March 7, 1944. C. HERZOG 2,343,457

METAL ENVELOPE RADIO TUBE

Filed Nov. 28, 1942

Fig. 1.

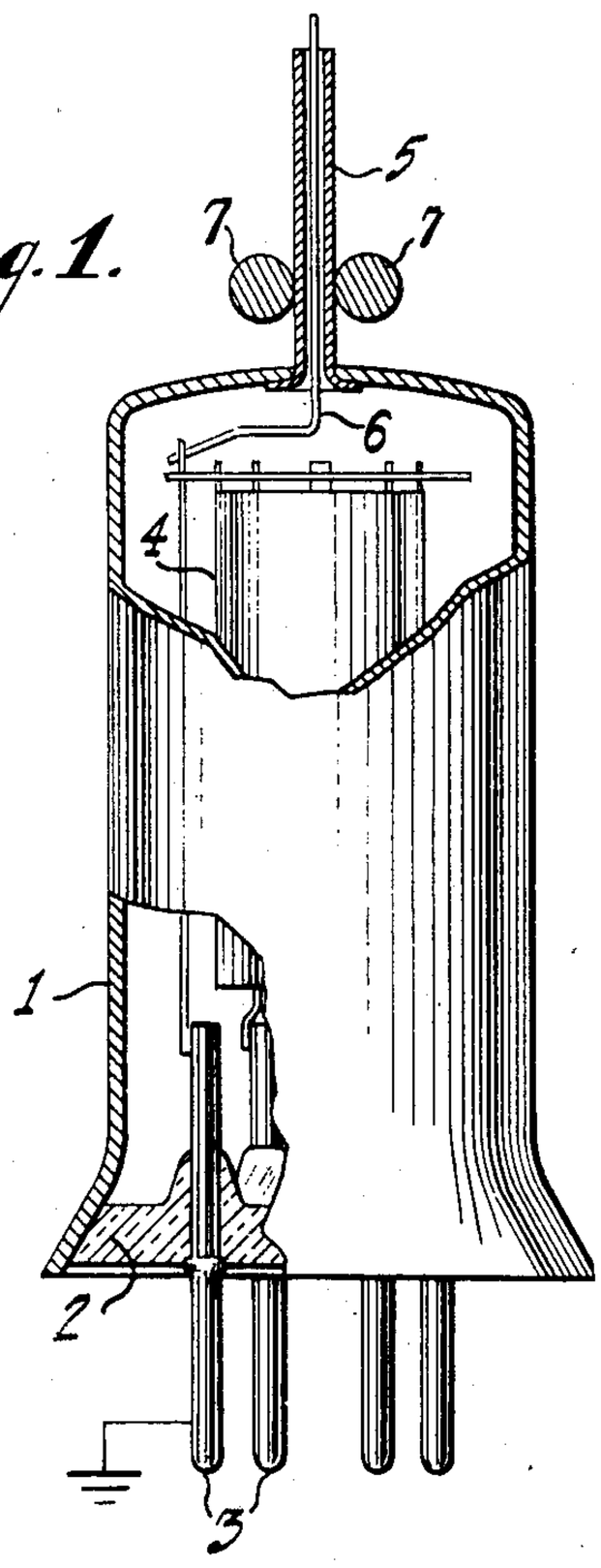
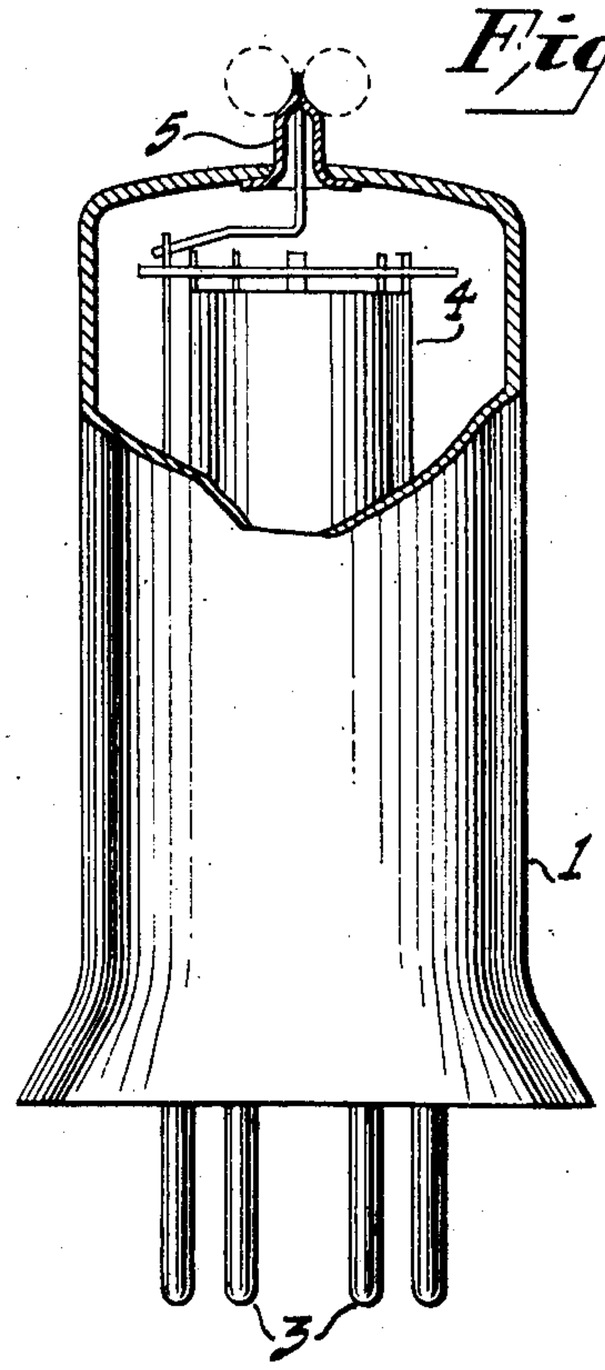


Fig. 2.



