March 20, 1951 A. BINNEWEG, JR 2,545,759

SUPPORTED ELECTRODE METAL RADIO TUBE

Filed Nov. 24, 1947

Fig. 1.

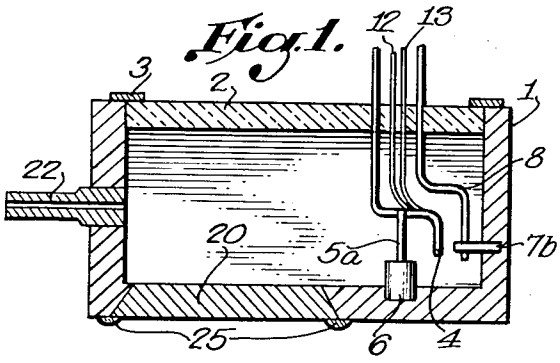


Fig. 2.

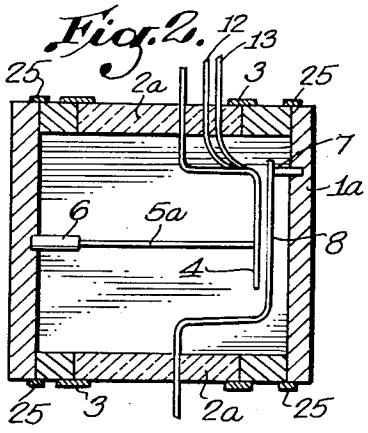


Fig. 3.

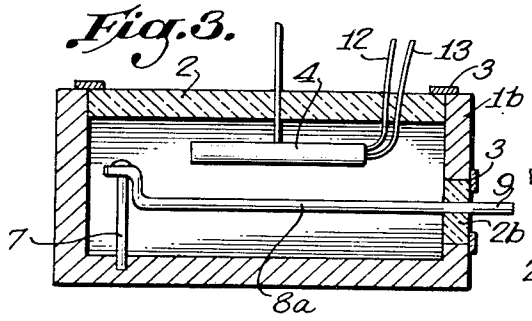


Fig. 4.

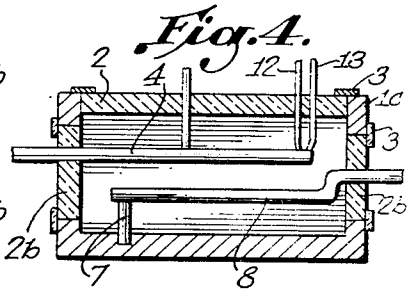


Fig. 5.

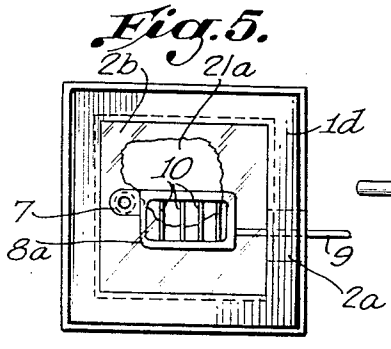


Fig. 6.

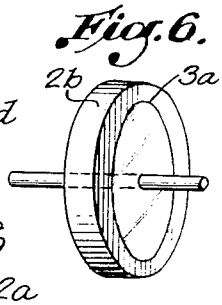


Fig. 7.

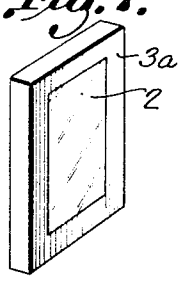


Fig. 8.

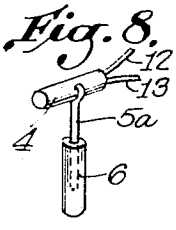


Fig. 9.

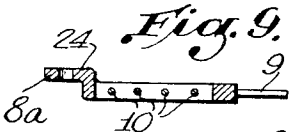


Fig. 10.

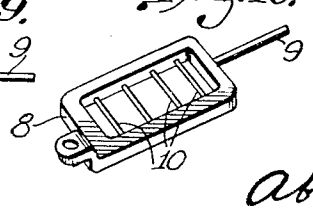
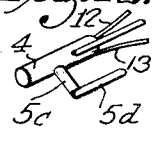


Fig. 11.

Fig. 12.



