

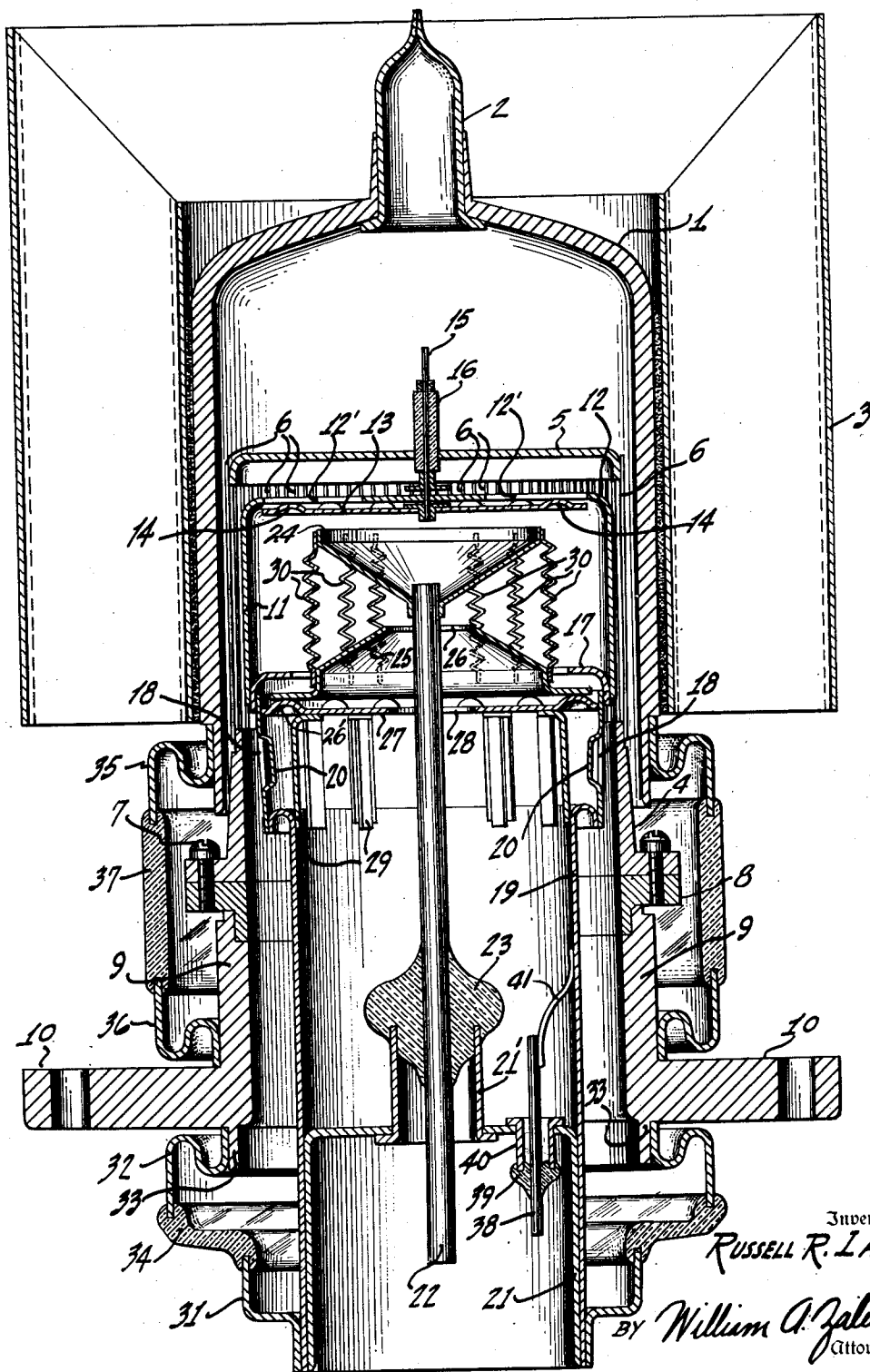
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THERMIONIC CATHODE AND HEATER

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THERMIONIC CATHODE AND HEATER

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6 Claims. (Cl. 250—27.5)

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This invention relates to ultra high frequency electron discharge devices capable of delivering high power.

