June 18, 1929. I. E. MOUROMTSEFF 1,718,206

VACUUM TUBE

Filed Aug. 29, 1927

Fig. 1.

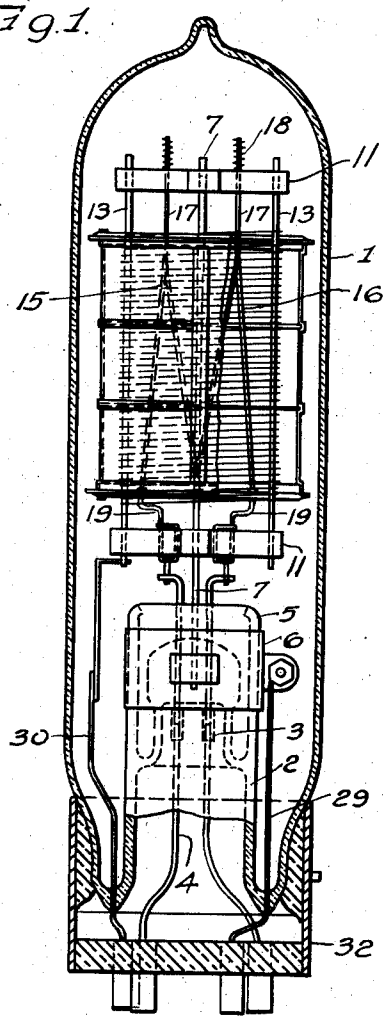


Fig. 2.

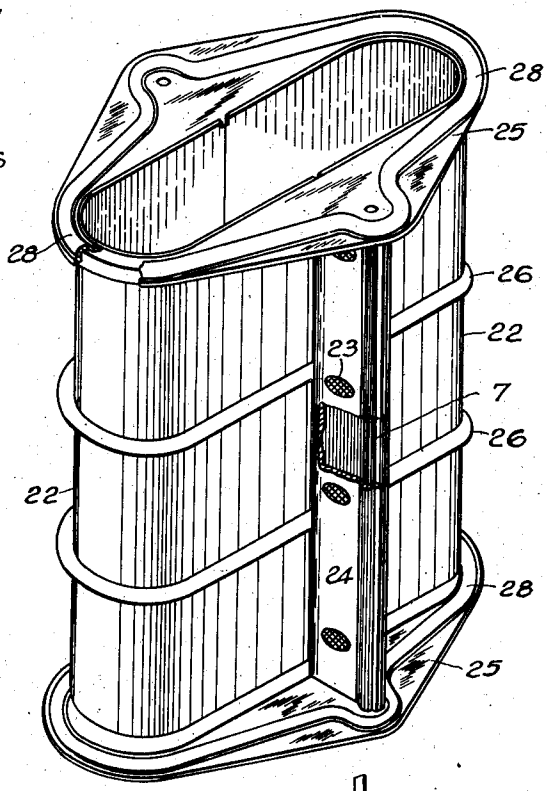


Fig. 4.

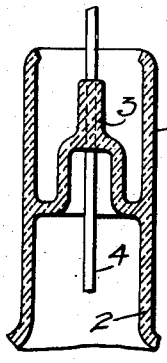
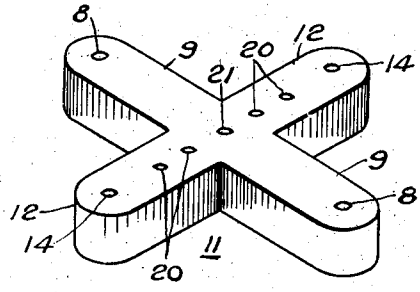


Fig. 3.



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Patented June 18, 1929. 1,718,206

UNITED STATES PATENT OFFICE.

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VACUUM TUBE.

Application filed August 29, 1927. Serial No. 216,138.

My invention relates to space-discharge devices and particularly to devices of that type adapted to generate oscillations of radio frequency and of considerable power.

One of the objects of my invention is to provide a supporting structure for the electrodes of an oscillation generator which shall provide the desired rigidity of support between the various parts and which shall be light in weight to eliminate the mechanical stresses upon the various support members.

Another object of my invention is to provide a cylindrical anode construction for oscillation generators which shall be rigid even when subjected to the relatively high temperatures incident to its operation, and which may be readily supported in place within the tube structure.

Another object of my invention is to provide a structure for the seal of the cathode leads in an oscillation generator of high power and voltage, and for supporting a collar holding the electrode structure in such a way as to provide the necessary length of insulating path for high voltages and to prevent destruction by electrical corona on the inleading wires.

A further object of my invention is to provide a unitary supporting structure for the entire plate, grid and filament assembly which makes it possible to subject them to a preliminary treatment as a finished unit, in hydrogen for example, and to then seal them into the container without further contamination.