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SUPPORTED ELECTRODE METAL RADIO TUBE

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Application November 24, 1947, Serial No. 787,785

2 Claims. (Cl. 250—27.5)

1

The present invention relates to a radio tube having a metal envelope, ordinarily here used as the anode, and other electrodes within said envelope one or more of which electrodes are supported by both the lead to the electrode and an auxiliary means of support such as a pillar of insulation in which a stiff wire is imbedded for a short distance. If the electrode is made stiff, however, it may not need the auxiliary means of support.

As objects and advantages of this invention:

An object of this invention is to simplify the manufacture of strong and compact ultra-high radio-frequency radio tubes employing simple means for lead entry and generally a simple construction.

Another object is to provide simple airtight radio tubes having metal envelopes.

An object is to produce better metal tubes for ultra-high frequencies.

An added object is to provide properly supported electrodes within metal envelopes.

And a combined object is to produce better metal radio tubes for ultra-high radio frequencies having rigid internal support as well as short and direct leads to the outside so reducing capacity between leads and between leads and envelope of the radio tube.

My tube as described and illustrated differs from former tubes in structure and design with electrodes more compactly arranged than in the ordinary tube. Essentially the tube is a shallow metal box with an insulating cover and flattened electrodes, the bottom of the box itself forming the anode. Special inserts in opposite walls for leads make possible a still more compact and efficient tube with reduced capacity effects.

Fig. 1 is a vertical view of one form of the invention showing bent electrodes supported as shown. **22** is the exhaust tube in Fig. 1.

Fig. 2 is a vertical view of another form of the invention showing the electrode leads entering from opposite sides of the envelope.

Fig. 3 is a vertical view of another form of the invention showing top and side lead entry to the electrodes. The grid is bent in this form of the invention.

Fig. 4 is a vertical view showing both sides as entrances for the leads to the electrodes.

In each of the four drawings as listed above, the electrodes have an auxiliary means of electrode support in addition to the lead that supports the electrode and brings the current to it. It is obvious that, if the electrode leads are very stiff, no auxiliary supports may be needed for any of the electrodes.

2

Fig. 5 is a plan view of a radio tube illustrating the invention. Fig. 1, Fig. 2, Fig. 3, and Fig. 4 have square envelopes as shown in plan view of Fig. 5.

The entering insulators to any of the radio tubes illustrated, are circular as in perspective view in Fig. 6, which shows a lead sealed in the insulator, or square as in perspective view Fig. 7 which may also have a lead sealed into it as shown for the insulator of Fig. 6.

Fig. 8 is a perspective view of a cathode **4** supported on a lead **5***a* which is imbedded in an insulating rod **6**.

Fig. 9 is a vertical partially sectioned view of a grid electrode such as shown in Fig. 10 perspective view of the same grid without the end bend **24**.

Fig. 11 shows a cathode in perspective with a lead attached at its center, while Fig. 12 also shows a cathode in perspective having a lead attached at one end, and also a lead attached to its center which lead may be bent as shown.

The cathode in any of the radio tubes are simple metal cylinders having internal electric heaters which have two external leads **12** and **13**. The metal cylinder of the cathode is covered with electron-emitting material as usual.

Fig. 1 shows the metal envelope **1**, the glass insulator **2** having two leads sealed in it as shown. See Fig. 6 for a sealed lead construction. **3** is a metal ring around and on the glass insulator which ring is sealed by soldering it airtight, to the metal envelope all around. A bent lead supports the grid which is nearest the flat wall of the envelope, and a rod support **7B** also supports the end of the grid **8**. Fig. 10 shows the grid **8** with a hole in its end into which the rod is expanded or riveted to hold the grid end. A hole is drilled on the inside of the metal envelope wall, the insulating supporting rod is then driven tightly into this hole. The hole in the end of the grid is fitted over the rod. In Fig. 1, the insulator **6** with metal lead **5***a* of Fig. 8 is used to support the cathode or cathode lead.

