May 4, 1948. A. BINNEWEG, JR 2,440,889

RADIO TUBE INSULATION

Filed Aug. 15, 1944

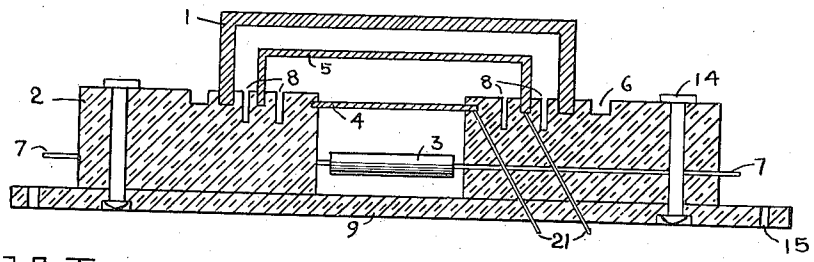


Fig. I

Fig. III.

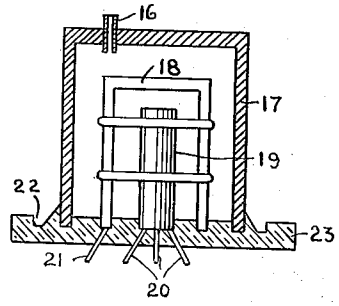
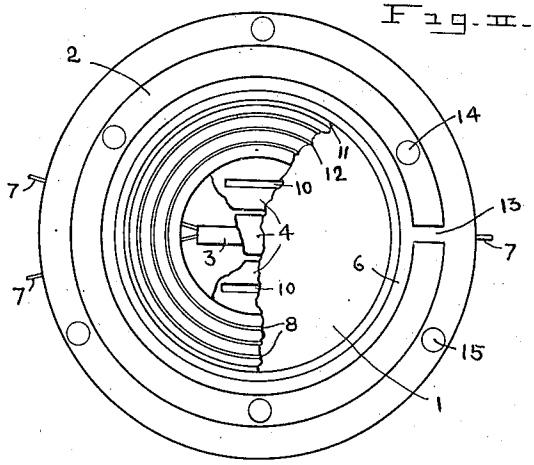


Fig. III



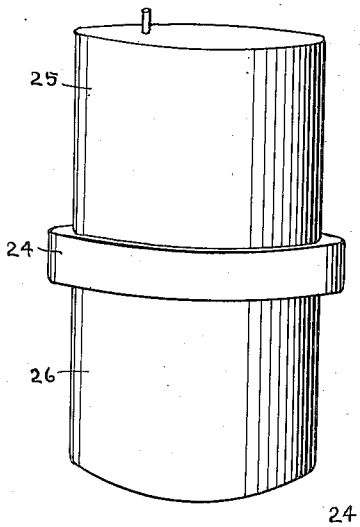


Fig. IV

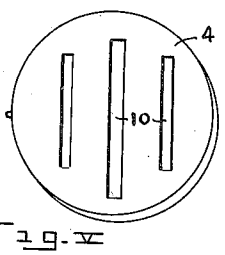


Fig. V



Fig. VI

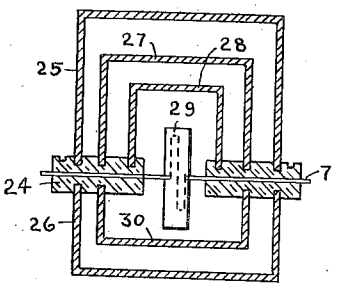


Fig. VII

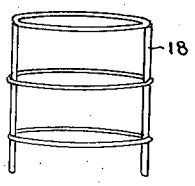


Fig. VIII

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RADIO TUBE INSULATION

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12 Claims. (Cl. 250—27.5)

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The present invention relates to radio tubes of the ultra-high-frequency type. The receptacle consists of metal and dielectric materials joined together. The elements have short leads, and are simple, the anode being part of the receptacle of the tube.

