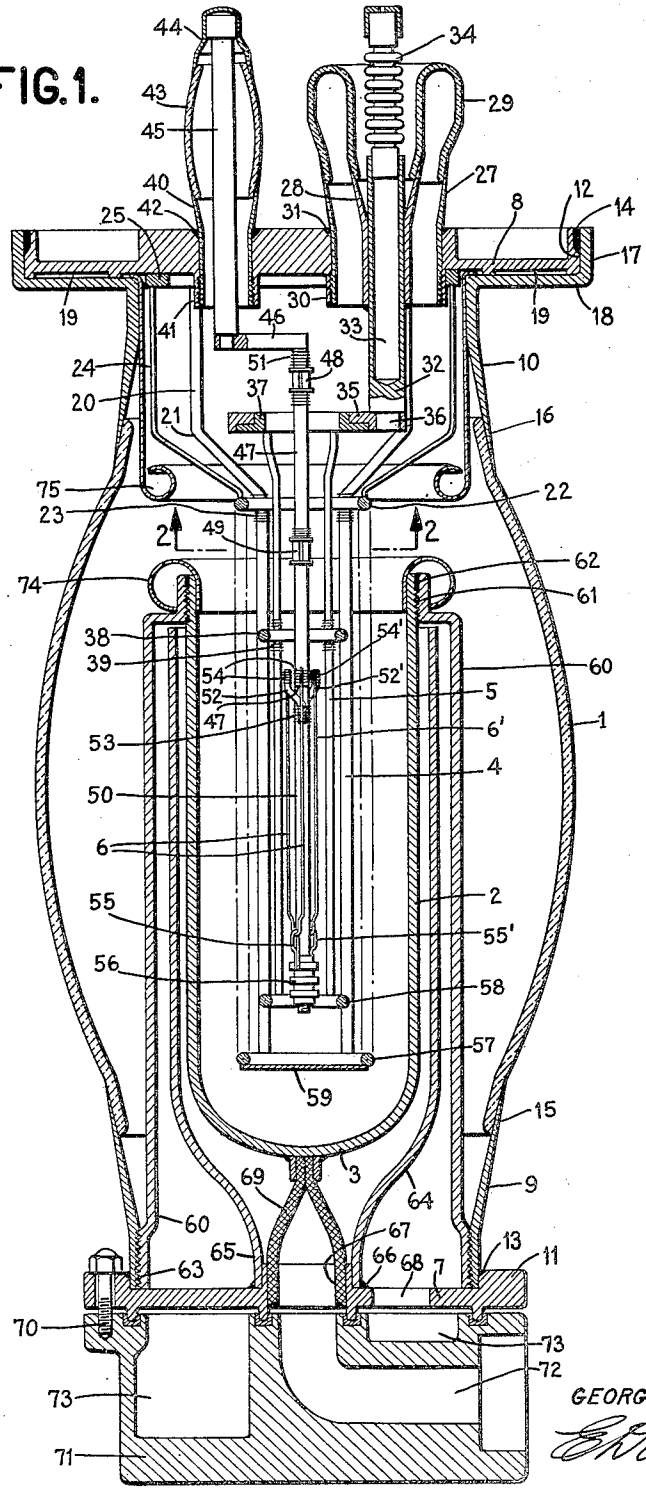
April 27, 1943. G. P. CHEVIGNY 2,317,442

ELECTRON DISCHARGE TUBE

Filed April 2, 1941 2 Sheets-Sheet 1

FIG. 1.



INVENTOR.
GEORGES P. CHEVIGNY

ATTORNEY.

April 27, 1943. G. P. CHEVIGNY 2,317,442

ELECTRON DISCHARGE TUBE

Filed April 2, 1941 2 Sheets-Sheet 2

FIG. 3.