Fig. 2, **1***a* the metal envelope, **2***a* the top and bottom circular insulators shown in Fig. 6, grid **8** near the wall with bent lead, and cathode **4** near it, also with bent lead. **7** is a support as in Fig. 1 (insulator **6** of Fig. 8) and 6 is an insulator as in Fig. 8 having a wire **5***d* (as in Fig. 8) imbedded in an insulating rod. Rings of metal are soldered over on to the metal of the radio tube. Note that in Fig. 2 insulators **2***a* are smaller than the insulator **2** in Fig. 1. In Fig. 2, metal pieces are welded inside the envelope to reduce the size of the insulator openings. **25** are welds in Fig. 1 and

Fig. 2. Similar openings and welds can be made in any of the other envelopes for assembly purposes.

In Fig. 3, there is an insulator 2b at the side of the envelope and also a top insulator, 2. Grid 8a is supported by a stiff lead 9 from the side of, and an insulator 7 from the bottom of, the envelope 1B. The cathode 4 is supported by a metal lead from the top of the envelope.

In Fig. 4, the cathode 4 has a side insulator 2b and the grid 8 which is the lowest electrode, also has a side insulator 2b.

The heater leads are all brought out the top of the envelopes. Fig. 5 is a plan view showing envelope 1d, and insulator 2a in the wall. Grid 8a is supported by insulating pillar 7 and grid-lead 9. Grid wires 10 are shown plainly.

The assembly of this radio tube is as follows: For example, in Fig. 1, it is necessary to cut an opening 20 in the envelope, adjust and arrange the electrodes and insulators, then to weld the opening 20 shut again, care being taken that the welding heat does not damage the insulators by holding that part of the envelope under water while the welding is being done. In Fig. 5, a hole 21a in the bottom of the envelope shows how easily the assembly is made through the hole 21a. The hole is then welded closed from the outside of the envelope.

In Fig. 1, insulators 7b and 6 are first arranged in the envelope, then the assembly consisting of insulator 2 supporting the grid and cathode leads and electrodes is set down into the envelope, and sealed airtight such as by soldering the metallizing of this hard glass to the top rim of the alloy metal envelope. Previously, a hole 20 had been burned or otherwise formed in the bottom of the envelope. Small tools can be passed through opening 20 to form a head on the end of rod 7b to so hold the grid in place. 5a is also welded to the cathode or cathode lead. It is always possible to open the envelope at one or more places and so complete the internal electrode assembly of these radio tubes.

The metal envelopes are cast or formed of metal material of a suitable kind such as any alloy designed to have the same expansive qualities as the glass or other material insulator used.

In Fig. 1, the top insulator covers the entire opening. This insulator has a metallized ring around its outside which rim is soldered to the envelope all around. Fig. 2 is a similar envelope having top and bottom insulators set in, in a similar manner. Fig. 3 is similar having a top insulator and an insulator 2b cemented in a hole in the side of the envelope. Fig. 4 has two insulators 2b set in, one on each side, like the insulator 2b of Fig. 3.

Fig. 5 shows a grid mounted on an insulating peg for additional support over the metal base. Circular grids or anodes are supported also on insulating supports as illustrated.

The present design gives the heat generated a large area for dissipation. Leads are short and direct with very high frequency operation. Envelopes have a flat area near the grid.

I claim:

1. A radio tube comprising a shallow metallic receptacle, the bottom of which constitutes an anode, an insulating cover for said receptacle rendering it air-tight, insulating inserts in opposite walls of said receptacle, a flattened grid above the bottom of said receptacle and parallel thereto, a stiff lead attached to one end of said grid and passing through one of said inserts, a short insulating peg attached to the bottom of said receptacle and supporting the other end of said grid, a cathode parallel to the cover of said receptacle, a cathode lead passing through the other of said inserts and filament leads passing from said cathode through the cover of said tube.

2. A radio tube comprising a shallow metallic receptacle, the bottom of which constitutes an anode, an insulating cover for said receptacle rendering it air-tight, insulating inserts in opposite walls of said receptacle, a flattened grid above the bottom of said receptacle and parallel thereto, a stiff lead attached to one end of said grid and passing through one of said inserts, a short insulating peg attached to the bottom of said receptacle and supporting the other end of said grid, a cathode parallel to the cover of said receptacle, a cathode lead passing through the other of said inserts, filament leads passing from said cathode through the cover of said tube, and a metal ring encircling the insulating cover and overlapping the lip of said metal receptacle and soldered thereto.

ABRAHAM BINNEWEG, JR.

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