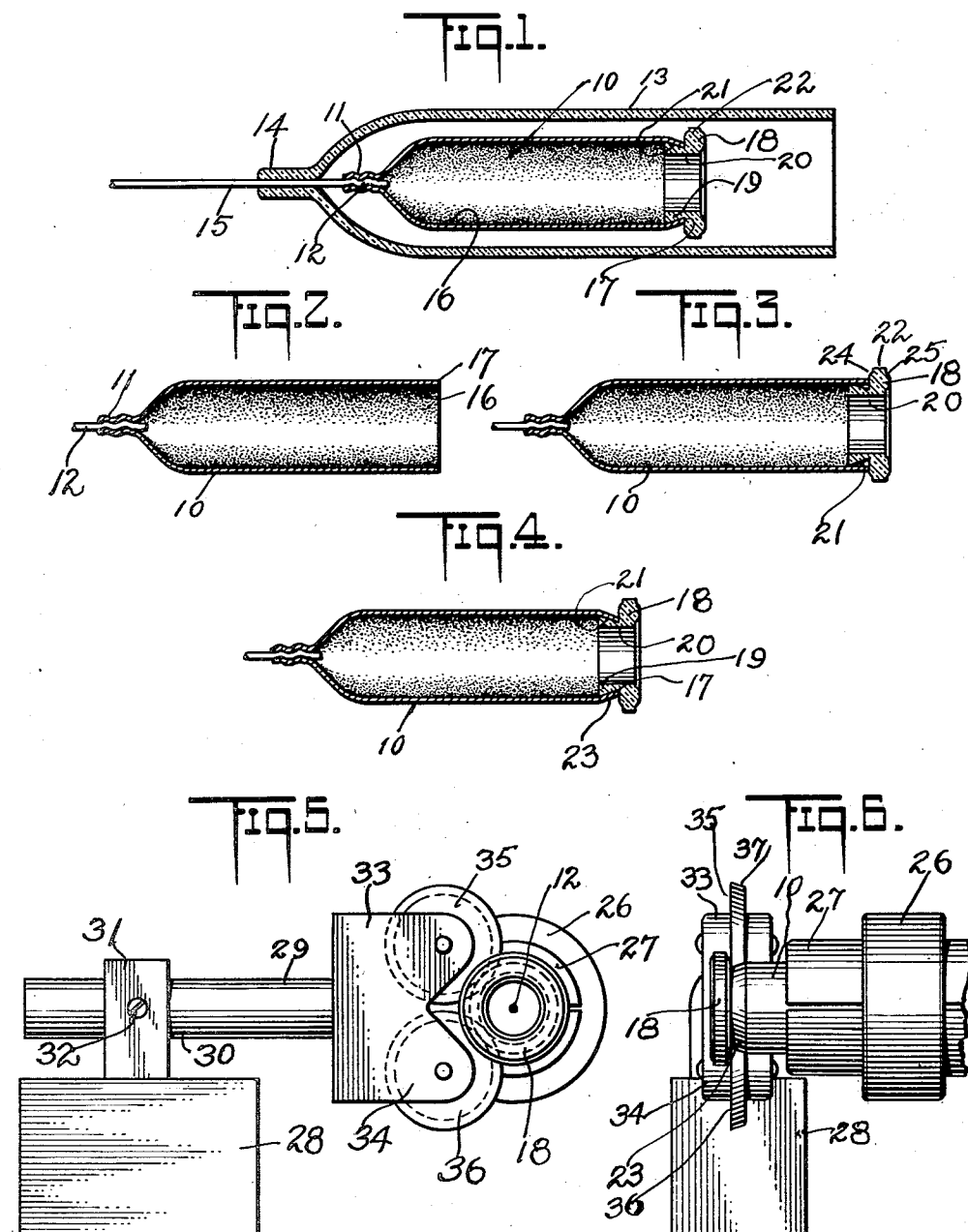
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ELECTRODE FOR LUMINOUS TUBES

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ELECTRODE FOR LUMINOUS TUBES

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3 Claims. (Cl. 176—126)

My invention relates generally to luminous devices of the so-called neon tube variety and has particular reference to the electrodes employed in such devices and to apparatus for making the same.

