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STEM FOR ELECTRON DISCHARGE DEVICES

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*Fig. 1*

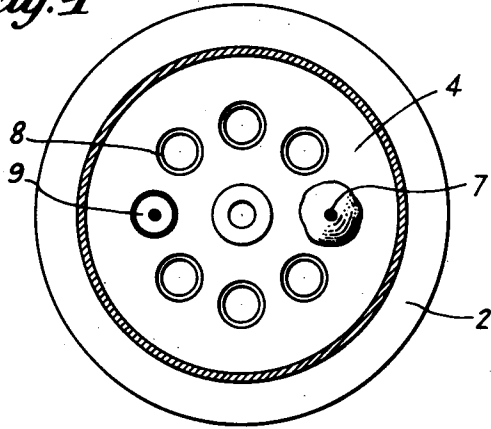


*Fig. 2*

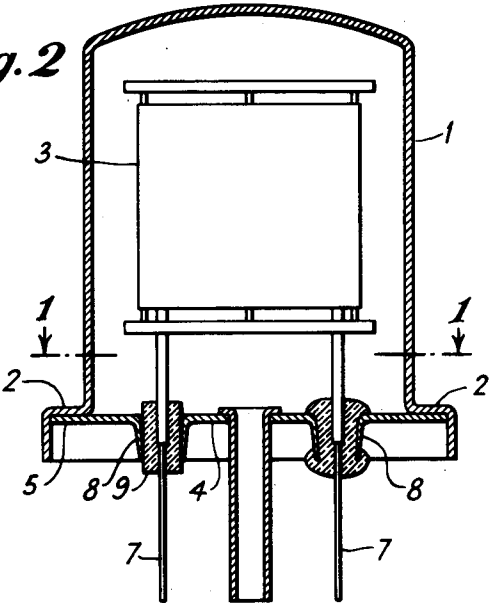
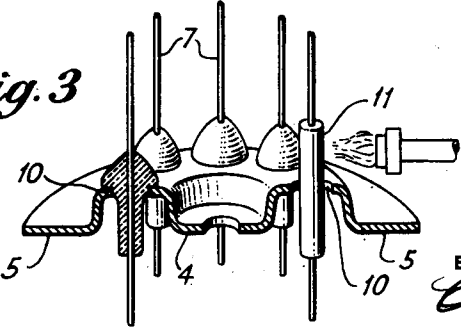


*Fig. 3*



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STEM FOR ELECTRON DISCHARGE  
DEVICES

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4 Claims. (Cl. 250—27.5)

The present invention relates to electron discharge apparatus, and more particularly to the glass-to-metal seals employed in thermionic discharge devices of the metal envelope type.

5 Metal radio tubes of the usual type have a cylindrical iron shell closed at one end by an iron header with electrode lead-in conductors sealed into and extending through it. In the usual form of lead-in seal the iron header is 10 perforated, short tubes with flanged ends and made of a different metal are brazed or welded in the perforations, and the lead-in wires are sealed in these tubulations with beads of glass. Such construction has numerous metal-to-metal seals 15 and is difficult and expensive to manufacture.

It is an object of my invention to provide a metal header with lead-in conductors sealed vacuum tight directly to the header and which is inexpensive to manufacture, rugged in construction, and free from leakage failures due to defective seals.

For a more complete understanding of my invention reference may be had to the accompanying drawing in which Figure 1 is a sectional view along line I—I of Figure 2, which shows a 25 cross sectional view of an envelope with a header embodying my invention, and Figure 3 is a view of a header modified in accordance with my invention.

30 The tube shown in Figures 1 and 2 has a metal envelope comprising a cylindrical shell 1, preferably having a flared rim or shoulder 2, and enclosing an electrode assembly 3. The shell is closed at the lower end by a header or stem made in accordance with my invention. This stem 35 comprises a circular metal disc 4 with an annular shoulder or flange 5 which may be joined gas tight to the shoulder of the shell 2 by welding or brazing. The disc may conveniently be stamped from sheet metal, such as chrome-iron or nickel-iron having the same coefficient of expansion as the glass used for the seals, and to facilitate welding and reduce oxidation the sheet metal may be copper plated. To permit evacuation of the envelope an exhaust tube 6 of metal or vitreous material may be centrally joined to the header.