Systems operating at frequencies of 500 to 1200 megacycles, for example, sometimes demand electron tubes at these frequencies with power outputs of 500 to 1000 kilowatts. At such high power output the electrodes must have relatively large areas. This imposes the problem of uniformly heating the cathode.

It is an object of this invention to provide a means for uniformly heating a cathode of large area.

It is a further object of the invention to provide a cathode and heater structure in an electron tube that concentrates the heat on the thermionic active surface of the cathode with shields for blocking passage of the heat to other parts of the tube.

Other objects of the invention will appear in the following specification, reference being had to the drawing in which:

The figure is a longitudinal axial section of a tube embodying the invention.

Referring to the drawing the anode 1 which may be copper, for example, is a cylinder open at the bottom and closed at the top except for the exhaust tubulation 2. A series of heat radiating vanes spaced apart are silver soldered or otherwise attached to the outside of the anode, so that air can be forced from blowers, not shown, between the vanes extending longitudinally of the axis of the tube. The construction of the vanes is not part of the invention and they have been generally indicated only, at 3.

The grid assembly comprises a conical drawn copper base 4 and a nickel cap 5 between which extend a plurality of grid wires 6 forming a grid surface coaxial to the anode. These wires may be spot welded to the cap and base or joined thereto in other ways. The grid base 4 is fastened, for example, by screws 7 to a copper ring 8 which is joined as by soldering or welding to the copper cylinder 9 having a grid lead flange 10.

Cathode cylinder 11 is coaxial with the grid and anode surfaces and the cylindrical surface facing the grid wires is made thermionically active by the usual oxide coatings. The end 12 of the cathode cylinder has openings 12' for reasons to be explained below. A heat baffle or shield 13 is stamped with a plurality of round beads or elevations 14 to abut against the end 12. A centering rod 15 passes through the center of the cathode end 12 and grid cover 5 to maintain accurate spacing between the grid surface and the therm-

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ionically active cathode surface coaxial. Insulator 16 electrically isolates the rod 15 from the grid cover. The apertures 12', and beads 14 are for the purpose of reducing heat conduction from cathode to grid by the centering rod 15, providing passageways for gaseous products during exhaust.

The cathode cylinder is welded, soldered, or otherwise secured to the outside of the downwardly extending flange of stiffening ring 17 and a plurality of spaced cathode support tabs 18 are similarly joined at one of their ends to the inside of this flange, the other ends being attached to the turned over rim of the cathode support cylinder 19. The support tabs may have a stamped offset 20 to increase their rigidity. An end cup 21 fits into the bottom end of cathode support cylinder 19. A heater eyelet 21' is welded or soldered at the center of the end cup and a heater lead 22 is sealed to the eyelet by glass bead 23. The heater lead is attached to the center of the upper metal heater cone or heat shield 24. A lower metal heater cone or heat shield 25 has a central opening 26 through which lead 22 passes without making contact with the shield. The rim at the base of the shield 27 is attached to beads or elevations 28' of radiation baffle or shield 27, which has a central opening 28 spacing it from the heater lead. A plurality of heater return tabs 29 are welded at one of their ends to the shield 27 and at the others of their ends to the inside of cathode support cylinder 19. Heater coils 30 are welded at one of their ends to cone 24 and at their other ends to cone 25.

A cathode sealing ring 31 is welded or soldered to the cathode support cylinder 19 and a grid sealing ring 32 S-shaped in cross-section is similarly attached to an integral ring 33 on grid lead flange 10. A glass ring 34 is sealed to flanges 31 and 32. Sealing rings 35, 36 of S cross-section are welded or soldered to anode 1 and the cylindrical surface of grid support 9 respectively. A glass ring 37 is sealed to the flanges 35, 36 which completes the sealing of the tube except for the exhaust tubulation 2, which after the tube has been exhausted is pinched off preferably by the cold weld method disclosed in the application of Garner and Bricker, filed November 1, 1941, Serial No. 417,424, now U. S. Patent 2,427,597 issued September 16, 1947, but it may be otherwise sealed.

