Dec. 27, 1955 C. L. DAY 2,728,425

ARTICLE COMPRISED OF A METALLIC PART AND A CERAMIC BODY

Filed March 30, 1953

FIG. 1

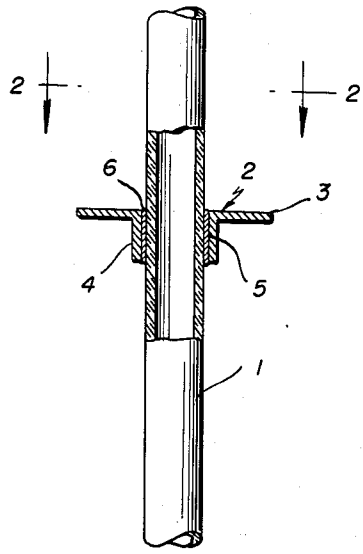
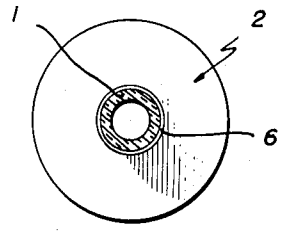


FIG. 2



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ARTICLE COMPRISED OF A METALLIC PART AND A CERAMIC BODY

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1 Claim. (Cl. 189—36.5)

The present invention relates to an article comprised of a metallic part and a ceramic body, this article having particular utility in the construction of electron discharge tubes.

In vacuum tube constructions, there is provided a rigid assembly comprised of the necessary tube electrodes and suitable supporting structure for holding these electrodes in place. It is conventional practice, in fabricating vacuum tubes, to provide as the aforementioned structure, a number of upright ceramic posts between which are supported the various tube electrodes. These posts usually have metal eyelets or rings secured thereto, with the tube electrodes being welded to these rings. The rings are normally crimped to grip securely the ceramic posts for providing a secure attachment.

However, with repeated heating and cooling of the vacuum tube, the metal ring, after a period of time, will loosen and cause a change in the spacing between the tube electrodes, this in turn affecting the electrical parameters of the vacuum tube. Loosened or damaged supporting structure is often manifested in the form of "microphonics," these "microphonics" being produced by relative vibratory movement of the loosened electrodes as a result of shock imparted to the tube.

It is, therefore, an object of this invention to provide a rigid assembly of a metallic part on a ceramic body which will not loosen because of the repeated heating and cooling of the assembly nor of physical shock or vibration imparted to the assembly.

It is still another object of this invention to provide in a vacuum tube a supporting structure comprised of a ceramic post and a metal ring, these two parts being rigidly joined together against loosening as the result of ambient temperature changes or of the usual jarring and vibration to which the structure is subjected.

In accordance with the present invention there is provided a supporting structure for use in electron discharge devices, this structure comprising a support made of an electrically non-conductive refractory material, a metallic part carried by this support, and a metallic bond securing this part to the support, this metallic bond closely resembling a brazed or welded joint. Also, in accordance with this invention, there is provided a method for brazing a metal part to a ceramic body, this method being the ultimate in simplicity, and providing a joint which may not be broken without causing damage to the ceramic body.

For a better understanding of the invention, together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claim.

In the drawing:

Fig. 1 is a longitudinal section of one embodiment of this invention, this embodiment being used as a portion of the supporting structure for the electrodes of a vacuum tube; and

Fig. 2 is a cross section thereof.

This illustrated supporting structure comprises an elongated tubular member 1 which is of annular cross section, and which is made of an electrically non-conductive refractory material usually characterized in the art of electronics as "ceramic" material. For purposes of convenience in further explaining this invention and of defining the invention in the appended claims, this material will be characterized as "ceramic," and it is intended to cover within the meaning of this word any non-conducting body used in the art of electronics which is suitable for supporting purposes.

A metal eyelet 2 is received over the ceramic post 1 and comprises a radially outwardly extending flange 3 and an axially extending tubular portion 4. The inner diameter 5 of this axial extension 4 may be somewhat larger than the outer diameter of the post 1 thereby providing a loose tolerance fit with the post. However, the proper size of this opening 5, which is not critical, will become apparent from the following description.

This eyelet 2 is secured to the post 1 by means of a metal joint 6 which is annular in cross section and which preferably extends the full length of the axial extension 4. This metal joint or bond 6 completely fills the radial clearance between the opening 5 and the outer surface of the post 1, and is brazed to the eyelet 2 and gripped onto the post 1. It has been found that this joint 6 is so secure that any reasonable effort exerted to pull the eyelet 2 off the post 1 results in fracture of this post.

The formation of this joint 6 may be achieved in accordance with the following described method. After assembling the eyelet 2 on the ceramic post 1, the assembly is inserted in a suitable furnace containing a hydrogen atmosphere. A suitable number of small metal rings of silver or the like are placed on top of the eyelet 2. These rings are melted and caused to flow into the radial space between the eyelet 2 and the post 1, and the assembly is thereafter cooled in accordance with preferred practices. If the eyelet 2 is made of copper, and the brazing rings are composed of silver material such as that normally used for brazing purposes, the joint 6 will be characterized by the usual brazing fusion between the brazing metal and the copper part 2; however, no fusion of this same character is believed to occur with the ceramic post itself.

While copper has been suggested as the material for the eyelet 2, and silver as the brazing material, any combination of materials which will provide a brazed joint between the metal part 2 and the brazing material itself will satisfy the requirements of this invention. In the use of these particular materials, the hydrogen atmosphere serves as a reducing agent which allows the silver to wet the contiguous surface of the copper eyelet. In melting the brazing material, a radio frequency heating field of the type normally used in the fabrication of vacuum tubes is preferably used, but, of course, any suitable furnace arrangement may be used for forming the joint.

The tenacious connection between the metal eyelet and the ceramic post is believed to occur by reason of the fact that the melted brazing metal flows into the spaces between the two parts, and also fills the indentations and crevices in the surface of the ceramic. Upon hardening, the joint shrinks about the surface of the ceramic and thereby more forcefully enters and adheres to these indentations and crevices.

While the foregoing invention has been described in connection with its use in vacuum tube construction, it will be appreciated that this invention of, in effect, brazing two completely dissimilar materials, such as ceramic and metal together may be utilized in other arts. While ceramic has, heretofore, in effect, been soldered to companion metal parts, the methods heretofore known have been fairly complex and expensive to perform. By the

use of the method of this invention, an extremely simple and economical method is presented for obtaining the secure bond.

While there has been described what is at present considered the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claim to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

A supporting structure in an electron discharge device comprising a ceramic rod with a clean, roughened, unglazed, annular surface area, a sleeve of copper material telescoped loosely over said rod and encircling said area; and a silver-type solder filling the annular space between the rod and the sleeve, said solder being wetted and bonded to the copper of the sleeve and mechanically interlocked without fusion with the roughened ceramic surface of said area.

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