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2,443,633

ELECTRODE FOR GASEOUS DISCHARGE DEVICES

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Fig. 1.

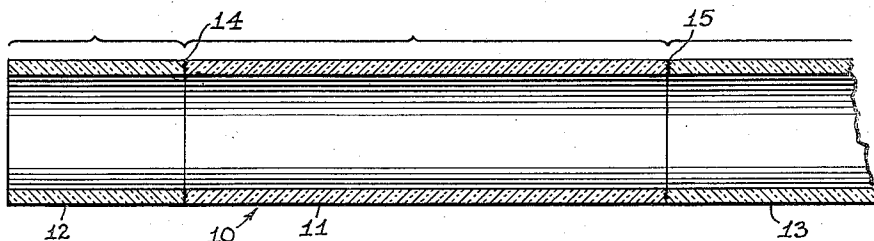


Fig. 2.

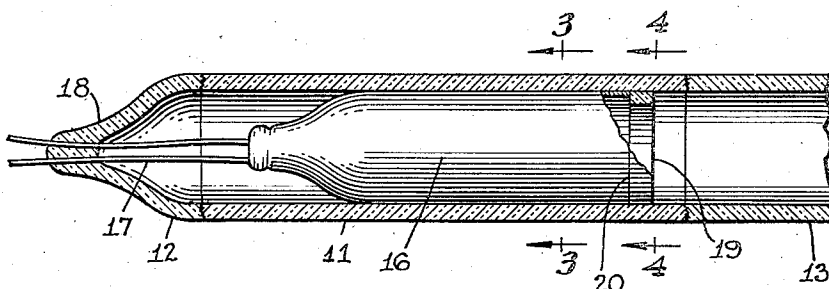


Fig. 4.

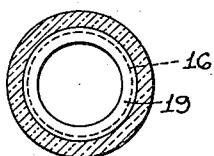


Fig. 3.

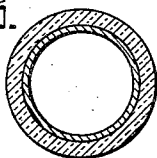
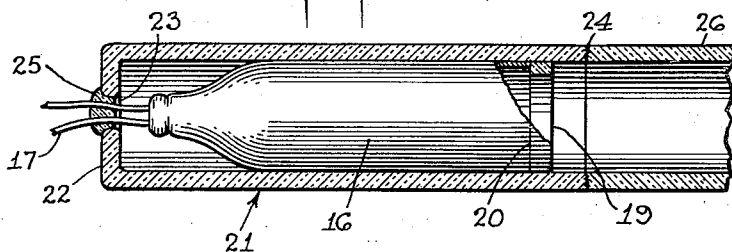


Fig. 5.



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ELECTRODE FOR GASEOUS DISCHARGE DEVICES

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6 Claims. (Cl. 176—126)

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This invention relates to gaseous electrical discharge devices, more particularly to the electrode terminal end construction of such a tubular illuminant.

Known to me is the provision of means to support a shell electrode at the terminal end of a gaseous electrical discharge device by inclusion of spacer material between the shell electrode and the glass envelope in which the shell electrode is sealed. Such spacer supports are employed to prevent the electrode from sagging from its concentric axial position in the envelope to where it contacts the glass envelope. This action may occur during processing of the gaseous electrical discharge device and result in either cracking of the glass or its perforation. The use of spacers cannot be controlled with any degree of close tolerance and a true axial alignment of the electrode and envelope is not maintainable because commercial glass tubing for this field varies in size within a wide range. The commercial forms of glass tubing employed for making illuminants or electrical signs do not want such close selection of size of tubing to do more than to have a rough approximation between the shell electrode and its glass envelope, and the interposed spacer material. Thus, even if glass of high heat resistance is employed, it is commercially economical to maintain close working dimensions between the shell electrode and the enveloping glass.

I have discovered that the glass electrode device or illuminant need not be made entirely of glass in forming the envelope at the terminal end holding the electrode. I have discovered that I may make an envelope for the electrode of ceramic material known as "Alsimag" and that this material has a linear co-efficient of thermal expansion and compatibility to glass working that the shell electrode may be sealed in direct contact with it. I have further discovered that the ceramic material mentioned may be worked into a size of such close tolerance that the envelope for the electrode may be in close contact with each other, minimizing sputtering and preventing the electrical discharge from attacking the outside of the electrode shell and the lead-in wires.