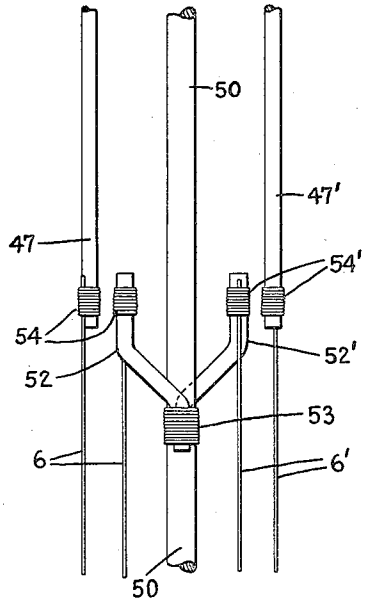
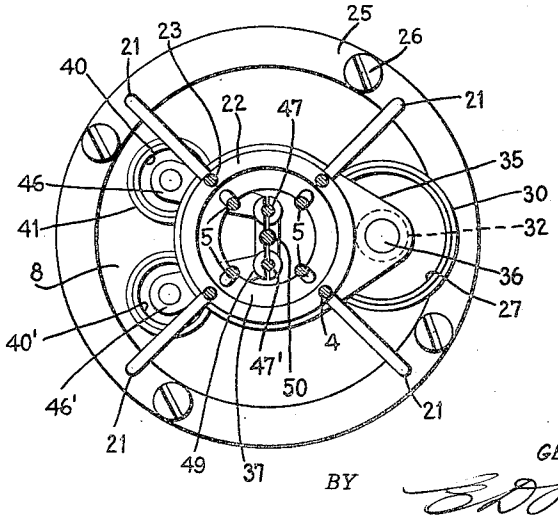


FIG. 2.



INVENTOR.
GEORGES P. CHEVIGNY

BY E. D. O'Shinney

ATTORNEY.

Patented Apr. 27, 1943 2,317,442

UNITED STATES PATENT OFFICE

2,317,442

ELECTRON DISCHARGE TUBE

Georges Paul Chevigny, New York, N. Y., assignor to International Standard Electric Corporation, New York, N. Y., a corporation of Delaware

Application April 2, 1941, Serial No. 386,514
In France March 30, 1940

6 Claims. (Cl. 250—27.5)

The present invention relates to electron discharge tubes and more particularly to power electron discharge tubes.

In tubes of this kind which are especially suitable as emission tubes intended for operating at high frequency, it is desirable to reduce to a minimum the capacities between the electrodes and the electrode connections and, for this purpose, to reduce to a minimum the lengths of these very connections and also the surfaces of the electrodes themselves. It is furthermore desirable to provide a screening of the tube elements with respect to the sources of feed when these tubes are intended to operate at very high frequencies.

The object of the present invention is consequently the providing of tube structures and designs of electrodes and electrode connections that have the above mentioned desirable features.

A power tube, according to one variation of the invention, may comprise a cathode, a control grid, and anode and auxiliary grids of which one at least takes the part of a screen, one end of the insulating protecting envelope of the tube being hermetically sealed by a conducting plate that serves as an electrical connection and as a mechanical support for the anode. Cooling means are associated with the anode located within the insulating envelope of the tube, and the other end of the tube has secured to it hermetically another metallic plate that serves as output connection for the screen grid; this plate is provided with insulating hermetical ducts for the other tube electrodes. This last mentioned metallic plate may be connected direct to a conducting screen outside the tube without any interposed insulating material.

According to another characteristic feature of the invention, the anode is supported within the envelope by means of a cooling liquid circulation jacket which surrounds it and to which it is secured hermetically, this jacket being supported by the above-mentioned end conducting plate.

These features, as well as others, are explained in detail hereunder in the following description with reference to the appended drawings, in which:

Fig. 1 illustrates one example of an embodiment of a screen grid power tube that displays features of the invention;

Fig. 2 is a sectional view of a plane taken substantially along the line 2—2 of the tube of Fig. 1, the screens being omitted for greater clearness; and

Fig. 3 shows detail of the filament structure of the tube of Fig. 1 which gives a better view of the connection of the filament strips.