Other objects of my invention will become apparent upon reading the following specification, taken in connection with the drawings, wherein

Figure 1 is a view showing a longitudinal section of a space-discharge device embodying my invention.

Fig. 2 is a perspective view of the anode structure which I have invented, and

Fig. 3 is a detail of an insulator used as an element in the electrode structure.

Fig. 4 is a sectional view of the reentrant stem and seal of my discharge device.

In radio tubes intended for high power and, in particular, in oscillation generators, it is necessary to make use of relatively high supply voltages. It is further necessary that the spacing between various electrodes shall be relatively small, in consequence of which very high electrical stresses are produced between the parts of the various electrodes. At the same time the distance between the tube elements must not vary during the life of the tube. This requires a very considerable rigidity and mechanical strength in the supporting structure, the more so because the electrodes of such tubes usually operate at rather high temperatures at which the constituent metals of the electrodes are of relatively low mechanical strength. These electrode structures must be supported within glass tubes, which are, in the very nature of things, relatively weak mechanically. The problem presented, therefore, is that of devising supporting structures having the necessary mechanical strength with as light weight as possible. The construction which I have devised is intended as a solution of such problem.

Referring to Figure 1, a vacuum container 1 of the ordinary cylindrical type has at one end a reentrant stem 2 enclosing a press 3, in which are sealed cathode leads 4, all in a manner well-known in the art. The press 3 is surrounded by an extension of the stem 2, which rises well above the top of the press in the manner indicated in Fig. 4. Upon the extension 5 is supported a split metal collar 6 to the diametrically-opposite sides of which are attached two vertical support wires 7 which may be of molybdenum. These wires pass through holes 8 at the diametrically-opposite ends of the arms 9 of two cross-shaped members 11 of insulating material of the type shown in detail in Fig. 3. One such insulator forms the bottom framework of the electrode structure while a second one forms the top framework thereof. These two insulators serve to hold the various electrode elements rigidly in proper spaced relation.

The pair of arms 12 of the insulators 11, not occupied by the support rods 7, are provided with a second pair of molybdenum rods 13 set in holes 14 therein. A grid electrode 15 of well-known form is provided for the space-discharge tube by winding a molybdenum wire spirally about the two support rods 13. The diameter of these rods is such that the winding of molybdenum wire forms a double-wall grid electrode in the middle of which may be supported an M-shaped cathode filament 16 of well-known form. The apexes of this M-shaped filament are supported on vertical wires 17 running through holes in the cross arm of the upper

insulator. They are resiliently supported therein by means of springs of tungsten wire 18. The two lower ends of the M-shaped filament are supported on molybdenum wires 19 which are anchored to the lower cross-shaped insulator by passing through holes 20 in one set of arms thereof. The mid-point of the filament may be similarly anchored to the center 21 of the lower insulator. This construction will be evident from an inspection of Figs. 1 and 3.

The anode which is shown in detail in Fig. 2 consists of two flanged, trough-shaped members 22 which are held together to form a closed cylinder, by rivets 23 through their longitudinal flanges 24 aforesaid. The upper and lower ends of this cylinder are provided with transverse flanges 25 to add rigidity to the structure, and two transverse corrugations 26 are provided at intervals along the cylinder walls to add further rigidity. Corrugations 28 may be provided to increase the stiffness of the flanges 25. The anode structure so constructed is supported on the pair of molybdenum support rods 7 already mentioned, running between the arms 9 of the two cross-shaped insulators 11. The longitudinal flanges 24 of the anode are pressed into a fit around the molybdenum rods 7, as will be clearly seen from an inspection of Fig. 2, in which a portion of one flange is shown cut away, in order to show the molybdenum rod 7 in the interior thereof.

This entire electrode structure comprising the two pairs of molybdenum rods 7 and 13 at the end of the arms of the cross-shaped members 11, thus forms a mechanically rigid frame for the anode cylinder 22, the control electrode 15 and the M-shaped cathode 16 above described. It will be evident that the entire electrode structure described in the preceding paragraph is supported upon the split collar 6, which is clamped on the extention 5 of the stem 2. Small connecting members are welded between the filament supports 19 and the inleading wires 4 which enter through the press 3, as above described. An inleading wire 29 for the plate current is sealed through the very bottom end of the container 1 and is attached to the split collar 6. A lead 30 for the control electrode passes through a diametrically-opposite seal at the lower end of the container 1 and is welded to one of the vertical molybdenum rods 13 which constitute the framework for the control electrode.

The tube thus constructed may be provided with a base 32 of conventional form.

The oscillation generator so constructed may be utilized in any of the standard connections for three electrode tubes which are well-known in the art and require no separate description.

The cross-shape insulating members 11 in conjunction with the molybdenum tie rods 7 and 13 extend in, between them, providing a framework which is extremely rigid and yet light. They also provide large creepage distances along the surface of the insulators and thereby provide excellent insulation between electrodes of different potentials. When provided with sets of holes as shown in Fig. 3, the same insulator may be used for both the upper and lower member of the structure.