In accordance with my invention, openings in the header through which the lead-in conductors 50 7 extend and into which they are sealed are arranged in a circle, preferably concentric with the periphery of the header, and in one form of my invention each opening is formed by drawing the metal of the header out and into tubular eyelets 8 integral with the header. The eyelet

may be conical or cylindrical as desired and may conveniently be formed by a series of pressing operations to draw out the metal from the header stock to form a thin walled tube with a sharp edge at the rim. The eyelets may be protruded 5 to extend either above or below the header. The lead-in conductors are threaded through the eyelets with concentric cylinders 9 of insulating material, such as tubes of glass, positioned centrally in the openings where gas flames are 10 played upon the glass to melt and puddle the glass into the eyelet when it seals to the inner wall of the eyelet and to the lead-in conductor. The production of uniform gas-tight seals between the glass and inner metal surface of the 15 eyelet is facilitated and made feasible by the taper and thinness of the wall of the eyelet. The walls of the eyelets are thin enough to readily yield and follow relative movements between parts in the header without breaking the seals.

The glass tubes used in making the seals may 20 be chosen of such size as to leave a substantial portion of the molded glass beyond the ends of the eyelets to mechanically strengthen the lead-in wires and lengthen leakage paths over the surfaces of the glass. Good results have been 25 obtained by stamping headers about one inch in diameter from chrome-iron sheet metal .020 inch or more thick, with eyelets of a diameter of about  $\frac{1}{8}$  inch and a wall thickness of about .003 inch. The glass tubes for the seal are 30 slightly longer than the eyelets and fit loosely into the eyelets and over the lead-in wires. The glass tube may be made of the usual lead or soft glass, which has been found to readily seal with the copper plated nickel-iron alloy of the header and to withstand the strains and shocks of manufacturing and use. When the lead-in wires have 35 been sealed in, the electrode assembly may conveniently be connected to the upper ends of the wires and the header welded to the shoulder 2 of the shell. In practice, the flange 5 of the header is pressed to the shoulder 2 with a pressure of several thousand pounds whereupon a current of the order of 60,000 to 75,000 amperes 40 is passed through the annular junction for about 1/20 of a second. After exhaust and sealing the tube may be attached to a base in the conventional manner.

Figure 3 shows a modified form of header embodying my invention. A series of holes 10 are 50 made in the header and are preferably arranged in a circle concentric with the periphery of the header. Threaded through each hole is a lead-in wire 7, spaced centrally in the hole by short 55

cylinders of glass 11. Gas flames are directed upon the upper ends of the glass cylinders to melt the glass down and seal it to the upper surface of the header. The portion of the glass cylinder which is below the header is protected from the gas flame, and remains tubular, forming along the conductor a pant leg insulator between the conductor and the header. Mechanical and thermal shocks of the welding operation between the shell and header flanges severely stress adjacent parts of the stem. To minimize stresses on the glass-to-metal seals I have found it desirable to shape the header to provide an annular ridge, U-shaped in cross-section, and fairly flat at the top, and to make the eyelets 8 or holes 10 in the top or transverse portion which joins the sides of the annular ridge. Fractures of the glass seals caused by relative movement between parts of the header are thus effectively prevented by the right angle bends in the annular ridge on the header.

While I have indicated the preferred embodiments of my invention of which I am now aware, it will be apparent that my invention is by no means limited to the exact form illustrated or to the use indicated, but that many variations may be made in the particular structure used and the purpose for which it is employed without departing from the scope of my invention as set forth in the appended claims.

I claim:

1. An electron discharge device comprising a cylindrical metal envelope with a flared rim at one end containing cooperating electrodes, a stem for closing said end comprising a circular metal

disc sealed gas tight to said rim, a series of perforations in said stem along a circle concentric with the periphery of said stem, lead-in conductors extending through said perforations and sealed gas tight therein with vitreous insulating material and connected to said electrodes.

2. An electron discharge device comprising a cup-shaped metal shell containing electrodes, a disc-shaped header sealed gas tight to the open end of said cup-shaped shell and having eyelets shaped directly on the disc and extending laterally of the plane of said disc, electrode lead-in conductors extending through said eyelets and sealed into said eyelets with an insulating material and connected to said electrodes.

3. A stem for electron discharge devices, comprising two spaced concentric metal cylinders integrally joined at their ends by a transverse section to form a ring U-shaped in cross-section, an annular flange extending radially outward from the rim of the outer cylinder of the ring, a plurality of perforations in said transverse section and lead-in conductors sealed gas tight therein by vitreous insulating material.

4. The method of manufacturing a metal-envelope electron tube with lead-in wires for the electrodes insulatingly passing through the envelope of the tube, which comprises punching holes in the wall of said envelope, forcing outwardly the metal immediately surrounding the hole to form a tubulation integral with the wall of the envelope, extending leading-in wires centrally through said holes, and then molding an insulating material in said tubulations in gas-tight engagement with said tubulations and wires.

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