Coordinately, my invention relates to improved apparatus for manufacturing and assembling such electrodes.

My invention is a continuation-in-part of my application Serial No. 319,820, filed February 20, 1940, now Patent No. 2,310,983, granted February 16, 1943, for Electrodes for luminous tubes and the method of producing the same.

In my application aforesaid I have disclosed and claimed an electrode and method of producing such electrode involving the solution of the problem in connection with electrodes which carry a protective coating of electron-emitting material by providing an electrically conducted shell having a smoothly rounded closed end carrying the electron-emitting coating within a conductive envelope to which the lead-in wire is secured, as well as the provision of means for minimizing sputtering by protecting the free edge of the envelope with a ceramic collar.

In the form of my invention involving a composite structure which assures retaining an unbroken layer of protective electron-emitting material at the bottom, the enveloping shell takes on the stresses, especially where the edges thereof are turned in to engage a ceramic collar, as more particularly described in the application Serial No. 319,820.

I have found that where the electrode carries the layer of protective, electron-emitting material directly on its interior surface, beneficial operation is secured and long life maintained by encasing the edge of the electrode to cover the protective coating adjacent the edge during operations affixing the shell into position where it holds the ceramic collar. I have further discovered that shielding the edge of the shell by extending the peripheral flange of the dielectric material maintains a high order of efficiency in operation and minimizes rejects or discards, which may occur by reason of perforation, splintering or scaling of the protective, electron-emitting coating.

The invention, accordingly, has for its object the provision of a non-sputtering electrode wherein a single shell has its edge protected with insulating material, eliminating in part the necessity for composite layered shells to carry the electron-emitting coating and thereby effecting saving in labor and materials. Coordinately, my

invention has for its object the provision of apparatus for assembling an insulating collar with a shell electrode which may directly carry the electron-emitting coating.

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 longitudinal sectional view of an electrode and glass jacket, in accordance with my invention;

Figure 2 is a longitudinal sectional view of the electrode shell;

Figure 3 shows the shell of Figure 2 at one stage of the assembly operation;

Figure 4 likewise shows the assembly of electrode and collar;

Figure 5 is a side elevation of the apparatus for effecting the assembly in accordance with my invention;

Figure 6 is an end view thereof.

Making reference to the drawing, there is shown a cylindrical electrode shell 10, one end whereof is formed with a neck 11, crimped upon a lead-in wire 12. This assembly is concentric with a glass jacket 13, one end whereof is formed with a seal 14 about the shank 15 of the lead-in wire. The interior of the shell 10 has deposited thereon a layer of an electron-emitting protecting material 16. This may be barium-strontium salt, held together with a butyl acetate binder. Later, during the processing step for purifying the electrode under the influence of heat that is engendered, this protecting coating is converted to an oxide.

The edge 17 of the electrode shell is provided with a ceramic collar 18, having an inwardly directed flange 19, defining the orifice 20, and an external wall 21, tapered in the direction of the extended shield 22. The dimension of the shield 22 is calculated to be greater than the diameter of the shell, however within limits permitting a loose fit within the glass jacket 13. The extended shield 22 is formed with rounded walls 24 and 25.

Affixation is secured by inwardly turning the portion 23 to conform with the tapered external wall portion 21 of the collar. This collar is made of heat resistant ceramic material of high electrical insulating properties. I have found that a highly pressed ceramic known as Alsimag, which is believed to be an aluminum-beryllium-magnesium silicate, as made by the American Lava Corporation, is very suitable for my purposes. This material has an unusually high mechanical

strength and is capable of resisting the stresses involved in assembling the contrivance, hereafter more particularly described.

The shells, in accordance with my invention, are self-sustaining drawn metal tubing made of either pure nickel or Swedish steel, known as Svea metal. By "self-sustaining" I mean to include metals which will resist, without further reinforcement, deformation by the heat engendered in the processing common to this art in the purification of the neon tube assembly.

Making reference now to Figures 5 and 6, I will describe the apparatus for assembling the cylindrical electrode shell and the ceramic collar.