Referring to the drawings, and more particularly to Fig. 1, the tube structure selected for illustrating the invention is a power tetrode. Within an insulating protecting envelope 1 it comprises a cylindrical shaped anode 2 closed at one end, as shown at 3; a screen grid that consists of a winding (not shown) is supported by rods indicated at 4; a control grid that likewise consists of a winding (not shown) is carried by rods shown at 5 and a thermionic cathode that consists of two filament strands in series 6 and 6'.

The two ends of the insulating protecting envelope 1 have connected to them two metallic plates 7 and 8, e. g. of copper and these plates are hermetically sealed to the protecting envelope 1 by means of flaring sleeves 9 and 10, respectively, made of a metal such as copper. These sleeves 9 and 10 are respectively brazed at one end on rims 11 and 12 of the metallic plates 7 and 8, the tightness of the joint of each plate with its sleeve being furthermore reinforced by peripheral solderings 13 and 14, e. g. with tin. The other ends of the sleeves 9 and 10 are sealed to the ends of the insulating envelope 1 in any known manner, as shown at 15 and 16. It is to be observed that the metallic plate 7 on the anode side is connected to sleeve 9 by means of rim 11 which surrounds sleeve 9, while the metallic plate 8 at the other end is connected to sleeve 10 by rim 12 which cooperates with a peripheral rim 17 of sleeve 10 which is of such a shape that it has an annular surface 18 that cooperates with the corresponding surface of plate 8 so as to form between these two surfaces a narrow annular compartment 19 which is connected to the inside of the tube in order to insure pumping between the plates. This extension of the annular plate 8 around this end of the tube provides a screening effect which may be increased by means of another annular metallic plate (not shown) that is connected direct to rim 17, all in such a way that the screen constituted in this way displays practically no electrical discontinuity.

The screen grid is electrically and mechanically connected to the metallic plate 8 by means of rigid rods 20, four in the example shown in the drawings (Fig. 2). These rods are bent as shown at 21 in order to follow the line of the fictitious cylinder of the screen grid along which they extend, as already described. They are held

in position at this point by a rigid metallic ring 22 on which they are secured, e. g. by means of soldered beads 23. Connecting wires 24 connect this ring 22 to a conducting annular member 25 in which the rods 20 are secured, the mechanical centering of the screen grid assembly being assured by the centering of this annular member 25 on the metallic plate 8, i. e. by the centering of screws 26 that secure the annular member 25 to the metallic plate 8.

In this way, electrical continuity is provided between screen grid 4 and the metallic plate 8 within the tube and, as said above, the connection of this metallic plate to a screen grid 4 to its outside part.

In the metallic plate 8 there are provided the leads required for the control grid and cathode electrodes. If the tube were a pentode, the suppressor grid would be directly connected to the cathode within the tube and this would save the use of extra leads.

The control grid connection lead comprises two coaxial metallic sleeves 27 and 28 which are connected at one end by an insulating annular portion 29 that is sealed to the ends of the coaxial sleeve. The outer sleeve 27 is screwed direct into a corresponding sleeve portion 30 that is provided in the metallic plate 8. The tightness of the joint is furthermore insured by means of tin soldering, for example, as shown at 31. The inner sleeve 28 is brazed and soldered to a metallic rod 32 which may hold the rigid threaded end 33 of a flexible conductor 34 that serves as a terminal for supplying potentials to the control grid. This conducting rod 32 is secured within the tube to a supporting plate 35 which is hollowed at its center and to which it is arc welded, for example, as shown at 36. This supporting plate is made integral, e. g. by brazing or by the threading of an annular member 37 in which the ends of the grid supporting rods 5 are secured. These rods 5 are furthermore kept exactly centered by means of the ring 38 to which they are secured, e. g. by means of soldered beads 39.