The heater current passes through lead 22, cone 24, the coils 30 in parallel, cone 25, shield 27, tabs 29 and cathode support cylinder 19 to the other terminal at 21 or 31. The heater coils 30 have their heat reflected outwards by cones 24, 25

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against the cathode and substantially no heat from the coils passes through shield plates 13 and 27 to other parts of the tube.

The grid is insulatingly supported at one end on the cathode end 12 by center rod 15 and at the other end is supported in fixed relation to the cathode through its rigid rings 4 and 9 and seal rings 32, 34, 31, cylinder 19, support tabs 18 and stiffening ring 17. The grid and cathode are held coaxial to the anode in proper spaced relation by seal rings 35, 36, and 37. Thorough cooling of the grid is obtained by the massive connections 4, 8, 9 and 10 to the exterior of the envelope.

The greater lead 38 is sealed at 39 to a nipple 40 welded or soldered to the cup 20. By applying potential between 20 and 38 the getter wire 41 is heated and the getter vaporized in known way for cleaning up the residual gas.

I have disclosed a particular embodiment of my improvement but this is by way of example only and various modifications may be made without departing from the spirit of the invention.

What I claim as new is:

1. A cathode assembly comprising a cathode cylinder having a thermionically active outer surface, a hollow metal cone coaxial with said cathode cylinder and having a base at one end of said cathode cylinder and an apex facing the other end thereof, a second hollow metal cone coaxial with the first cone having a base adjacent to the other end of the cathode cylinder and an apex adjacent the apex of the other cone and a plurality of heater wires extending from the base of one cone to the base of the other cone and conductively connected thereto.

2. A cathode assembly comprising a cathode cylinder having a thermionically active outer surface, a metal cone coaxial with said cathode cylinder and having a base conductively connected to one end of said cathode cylinder and an open apex facing the other end thereof, a second metal cone coaxial with the first cone having a base adjacent to the other end of the cathode cylinder and an apex adjacent the apex of the other cone, a plurality of heater wires extending from the base of one cone to the base of the other cone and conductively connected

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thereto, and a lead wire extending through said open apex and conductively connected to the other apex.

3. A cathode assembly comprising a cathode cylinder having a thermionically active outer surface, a hollow coaxial support cylinder, tabs supporting said cathode cylinder on said support cylinder at spaced points, a heater unit inside said cathode cylinder, a heat shield between said heater and the end of said support cylinder and tabs supporting said shield on said support cylinder at spaced points.

4. A cathode assembly comprising a cathode cylinder having a thermo active outer surface, top and base heat shields at the ends of the cathode cylinder and inside thereof, heater wires inside said cathode cylinder between said shields having one of their ends connected to the base shield, a cathode support cylinder, a plurality of tabs supporting the base shield on one end of said support cylinder, a plurality of tabs supporting said cathode cylinder on said end of the support cylinder, a conductor connected to the other ends of said heater wires and extending through said support cylinder and a sealing member between the other end of said support cylinder and said conductor.

5. A cathode assembly comprising a cathode cylinder having a thermionically active outer surface, a metal cone within said cylinder having its base at one end thereof, a metal heat shield at the other end having a central opening, a conductor passing through said opening, and joined to said cone, and heater wires extending from the base of said cone to said shield.

6. A cathode assembly comprising a cathode cylinder having a thermionically active outer surface, a metal cone within said cylinder having its base at one end thereof, a metal heat shield at the other end having a central opening, a conductor passing through said opening and joined to said cone at its apex, heater wires extending from the base of said cone to said shield, and a conducting cylinder around said conductor connected to said shield.

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No references cited.