June 3, 1941. K. G. BUCKLIN 2,244,356

CATHODE SLEEVE

Filed March 28, 1940

Fig. 1

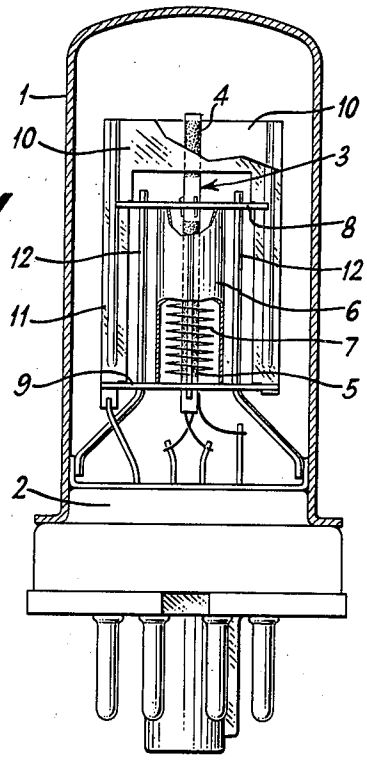


Fig. 2

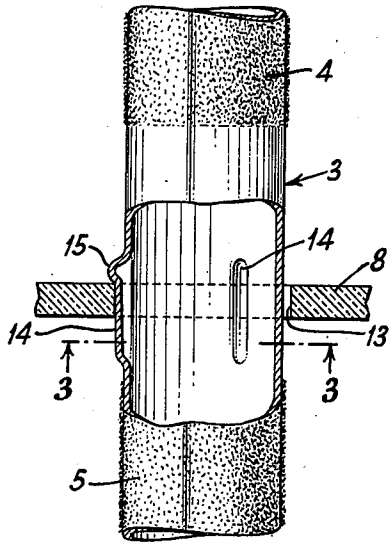
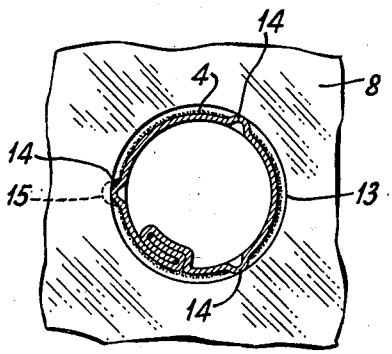


Fig. 3



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2,244,356

CATHODE SLEEVE

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Application March 28, 1940, Serial No. 326,347

5 Claims. (Cl. 250—27.5)

My invention relates to electron discharge devices particularly to cathode sleeves of the indirectly heated type for such devices.

Insulating spacers for electrode assemblies in radio tubes are usually slipped over opposite ends of the cathode sleeve and onto the ends of the grid and plate side rods to hold the electrodes in insulated spaced relation. In some electrode assemblies, however, it is desirable and even necessary first to assemble the grids and plates with the spacers and then to pass the cathode sleeve through its hole in one spacer and into a registering hole in the other spacer. As the oxide coated portion of the sleeve passes through the hole, it is scraped and damaged.

The object of my invention is an improved cathode sleeve that can be easily mounted in an electrode assembly without damage to the surface of the cathode.

The characteristic features of my invention are defined in the appended claims and one embodiment is described in the following specification and shown in the accompanying drawing in which Figure 1 is an elevational view of an electrode assembly embodying my novel cathode, Figure 2 is a detailed view of a cathode sleeve constructed according to my invention, and Figure 3 is a sectional view of my cathode taken on line 3—3 of Figure 2.

The particular electron discharge device shown in the drawing for illustrating my invention comprises a metal envelope 1 closed at its lower end with a non-reentrant or button type stem 2, into which is sealed the lead conductors for the electrodes. The electrode assembly within the envelope comprises a tubular cathode sleeve or cylinder 3 with two spaced emitting sections 4 and 5, around the lower emitting section being mounted an anode 6 and a grid 7. The anode and grid are supported at their ends by spaced parallel insulating spacers 8 and 9, preferably of mica, and the cathode sleeve is held in registering holes in the two spacers with the upper spacer 8 engaging the sleeve intermediate the two emitting sections and the lower spacer engaging the lower end of the sleeve. The two emitting sections of the sleeve are activated, preferably by coatings of the usual active metal oxides, such as barium strontium oxide, and the lower emitting section of the cathode in combination with the grid and the anode functions in the usual way as a triode.