I have further discovered that I may employ a ceramic envelope directly supporting in contact the electrode shell, and use this supporting section as part of the glass tubing in making the tubular illuminant or displaying sign in that the ceramic material, particularly "Alsimag," may be united by a butt joint seal to the glass tubing heretofore employed in making these illuminants,

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Accordingly, it is an object of my invention to provide a gaseous electrical discharge device in which the terminal end includes a shell electrode and an envelope within which said electrode nests, substantially in contact therewith to hold the electrode against sagging while protecting its periphery and the lead-in wires from the electrical discharge which may accentuate sputtering or destroy an attack on the outside of the electrode and lead in wires.

It is a further object of my invention to provide in a gaseous electrical discharge device a terminal end construction which includes a shell electrode comprising an envelope of a ceramic material within which said electrode nests concentrically and in contact with the envelope within close tolerances of sizes.

It is still further an object of my invention to provide a gaseous electrical discharge device in which the terminal end thereof includes a shell electrode sealed in over the lead-in wires or conductors and in which the envelope is a ceramic material with which the electrode is in contact, the envelope likewise extending to form the entire illuminant or display sign whereby the translucent character of the ceramic material contributes to the illuminating value of the device. It is further contemplated by my invention to provide an envelope forming a gaseous electrical discharge device wherein the electrode shell may be supported directly in contact with the envelope to minimize the attack on the outside of the shell and the lead-in wires for the electrode shell.

Still further objects of my invention reside in the provision of a gaseous electrical discharge device in which the terminal end supporting the electrode shell is made in whole or in part of ceramic material which is pre-formed to narrow tolerances thereby nesting the shell electrode in close contact.

Still further objects of my invention reside in the provision of a gaseous electrical discharge device in which the body of the illuminant as well as the terminal ends are made of substantially translucent ceramic material including fluorescent or luminescent ingredients which are self-exciting to be visible during operation.

Still further objects of my invention reside in the provision of a gaseous electrical discharge device in which the employment of a ceramic material known as "Alsimag" effects substantial economies in assembly and in the construction of these devices.

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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 showing a composite glass and ceramic tubing for practicing one embodiment of my invention.

Figure 2 is a longitudinal sectional view with the electrode sealed in position.

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

Figure 4 is a section taken on the line 4—4 of Figure 2.

Figure 5 is a longitudinal fragmentary sectional view of another embodiment of my invention.

Making reference to the drawing, it is contemplated by me to provide an electrode 10 for a gaseous electrical discharge device in which a terminal segment 11 is made of ceramic material.

The ceramic material which I have discovered to have desirable properties is known under the trade name "Alsimag No. 35," a product made by the American Lava Corporation of Chattanooga, Tennessee, and is comprised largely of alumina silica and magnesia. This material may be extruded or pressed into tubular sections and has a softening temperature of about 1430 degrees centigrade. In tubular sections when the walls are approximately .032" (thirty-two thousandths of an inch), the kilned material is almost translucent. The pressed material of almost negligible water absorption properties is a desirable form to be employed by me. This material in the form of a tube may have sealed to it a section of glass tubing 12 and 13 at opposite ends by butt joint seals 14 and 15 respectively. The glass tubing employed is that known to the neon sign trade as lead-glass. The lead-glasses known as G1 and G12 supplied by the Corning Glass Works, have been used by me successfully.

In making the butt joint seals 14 and 15, restraining the glass in abutting contact so that it does not extend over the sides of the ceramic material, will minimize strains.

With a composite section thus provided, I may then insert the electrode 16 in nested position within the ceramic section 11 extending the lead-in wires 17 towards the section 12 whereupon the section 12 is fused and pressed to form the pedestal 18 and to form a seal for the lead-in wires 17. I may likewise position a ceramic collar shield 19 to protect the rim 20 of the electrode shell 16. The ceramic collar 19 may be held in this position by a spotting of fused glass or otherwise to hold the collar in the rim overlapping position.

While I have shown and described the section 11 with an attached section 13 of glass at the butt joint seal 15, it will be understood that the section 13 need not be affixed until after the terminal end comprising the ceramic section 11 and the seal 18 have been completely formed.

It will also be understood that while I have described the section 13 made of glass, it is contemplated by me that this section be a continuation of the section 11, and made of the same ceramic material including luminescent or fluorescent ingredients added thereto during the plastic condition of the ceramic or as a coating which in the final operation of the gaseous electrical discharge device becomes self-exciting to be visible and produce the fluorescent effects.

It is understood that where the tubing adjacent the terminal end is made of ceramic material,

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the walls of the tubing may be made so thin that the tubing is practically translucent for all purposes.