For this purpose, a power driven rotary head 26, such as the head of a lathe, is provided with a collet 27, arranged to receive the electrode shell 10. The collet 27 is provided with a limiting gauge to insert the electrode to the appropriate depth.

A cross slide 28 has mounted thereon a tool holder 29 comprising a shank 30, pivoted in the upright 31 by the pin 32, at the rear end thereof. The forward end carries spaced branches 33 and 34, pivotally rotating spinning disks 35 and 36, in spaced relation to each other. The peripheral edges of these disks are formed with tapered rims 37, turned in the direction of the rotary head 26.

By spacing the spinning disks 35 and 36, the edge of the electrode may be nested adjacent the nip between the disks 35 and 36. With this arrangement, the cross slide 28 may be fed towards the rotary head.

For operation, the collar 18 has its flange 19 inserted into the electrode shell adjacent the rim or edge 17 to the point where this rim abuts the inner edge of the shield 22. In this position, the finger of the operator may hold the collar in position during spinning of the head 26 without marring the protective coating where the flange 19 enters the interior of the shell 10. In this position the cross slide then feeds the spinning disks against the rim 17, inwardly turning the same against the tapered external wall 21 of the collar. The pivotal position at 32 of the work holder permits the mounting of shells of different diameters.

The rounded edge 24 of the collar permits entry of the edge of the disk to form the turn portion 23, with a self-sustaining neck having adequate friction fit, without requiring any additional reinforcement to resist the warping stresses which may be encountered in the heat developed in the processing operation for purifying the luminous tube assembly.

The completed shell and protecting insulating collar are shown in assembled position in Figure 4. This shell and collar may then be sealed within the glass jacket, as already explained in connection with Figure 1.

The electrode which I have described is characterized by non-sputtering qualities characteristic of the ceramic collar which protects the rim or edge of the electrode shell, with the additional feature that by disposing the flange 19 inwardly of the rim after the protective coating material

16 has been applied, chipping or scaling of the protective coating is minimized in that any difference in coefficient of expansion of the electrode shell and the ceramic collar does not start a break in the coating. By inwardly turning the rim 23 against the tapered external wall 21 of the collar, the shielding effect of the shield rim 22 of the collar is accentuated and the non-sputtering benefits of the insulation for the rim of the shell are assured to the maximum degree.

It will thus be observed that I have provided an electrode shell having non-sputtering features, without resorting to a composite shell structure and by spinning the shell rim about the flange of the collar, assure the maintenance of the protective electron-emitting coating continuously adjacent the rim, free from breaks or scaling.

It will also be observed that by rounding the edges of the shield, manufacturing operations are simplified and the elimination of sputtering in bombardment and in operation are assured to the maximum degree.

It will also be observed that I have provided simple spinning apparatus to assemble the ceramic collar to the metallic, cylindrical electrode, to take into account a wide range of sizes of these articles.

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

1. In an electrode for luminous devices, a cylindrical, electrically conductive shell coated with an unbroken layer of protective, electron-emitting material on the interior surface thereof, extended to the rim edge thereof, and a ceramic collar mounted on the shell covering said edge and having an extended flange inwardly directed into said shell and overlapping said rim edge and the coating carried thereby, the rim of said shell being inwardly turned to engage said flange of said collar.

2. In an electrode for luminous devices, a cylindrical, electrically conductive shell, one end whereof is arranged to be connected to a lead-in wire, the opposite end being open, with the rim thereof fitted with an insulating collar formed with a flange extended into the open end of said electrode and having an external tapered wall, the rim of said electrode being turned-in and spun over to engage said flange, said collar having a shield extending to protect the external walls of the electrode during bombardment and purifying operations, thereby eliminating sputtering.

3. In an electrode for luminous devices, a cylindrical metal shell of self-sustaining material, one end whereof is closed and connected to a lead-in wire, the opposite end whereof is provided with a ceramic collar including an inwardly directed flange, the exterior wall whereof being tapered and over which tapered wall the rim of said shell is inwardly turned, said collar being formed with an annular shield extending beyond the exterior wall of said shell.

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