One object is to provide an anode easily cooled and easily connected since one of its sides is exposed. The usual tube, glass enclosed, has leads passing through the glass walls. This tube consists partly of metal and partly of dielectric material, such as porcelain. The volume of the tube is small and the construction such that the total element inductance is quite low. Bunching of leads is avoided to reduce inter-lead losses, and radial arrangement is preferred. Circular grooves between elements in the insulation permit the application of higher voltages to the tube. The tubes are simple and easily assembled.

Some of the elements are flat, others are cylindrical. The anode preferably has one surface exposed to the air for cooling. Provision is made for two grids, one preferably flat and the other cylindrical.

Fig. I is a vertical section of the tube showing all electrodes in place. Fig. II is a plan view with parts of the anode and grid cut away to expose the cathode at the bottom. Fig. III is a vertical section of a modification. Fig. IV is a perspective view of a second modification. Fig. V is a perspective view of a flat grid. Fig. VI is a perspective of the cathode. Fig. VII is a vertical section of a modification of Fig. IV. Fig. VIII is a perspective of a cylindrical grid as used in the modification shown in Fig. III.

The anode 1 is a flat plate or cupped cylinder of metal with its lower edge cemented in a circular groove in the porcelain block 2 or cemented to the top of the block. It forms the cover of the envelope. Cathode 3 is supported near the base of the tube by heavy leads 7. A flat, circular, perforated grid 4, horizontally supported at its edge by a lateral groove in the block 2, lies above the horizontally disposed cathode 3. A second grid 5 similar in shape to the anode 1, but of lesser height and diameter, has its lower edge resting in a groove of block 2. There could be two flat grids like 4.

A groove 6 if used in the upper surface of block 2 encircles the anode cap 1; and a short channel 13 if used serves to drain off the water sprayed upon cap 1 and collected in the circular groove 6, after its cooling effect upon the anode 1.

Other deep circular grooves 8 in the upper surface of block 2, between the electrodes, serve to

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increase the insulation between them. A base plate 9, affixed by cement and bolts 14 to the block 2, serves as an airtight closure below for the envelope. Holes 15 serve for screw attachment of the tube to a bench or cabinet. Base plate 9 could be of metal, the element leads then passing out the sides through the insulation.

Fig. III represents a modified form of the device in which 16 is a small tube for exhausting the envelope of air, 17 a cylindrical anode, 18 a cylindrical wire grid, 19 a cylindrical cathode vertically arranged, 20 cathode leads, 21 the grid lead, 22 the drainage groove if used, and 23 the porcelain base.

Fig. IV shows a second modification having a dielectric block 24, an anode cap 25, above, and an anode cup 26 below. Fig. VIII, the same tube in section, shows the two anodes 25, 26, grids 27 and 28, cathode 29, and a lower grid 30.

In the tube of Fig. I and also in the modified forms the elements are sealed in the insulating base. Grid 4 may, of course be dispensed with if desired, as in many circuits the tube would operate with grid 5 alone. By removing base 9 of Fig. I and adding other cylindrical electrodes below one has a tube similar to the one represented in Fig. VII.

The modification shown in Fig. III shows a taller cylindrical anode, a wire grid, and a vertical cathode all resting in grooves or depressions in the dielectric base in a similar manner to the arrangement of Figures I and VII. The cathode leads of Figs. I and II are shown radially arranged to lower inductive losses between them.

For cooling, water may either be dripped or sprayed upon the top of the tube and carried off by the groove 6 and the channel 13. Both upper and lower electrodes shown in the modification (Fig. VII) are cemented in circular grooves in the same manner as in Fig. I or Fig. III.

The draining grooves may be omitted in small tubes. The illustrations show different numbers of electrodes in the different modifications. Obviously still other fewer and greater numbers and arrangements could be devised without departing from the general plan of my invention.

Fig. VII has a dielectric ring 24, two grids 27 and 28 above, and a third grid 30 below, with the cathode 29 between. These grids are cylindrical and all are seated in circular grooves in the ring 24 of dielectric material. Removal of the grids would have the result of converting the tubes into rectifiers.