In the particular tube shown, two diode plates 10 comprising a flat sheet of metal pressed out of thin metal stock, such as nickel, are mounted on opposite sides of the upper emitting section 4. Each anode is substantially U-shaped in plan with two flat leg portions 11 integral with the lower edge of each plate and extending downwardly and affixed to the two spacers to hold the diode anodes and cathode in rigid fixed spaced relation.

In manufacture the ends of the anode 6 and grid 7 are pressed into their openings in the spacers and the two flat anodes are added by slipping their arms downwardly over the edges of the spacers and their ends are clinched to lock the electrode assembly together. The electrode assembly is supported on the stem with two support rods 12 passing through the spacers and joined at their lower ends to upstanding ears on the stem.

The cathode sleeve in this electrode assembly must be passed through the hole in one of the spacers and the inserted end of the sleeve threaded into the registering hole in the other spacer. According to my invention the hole 13 in the upper spacer is made larger in diameter than the sleeve and the sleeve is lowered into the assembly from the upper end. As shown in greater detail in Figures 2 and 3 the sleeve is centered in the hole by beads 14, preferably integral with the sleeve, of uniform height and evenly spaced around the sleeve. These beads may be elongated and slightly tapered longitudinally of the sleeve to wedge the sleeve in place, as the edge of the hole rides up onto the beads. To prevent the sleeve from slipping through the hole, at least one of the beads is embossed near its end with a raised shoulder 15. The two-step embossing may be easily pressed in the walls of the sleeve by die punches, it having been found convenient in manufacture to emboss the flat sheet metal blanks from which the sleeves are made before they are rolled into cylinders and seamed along one side by welding or by the conventional lock seam. In embossing and drawing out the metal as shown, the sides of the blank are sometimes pulled in. When my cathode must be made of very thin sheet metal it is preferred first to draw the beads 14 and shoulder 15, then trim the sides of the blank to the proper size, and then roll into cylinders and form the seam. Seamless cathode tubing may be embossed from the inside with suitable mandrels. For most purposes three beads for centering the sleeve in its hole are sufficient and only one bead need be embossed at its end for providing a positive stop for the sleeve. Each of the beads may of course be embossed at its end with the raised

shoulder. A cathode sleeve with an outside diameter of .045 inch and a wall thickness of .002 inch when provided with three beads .005 inch high, one of which is embossed at its end to a height of .009 inch, is easily slid into its slightly oversize spacer hole about .05 inch in diameter without scratching the active metal coatings. The beads automatically center the sleeve in the hole as the shoulder 15 comes to rest on the spacer. A cathode tab fixed to the lower end of the sleeve and to a lead-in wire may hold the sleeve against removal.

My improved cathode sleeve is easy to manufacture and is easy to mount in an electrode assembly without damage to the surface of the cathode. My improved sleeve is firmly held in centered position in the assembly and is fixed against longitudinal movement.

I claim:

1. A cathode for an electron discharge device comprising a metal tubular cylinder, an integral embossing in the wall of said cylinder, said embossing having two steps, one step being farther above the surface of the cylinder than the other step.

2. An electron discharge device comprising a flat insulating spacer with an opening, a cathode sleeve extending through said opening, a bead for spacing said sleeve from the side of said opening and a boss on said bead overlying the edge of said opening.

3. In an electron discharge device, an insulating spacer with an opening, a sleeve extending through said opening, a bead on the side of said sleeve in said opening for spacing said sleeve from the side of said opening, and means for preventing longitudinal movement of said sleeve in one direction through said opening comprising a boss on said sleeve of greater height than said bead, said boss overlying the edge of said opening.

4. In combination a tubular cathode, a pair of spacers, said cathode being supported in registering openings in said spacers, the opening in one spacer being larger than the outside diameter of said sleeve, a raised bead on the side of said sleeve in said one of said openings, and a boss on said sleeve overlying the edge of said opening.

5. A cathode for an electron discharge device comprising a metal tubular cylinder, at least three elongated and relatively narrow beads extending longitudinally of said cylinder spaced circumferentially around the wall of the cylinder, one of said beads having adjacent its end and integral therewith a raised portion of greater height than said bead.

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