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H. L. THORSON

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GLASS-TO-METAL SEAL

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Fig. 1.

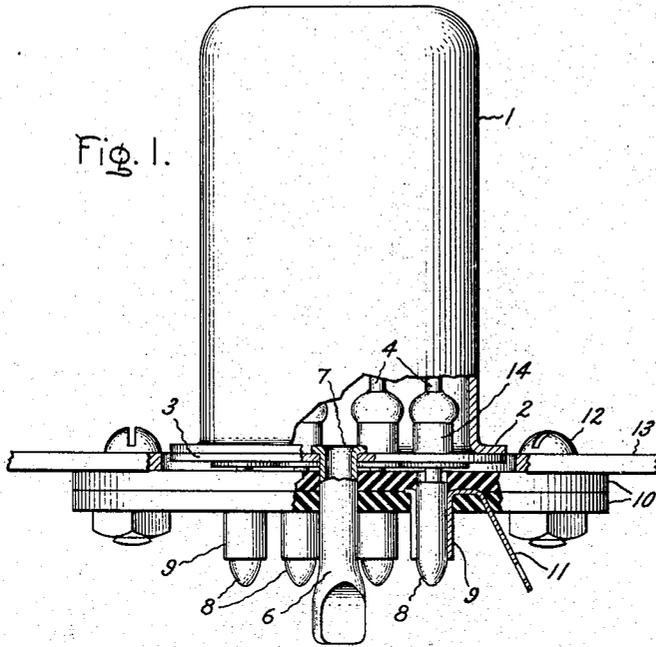


Fig. 2.

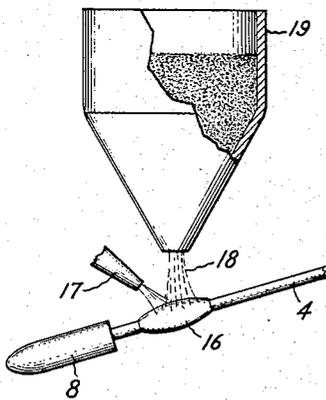


Fig. 4.

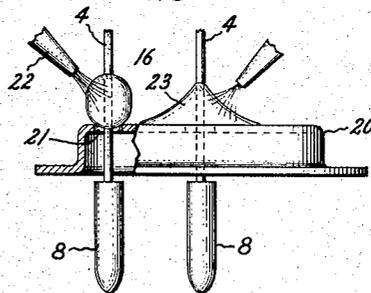


Fig. 5.

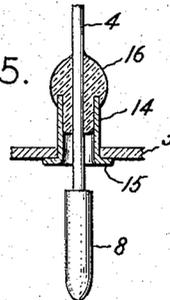


Fig. 3.

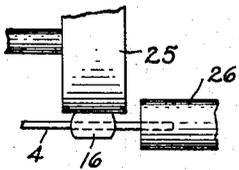
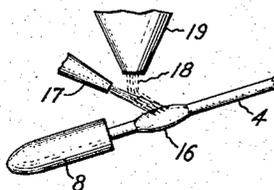


Fig. 3a.

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UNITED STATES PATENT OFFICE

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GLASS-TO-METAL SEAL

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4 Claims. (Cl. 49—81)

The present invention relates to the art of joining glass to metal and more particularly to the fabrication of glass-to-metal seals by which the leading-in conductors are insulatingly taken through the envelopes of metal electric discharge devices. Objects of the invention are to simplify the process and cheapen the cost of joining glass to metal; to simplify the method of making glass-to-metal seals for bringing out the leading-in conductors from the metal envelope of an electric discharge device; to provide a structure of the character indicated which employs comminuted or crushed glass for the insulating material.

In connection with the manufacture of a metal radio tube using heavy leads through the header it becomes necessary to bead the glass to the lead before making the seal to the eyelet, which, in turn, is then welded to the header. The usual manufacturing procedure employed in beading a lead is to drop a piece of glass tubing in position over the lead, then apply flames and wet the glass tubing to the lead. Hard glass tubing of correct diameters cut to the proper length is expensive. However, crushed glass, either hard or soft glass, is relatively cheap. In accordance with the present invention, I provide an improved process by which instead of using glass tubing for the bead, cheap crushed glass of any degree of hardness can be satisfactorily employed. The invention will be better understood in connection with the following description and the accompanying drawing in which Fig. 1 is an elevational view, partly in section, of a typical form of metal tube and socket which employs a seal made in accordance with the improved process; Figs. 2, 3 and 3a are diagrammatic views of apparatus employed in carrying out the improved process; Figs. 4 and 5 show typical forms of seal structures made in accordance with the present invention.

Referring to Fig. 1, numeral 1 designates the envelope of a metal tube, closed at the top and provided at the bottom with an outwardly extending flange 2. A header 3 is welded or otherwise secured to the flange 2. The envelope contains a plurality of electrodes of which only the leading-in conductors 4 are illustrated. For evacuating the interior of the envelope a metal tubulation 6 is provided which conveniently is brought out through the header 3 and welded thereto at the flange 7. After the envelope has been evacuated, the lower end of the tubulation 6 is collapsed and welded hermetically tight, the excess length of tubulation being snipped off.