The two leads for supplying the heating current for the filament shaped cathode 6—6' each consists of a metallic sleeve 40—40' screwed into a corresponding sleeve portion 41 of plate 8. The tightness of the joint is insured by soldering with tin, for example, as shown at 42. The outer end of each sleeve 40 and 40' is sealed to an insulating sleeve 43 which has its other end sealed to a metallic cap 44, e. g. of copper, in which there is the end of an attached current supply conducting rod 45 which thus passes through the metallic plate 8 without being in contact with it. Two supporting plates 46 and 46' are respectively secured, e. g. screwed, to the ends of rods 45, and the other ends of these supporting plates 46—46', respectively, admit the ends of two rods 47—47' for the electrical connection and the mechanical support of the filament strips 6 and 6'. These rods 47 and 47' are maintained in spaced relation at two points of their lengths by split stays 48 and 49 which are of such shape that they lock not only rods 47 and 47' but also a rod 50 extending generally axially of the electrode structure. These different rods are secured to the stays 48 and 49, e. g. by means of beads as shown at 51. As can be seen more clearly in Fig. 3, this central rod 50 carries a guide fork with two arms 52 and 52', and it is secured to the rod by a soldered bead 53. Each of the filament strips 6 and 6' is of loop shape and with parallel wires as shown in the drawings and the ends of strip 6 are secured by beads 54 to the ends of rod 47 and arm 52 of the fork, while the ends of strip 6' are secured by beads 54' to the ends of rod 47' and arm 52' of the fork respectively. These two strips of filament are consequently connected in series between the current leads described above.

The other ends of the looped strips 6 and 6' are passed through eyelets 55 and 55' installed on two different metallic rings of an end insulator 56 of a known type. The longitudinal play of strips 6 and 6' on passing through the eyelets 55 and 55' permits free longitudinal expansion or contraction of the strips of filament while insuring their lateral guidance. Insulator 56 is secured to the end of the axial rod 50 in any suitable manner. Besides, it is possible to adopt a different construction of the terminal device for the filaments, or even a different arrangement of the filaments within the design while retaining a discharge tube structure in accordance with the invention.

At the terminal end of the electrode structure on the side of the closed part 3 of the anode there are likewise centering rings 57 and 58 for the supporting rods 4 and 5 of the screen grid and control grid, respectively. Ring 57 of the screen grid may be provided with a terminal screen plate 59 that closes this end of the filament-grid electrode structure with respect to the anode.

With a construction according to the invention, e. g. the structure shown in the drawings in which the end metallic plate 8 actually supports the cathode-grid assembly, it is to be observed that when the cathode or one of the grids is damaged, it is easy to repair it or replace it by unsoldering plate 8, removing this plate and the electrode assembly supported by it and then, after the repairs are made, replacing this unit that has been disassembled and pumping out the tube again.

Although anode 2 which surrounds the other electrode is disposed within envelope 1 in which the vacuum has been made, it must be cooled in the ordinary way for power tubes. This cooling is effected within the envelope itself, as shown in the drawings. For this purpose, a cylinder 60 of a diameter greater than that of anode 2 is disposed around the anode and is hermetically connected to the open end of the same, e. g. by being screwed to the end of this anode as shown at 61, and furthermore by welding as shown at 62 in order to insure tightness of the joint. The other end of cylinder 60 is screwed and soldered to sleeve 9 as shown at 63, and it rests against the metallic plate 7. By this method of fitting, cylinder 60 forms part of the cooling liquid circulation jacket of anode 2 while providing a mechanical support for the anode in the general construction of the tube.

Between cylinder 60 and anode 2 there is inserted another cylinder 64 which forms a deflector for the cooling liquid circulation system. This deflecting cylinder 64 is constricted at its base at 65 and is soldered as shown at 66 to a central sleeve portion 67 of the metallic plate 7. This sleeve portion is open in such a way as to form a passage for the cooling liquid of the anode. The metallic plate 7 is perforated at another spot 68 between cylinder 60 and the end 65 of cylinder 64 in order to provide another passage for the cooling liquid.

The anode is electrically connected to the metallic plate 7 by means of braided wires, as shown at 69, which pass within the constricted portion

of sleeve 64 and are soldered within the sleeve portion 67 of plate 7.