The anode shown in Fig. 2 is of great mechanical strength because of the flanges and corrugations with which it is provided and even when operated at a red heat, has sufficient mechanical strength so that the electrostatic force incident to high voltage operation will not cause it to change shape.

The arrangement of the extension 5 of the stem to surround and extend beyond the cathode cell provides a very high degree of insulation and a long creepage distance between the cathode leads and the collar 6, which is at the potential of the anode. Furthermore, the position of the collar 6 near the upper end of the extension 5 insures that the electric field between this collar and the cathode leads shall be dense in the neighborhood of the latter, only around such portions of them as are inside the evacuated enclosure. This permits a density of electric field which, if it surrounded the portions of the leads which were exposed to the air outside the tube, would produce destructive heating, by reason of the electric corona.

While I have shown and described a particular embodiment of my invention, it will be clear to those skilled in the art that the principles thereof are capable of embodiment in modifications of those structures. I, therefore, desire that the claims should be limited only in accordance with their express terms and with the scope of the prior art.

I claim as my invention:

1. In combination with a vacuum-type container, an electrode and supports therefor disposed in one plane, a second electrode, supports therefor disposed in another plane and spacing means for said electrodes comprising an insulator having two pairs of radial arms supporting said first electrode with one pair of arms and said second electrode with the other pair of arms.

2. In combination with a vacuum-type container a cathode held upon supports in one plane, an anode held upon supports in another plane and spacing means for said supports comprising a cross-shaped insulator having one pair of arms adapted to engage the supports of one of said electrodes and another pair of arms adapted to engage the supports of said other electrode.

3. In combination with a vacuum-type container an electrode and supports therefor disposed in one plane, a second electrode, sup-

ports therefor disposed in another plane and spacing means for said electrodes comprising a plurality of cross-shaped insulators supporting said first electrode with one pair of arms and said second electrode with the other pair of arms.

4. In combination with a vacuum-type container a cathode held upon supports in one plane, an anode held upon supports in another plane, a control electrode having supports in one of said planes and spacing means for said supports comprising a cross-shaped insulator having one pair of arms adapted to engage the supports of one of said electrodes with their outer ends, and having another pair of arms adapted to engage the supports of said other electrodes.

5. In combination with a vacuum-type container, a cathode held upon supports in one plane, an anode having longitudinal flanges attached to supports in another plane, and spacing means for said supports comprising a cross-shaped insulator having one pair of arms adapted to engage the supports attached to said flanges and another pair of arms adapted to engage said cathode supports.

6. In combination with a vacuum-type container, a cathode held upon supports in one plane, an anode having longitudinal flanges attached to supports in another plane and spacing means for said supports comprising a plurality of cross-shaped insulators having one pair of arms adapted to engage the supports attached to said flanges with their outer ends and another pair of arms adapted to engage the said cathode supports.

7. In combination with a vacuum-type container an electrode and supports therefor disposed in one plane, a second electrode comprising a pair of trough-shaped members enclosing said first electrode and supports for said second electrode disposed in another plane, and spacing means for said electrodes comprising a cross-shaped insulator supporting said first electrode with one pair of arms and supporting said second electrode with its second pair of arms.

8. In combination with a vacuum-type container having a reentrant neck and leads sealed therein, an extension on said neck surrounding said leads, an electrode connected to said leads, a second electrode and supporting means for said second electrode comprising a collar engaging said extension remote from said seal.

9. In combination with a vacuum-type container having a reentrant neck and leads sealed therein, an extension on said neck surrounding said leads, an electrode connected to said leads, a second electrode and supporting means for said electrodes comprising a a pair of cross-shaped insulators supported upon a collar engaging said extension remote from said seal.

10. An electrical discharge tube having an electrode and comprising two trough-shaped members flanged at their edges and positioned to form a cylinder, other flanges transverse to each end of said cylinder, said trough shaped members having transverse corrugations in their walls.

11. An electrode for an electrical discharge tube comprising two trough-shaped members having flanges at their edges and positioned to form a cylinder, other flanges transverse to each end, said trough shaped members having transverse corrugations in their walls and support leads attached to each longitudinal flange, and a supporting collar attached to said leads at one end thereof.

In testimony whereof, I have hereunto subscribed my name this 24th day of August 1927.

ILIA E. MOUROMTSEFF.

DISCLAIMER

1,718,206.—*Ilia E. Mouromtseff*, Wilkinsburg, Pa. VACUUM TUBE. Patent dated June 18, 1929. Disclaimer filed May 2, 1936, by the assignee, *Westinghouse Electric & Manufacturing Company*.

Hereby enters this disclaimer to claims 1, 2, 3, and 4 of the patent specification.

[*Official Gazette May 26, 1936.*]