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METAL ENVELOPE RADIO TUBE

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3 Claims. (Cl. 250—27.5)

My invention relates to electron discharge devices, particularly to radio tubes with metal envelopes.

For electrical reasons the metal envelope of a radio tube should be grounded, and for convenience the envelope should be connected to one of the insulated contact pins in the base. Where the metal envelope is closed at one end by a glass header, it is difficult to obtain a reliable electrical connection between the envelope and one of the pins. The sliding contact of spring fingers against the inner surface of the envelope is unsatisfactory, open circuits often being caused by defective springs or by metal oxides on the metal. External connections from the envelope to the base pins across the insulation are undesirable for mechanical reasons.

The object of my invention is an improved radio tube with a metal envelope having a solid internal electrical and mechanical connection between the envelope and a base pin on the envelope.

The characteristic features of my invention are defined in the appended claims and one embodiment thereof is described in the following specification and shown in the accompanying drawing in which Figure 1 is an elevational view, partly in section, of an unfinished radio tube embodying my invention, and Figure 2 is an elevational view of a completed radio tube constructed according to my invention.

The particular radio tube chosen for illustrating my invention and shown in Figures 1 and 2 comprises a metal envelope 1 of the cup-shaped shell type closed at one end with a glass header tube 2, preferably of the glass disc or button type. The periphery of the glass header 2 is hermetically sealed directly to the inner surface of the metal shell adjacent its rim. Lead-in conductors 3 are sealed through the header and are joined at their inner ends to the various electrodes of the electrode assembly 4. The outer ends of the lead-in conductors are preferably of sufficient mechanical rigidity to serve as contact pins for insertion in conventional tube sockets. A metal exhaust tube 5 communicates with the interior of the envelope and is preferably attached to the end of the envelope opposite the header. A wire 6 extends from the electrode assembly into and through the exhaust tube.

In manufacture the electrodes are assembled as a unit and are mounted on the inner ends of the lead-in conductors 3. The electrode assembly is telescoped into the envelope, the wire 6 attached to the electrode assembly being guided into the exhaust tube, and the rim of the header is brought into registry with the lower end of the shell and sealed. The outer end of the exhaust tube is now connected to vacuum pumps in the usual way and the envelope exhausted to the desired degree of vacuum. According to one characteristic feature of my invention the metal exhaust tube is then squeezed off to permanently seal the evacuated envelope and to sever the exhaust tube close to the envelope. As more fully described in the copending application of Garner and Bricker, Serial No. 417,424, filed November 1, 1941, assigned to the assignee of this application, sufficient pressure may be easily applied to opposite sides of the exhaust tube to collapse the sides together and press them into welded contact. If desired, heat may be applied as in electrical resistance welding. The wire 6 between the collapsed sides of the exhaust tube is squeezed off with the exhaust tube and the outer end of the wire becomes an integral welded part of the sealed end of the exhaust tube. The wire, hence, becomes electrically and mechanically connected to the metal envelope and establishes a connection to one of the pins 3 in the base of the tube, as well as to any desired electrode in the envelope.

The exhaust tube 5 and wire 6 are preferably of the soft workable metal, such as copper, brass, nickel, tin or workable alloys of these or other metals. Copper, for example, is easily pinched off and hermetically sealed between two parallel hardened steel shafts 7, such as drill rods. The drill rod, embedded in iron blocks, can be pulled together by draw bolts. Good results have been obtained in sealing and pinching off copper exhaust tubes of standard sizes for radio receiving tubes telescoped over .015 inch copper wire with drill rods ¼ inch in diameter. Commercial machine bolts ½ inch in diameter with conventional V-cut threads were found sufficiently strong to apply the welding and pinch-off pressure for the copper wire and exhaust tube. The copper wire squeezed in the copper exhaust tube showed no tendency to create leaks through the pinched-off sealed region. The size of the wire 6 may, if desired, be made sufficiently large to mechanically brace the upper end of the electrode assembly and hence obviate the usual electrode-to-bulb spacer. The wire 6 may be preformed with an offset bend or other desired shapes to accur-

ately anchor the assembly centrally in the envelope.

My improved radio tube has a permanent internal connection between the metal shell and the inner electrodes and a grounding pin in the base of the tube, and is easy to manufacture.

I claim:

1. An electron discharge device comprising a tubular metal envelope, a glass header closing one end of said envelope, contact pins insulatingly carried on said header, a metal exhaust tube attached to the opposite end of said envelope and communicating with the interior of the envelope, said exhaust tube being hermetically sealed near the envelope, a wire extending into said exhaust tube and electrically connected to one of said pins, the wire and opposite walls of the tube being welded together.

2. An electron discharge device comprising a tubular metal envelope, an electrode assembly in said envelope, a metal exhaust tube attached to and communicating with the interior of said envelope, a lead-in conductor insulatingly sealed in said envelope, a wire, said wire being electrically connected at one end to said contact pin and extending at its other end into said exhaust tube, the exhaust tube and wire being welded together in a homogeneous mass.

3. An electron discharge device comprising a tubular metal envelope, a glass disc header closing one end of said envelope, a metal exhaust tube attached to the other end of said envelope, a plurality of lead-in conductors insulatingly sealed in said header, an electrode assembly mounted on the inner ends of said conductors, means to connect the metal envelope to one of said lead-in conductors comprising a wire extending into said metal exhaust tube, the side walls of the tube being pressed into contact with the wire and hermetically closed, the wire being electrically connected to one of said lead-in conductors.

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