On this plate 7 and to the outside of the tube, bolts as shown at 70 secure a hollowed block 71 for the supply and removal of the cooling liquid. This block 71 comprises a liquid supply channel 72 that leads to sleeve 67 of plate 7, and a liquid circulation compartment 73 that is provided with an outlet passage for the liquid (not shown). With an arrangement of this kind, a cooling liquid under pressure may be made to flow along the surface of the anode 2 and to cool this anode to the desired temperature. It is to be observed that the joint between sleeve 9 and the protecting envelope 1 is cooled at the same time.

Cylindrical screens 74 for the open anode end and 75 for the feed connections assembly of the other electrodes are likewise provided in the structure.

It is evident that the anode design shown in the drawings may be modified without departing from the scope of the invention. For example, the anode may be of the conventional tubular anode type that forms part of the wall and has its two ends connected to insulating portions of the envelope that carry metallic end sealings which serve as output connections for two electrodes passing through insulating portions of these metallic sealings.

Furthermore, the invention is not limited to tetrode tubes as described by way of example, but is on the contrary capable of being used advantageously with tubes of any desired number of electrodes, whether simple or multiple. For a triode tube it may likewise be suitable to provide a screen like that formed by plate 8 in the tube shown in the drawings; this screen may be extended as desired without electrical discontinuity outside the tube, the cathode and control grid connections issuing, for example, through this screen which will not be connected to an electrode of the tube.

What is claimed is:

1. An electron discharge device comprising an envelope and an electrode system including two electrodes within said envelope, one of said electrodes having a portion insulatingly sealed to said envelope at one end of said device, and means accurately securing the other of said electrodes in said envelope in a particular relation with respect to said one electrode, said securing means including a flange-shaped portion on said envelope at the end opposite said one end of said device, a plate-like member cooperatingly fitting on said flange-shaped portion, said other electrode being rigidly mounted on said plate-like member, and means sealing said plate-like member to said flange-shaped portion.

2. An electron discharge device according to claim 1, wherein said flange-shaped portion includes a flat portion extending generally transversely of the axis of the device and an annular portion extending generally axially thereof, said plate-like member being fitted upon said flat portion and extending in close adjacency to the inner wall of said annular portion.

3. An electron discharge device according to claim 1, wherein said flange-shaped portion includes a flat portion extending generally transversely of the axis of the device and an annular portion extending generally axially thereof, said plate-like member being fitted upon said flat portion and extending in close adjacency to the inner wall of said annular portion, and wherein said sealing means is solder bridging adjacent portions of the inner wall of said annular portion and said plate-like member.

4. An electron discharge device comprising an envelope and an electrode system including cathode, grid, and anode means within said envelope, said anode means having a portion insulatingly sealed through said envelope at one end of said device, and means accurately securing said cathode and grid means in said envelope in a particular relation with respect to said anode means, said securing means including a flange-shaped portion on said envelope at the end opposite said one end of said device, a plate-like member cooperatingly fitting on said flange-shaped portion, said grid and cathode means being rigidly mounted on said plate-like member, and means sealing said plate-like member to said flange-shaped portion.

5. An electron discharge device comprising an envelope and an electrode system including two electrodes within said envelope, one of said electrodes having a portion insulatingly sealed to said envelope, and means accurately securing the other of said electrodes in a particular relation with respect to said one electrode, said securing means including a conductive flange-shaped portion forming part of said envelope and axially aligned with said electrode system, a conductive plate-like member cooperatingly fitting said flange-shaped portion, said other electrode being rigidly mounted on said plate-like member, and means sealing said plate-like member to said flange-shaped portion.

6. An electron discharge device according to claim 5, wherein said other electrode has lead-in means and said plate-like member is conductive and also carries a generally tubular and axially aligned shielding member extending within the device substantially co-extensive with the lead-in means for said other electrode, whereby said tubular member, said plate-like member, and said flange-shaped portion cooperate to form an extended shield for said lead-in means.

GEORGES PAUL CHEVIGNY.