In the embodiment illustrated in Figure 5, a terminal end 21 of the gaseous electrical discharge device is pressed or formed into a generally cup-shaped segment having an integral bottom 22 formed with an aperture 23. An open mouth or rim 24 is provided at the opposite end. As before, an electrode shell 16 is chosen to fit snugly the interior of the ceramic terminal end 21 to nest therein in contact with the walls thereof with the lead-in wires or conductors 17, protruding through the orifice 23.

While in this position a glass bead is molten to form a seal 25 which is pressed in the aperture 23 to seal-in the lead-in wires 17. The rim 23 of the electrode 16 may be provided with a ceramic shielding collar 19 as in the prior embodiment to fit inside the terminal ceramic end. An assembly of this character may then be connected to a glass tube 26 by joining the same to the terminal end 24 employing a butt seal 28. The assembly is then ready for completion of the illuminant or display sign in the usual way.

It will be observed that by making a terminal end enveloping section at least of the ceramic material, particularly "Alsimag 35," that due to the high refractory nature of this material, its imperviousness and low co-efficient of expansion, direct contact between the electrode shell and the ceramic housing may be maintained during processing and the incident heat generated. By employing a pressed ceramic material close tolerances in sizes are possible and a fit between the shell electrode and the ceramic collar not possible with the usual drawn commercial glass, may be secured. The high heat insulating properties of the ceramic material eliminates the need for the cost and labor of applying spacer materials such as mica, previously employed with electrode assemblies of this kind. By close contact between the shell electrode and the ceramic casing or envelope, the lead-in wires are protected from attack by the electrical discharge during processing and operation. The outside surface of the shell electrode is likewise free from attack, thereby minimizing the darkening influence of the illuminant especially where fluorescent coatings are carried by the tube.

It will be understood that while the sections 13 and 26 may be of glass of tubular contour, the electrical discharge device may be part of a device in which the illuminant takes on a special contour, as the ceramic material is susceptible of being extruded or molded into hollow block letters during plastic cold working and may be then matured to its final refractory properties in the kiln or furnace. The letters may be joined by short lengths of glass tubing with the end members provided with the terminal electrode assemblies.

The employment of a ceramic envelope about the shell electrode permits of higher processing temperatures and therefore longer life to the illuminant assemblies. In general, it will be observed that a compact and efficient electrode terminal end has been provided, since the usual enlargement at this portion is not required. The density of the ceramic terminal fits in with ornamental effects especially where it carries fluorescent materials which minimizes the darkening effect of the electrode at this point.

Having thus described my invention and illus-

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trated its use, what I claim as new and desire to secure by Letters Patent is:

1. In a gaseous electrical discharge device for forming part of a luminous tube the terminal end whereof includes a shell electrode sealed in over the lead-in conductors, the combination therewith of an envelope in gas sealing position within which said electrode nests concentrically and substantially in contact therewith to hold the same against sagging, said envelope comprising a mold-shaped ceramic tubular element.

2. In a gaseous electrical discharge device for forming part of a luminous tube the terminal end whereof includes a shell electrode sealed in over the lead-in conductors, the combination therewith of an envelope within which said electrode nests concentrically and substantially in contact therewith to hold the same against sagging, said envelope comprising a mold-shaped ceramic tubular element, the rim of which is sealed in butt joint engagement with the luminous tube assembly.

3. In a gaseous electrical discharge device for forming part of a luminous tube the terminal end whereof includes a shell electrode sealed in over the lead-in conductors, the combination therewith of an envelope in gas sealing position within which said electrode nests concentrically and substantially in contact therewith to hold the same against sagging, said envelope comprising a mold-shaped ceramic tubular element and a ceramic shielding collar within said envelope and overlying the rim of said electrode.

4. In a gaseous electrical discharge device the

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terminal end whereof includes a shell electrode sealed-in over the lead-in conductors said electrode being directly in contact and supported by an envelope comprising a ceramic tubular member, said member being sealed-in butt joint contact with the luminous tube of the discharge device.

5. In a gaseous electrical discharge device the terminal end whereof includes a shell electrode sealed-in over the lead-in conductors said electrode being directly in contact and supported by an envelope comprising a ceramic tubular member, said member being sealed in butt joint contact with the luminous tube of the discharge device said tube carrying a luminescent visible light excitable coating.

6. In a gaseous electrical discharge device the terminal end whereof includes a section of a refractory ceramic impervious tubing, a coaxially disposed electrode shell, having lead-in conductors sealed by glass at one end and a section of glass tubing in butt joint sealing contact at the other end.

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