For making connection between the leading-in

conductors and external circuits, contact pins 8 are provided which preferably are butt-welded to the conductors in line therewith. These contact pins fit tightly into socket terminals 9 which are constituted of hollow metal cylinders held in place between two plates of insulating material 10. The socket terminals are provided with ears 11 for connection to the circuits. The plates 10 are secured together by means of a bolt 12 which also serves to secure the socket to the chassis 13 of a radio set.

The leading-in conductors 4 are brought through the header and insulated therefrom by means of a seal made in accordance with the present invention. This seal may consist of an eyelet 14 (Figs. 1 and 5) of cylindrical configuration provided at one end with a flange 15 which is secured to the header 3. A glass bead 16 is formed between the conductor 4 and the eyelet in the manner to be described presently.

As shown more particularly in Fig. 2, the bead 16 is built up on the conductor 4 after first heating the conductor in air in any suitable manner, for example, by means of a torch 17 and then causing glass particles 18 contained in a conical compartment 19 to drop by gravity onto the heated conductor 4. The latter is continuously rotated during the oxidation step, also during the deposition of the glass so that the bead, when built up to the proper size, will take on a symmetrical configuration. The glass particles 18 are preferably obtained from glass fragments which have been crushed or comminuted in any suitable and well-known manner. These fragments may consist of either the so-called hard or soft glasses. While there is no specific limit to the size of the glass particles, it has been found that granules of the ordinary commercial size make a satisfactory seal. It is apparent that instead of heating the conductor 4 in air, the conductor may be oxidized in any other suitable manner, for example, by heating in an atmosphere of pure oxygen. It is also apparent that instead of positioning the container 19 directly over the conductor so that the glass particles 18 drop vertically downwardly by gravity onto the conductor, the container may be moved to one side of the conductor as shown in Fig. 3 so that the particles will drop into the gas flame which carries them to the conductor. The particles, while moving toward the conductor 4, are being heated so that they stick tenaciously to the heated conductor 4.

The bead 16 may be built up to any suitable size, preferably larger than the interior diam-

eter of the eyelet 14. If desired, the bead may be pressed to a predetermined size and shape while in molten condition. One means for accomplishing this result consists of the combination of a roller 25 and a rotating chuck 26 used as indicated in Fig. 3a. The bead is formed on the conductor at such a position that when dropped into place within the eyelet 14 and the bead melted to seal with the eyelet, the lower end of the bead will be spaced away from the flange 15 of the eyelet. Thus the glass is positioned remote from the position where the eyelet is welded to the header.

Instead of providing an eyelet form of seal, it may be desirable to pass the conductor through a header in which only openings are provided, and the header takes the place of the eyelet. Thus in Fig. 4 the header 20 is provided with openings 21, and the glass bead 16 is set on top of the opening so that when heated by a directed flame 22, the glass flattens out as indicated at 23 and flows between the conductor and the header.

From the foregoing it is apparent that I have provided a very simple and cheap method of making a seal between glass and metal in which crushed glass may be advantageously employed as the sealing material. Glass of this character is relatively inexpensive but when applied to a conductor in the manner described hereinbefore, makes a seal equally as good if not better than when the glass is employed in tubulation form according to the prior art methods.

In addition to making good seals for leading-in conductors, the glass in comminuted form can also be employed in accordance with the present invention for applying a layer of insulation to a metal plate in order to provide long leakage paths across the plate. In this case, the metal plate would not be rotated but would still be heated in air or otherwise oxidized before the glass layer is applied.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a method of preparing a conductor for a sealing-in operation, the steps of simultaneously rotating and heating the conductor and depositing particles of fusible vitreous material on the conductor to form a bead of substantially greater diameter than the conductor while the conductor is being rotated and heated.

2. In a method of preparing a conductor for a sealing-in operation, the steps of simultaneously rotating and heating the conductor in air, depositing particles of glass on the conductor to form a bead of substantially greater diameter than the conductor while the conductor is being rotated and heated, and thereafter pressing the bead while in the molten condition to a predetermined shape and size.

3. The method of preparing a lead-in conductor for a sealing-in operation in which the sealing agent is to be a fusible vitreous material, which method comprises heating the conductor to a temperature at least as high as the temperature of fusion of the said vitreous material, and simultaneously rotating the conductor and depositing on an intermediate portion thereof granular particles of the vitreous material, the said deposition being continued sufficiently long to accomplish the formation of a bead of vitreous material of substantially greater diameter than the conductor.

4. The method of preparing a conductor for a sealing-in operation which comprises heating at least a portion of the conductor, rotating the conductor while maintaining the same in a generally horizontal plane, and depositing granular vitreous material by gravity flow on the upper surface of a heated region of the conductor while continuing the rotation thereof to produce on the conductor a rounded bead of the vitreous material.

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