I claim:

1. A radio tube having an envelope, a flat disc

forming the base of said envelope, a dielectric ring upon said disc, and sealed thereto, a horizontal cathode across said dielectric ring, circular grooves in the upper surface of said ring, a cylindrical cap above said ring fitting into one of said grooves, and a radial channel connecting with the outer of said grooves for drainage.

2. A radio tube having a dielectric receptacle, a cathode within said receptacle, retaining grooves in said receptacle, grid and anode elements with edges secured in said grooves, and other grooves between said retaining grooves functioning as insulation grooves.

3. A radio tube having a cup-shaped dielectric receptacle, a cathode athwart said receptacle, a flat grid above said cathode also athwart said receptacle, a groove in the upper rim of said receptacle, and a cylindrical cap fitting in said groove rendering the tube airtight.

4. A radio tube having an envelope, a flat disk forming the base of said envelope, a dielectric ring upon said disk and sealed thereto, concentric grooves on the upper surface of said ring, a perforated cylindrical cap fitting in one of said grooves, a closed cylindrical cap fitting over said first cap, spaced therefrom and also fitting into one of said concentric grooves, and a third groove between the cap holding grooves.

5. A radio tube having an envelope, a flat disk forming the base of said envelope, a dielectric ring upon said disk sealed thereto, a horizontal cathode athwart said dielectric ring, leads supporting said cathode, a horizontally arranged groove upon the inner surface of said ring, a flat circular grid with its rim held by said groove, two concentric grooves on the upper surface of said ring, a perforated grid cylindrical cap fitting in the inner of said grooves, and a metal anode cylindrical cap of greater height than said grid cap fitting in the outer of said grooves and closing the tube airtight.

6. A radio tube comprising a heavy dielectric ring, a disk sealed to the bottom of said ring and forming a closure therefor, concentric grooves on the upper surface of said ring, a circular anode cap sealed in one of said grooves, a grid cap sealed in another of said grooves, and cathode and grid electrodes athwart said ring between said bottom disk and said upper caps.

7. A radio tube having a dielectric receptacle, a cathode within said receptacle, retaining grooves in said receptacle, grid and anode electrodes with edges secured in said grooves, other grooves between said retaining grooves functioning as insulation grooves, and a groove on the upper surface of said dielectric receptacle for cooling.

8. A radio tube having an envelope consisting of a dielectric ring, metal caps sealed to the top and the bottom of said ring, the outer of said caps sealing the envelope airtight, and serving as anodes and the inner of said caps being perforated and serving as grids, a cathode also within the envelope.

9. A radio tube having an annular dielectric casing, a disk closing the bottom of said casing in an air-tight manner, a horizontally disposed cathode athwart said casing, a flat perforated grid athwart said casing above and spaced from said cathode, a second grid of cylindrical shape above said flat grid, forming a cylindrical cap thereabove, and insulated therefrom, and a cylindrical anode forming a cap over said cylindrical grid and sealed to said casing to form an air-tight top closure for the tube.

10. A radio tube having a dielectric envelope, cathode, grid and anode electrodes within and athwart said envelope with edges supported thereby, and insulating grooves in the wall of said dielectric envelope between the supported edges of said electrodes.

11. A radio tube comprising a heavy dielectric ring, a disk sealed to the bottom of said ring forming a closure therefor, an anode cap sealed to the top of said ring forming an air-tight upper closure therefor, cathode and grid electrodes athwart said ring, and deep insulation grooves in said dielectric ring between said anode cap and said grid electrode.

12. A radio tube comprising an annular dielectric casing, a closure for the bottom of said casing, a cathode athwart said casing near the center, a perforated disk athwart said casing near the top functioning as a grid, an anode cap forming an air-tight closure for said casing above, and a deep insulation groove in the wall of said casing between edges of said grid and anode elements.

ABRAHAM BINNEWEG, JR.

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