Feb. 25, 1947. J. E. BEGGS 2,416,565

HIGH FREQUENCY ELECTRONIC DEVICE

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Fig. 1.

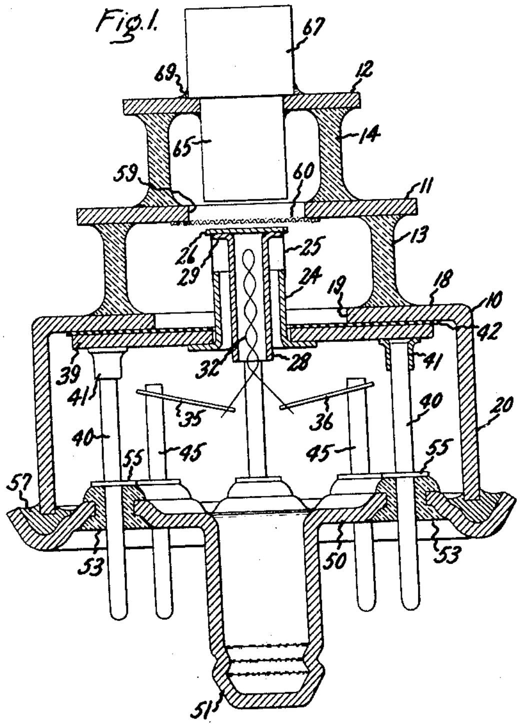

Fig. 2.

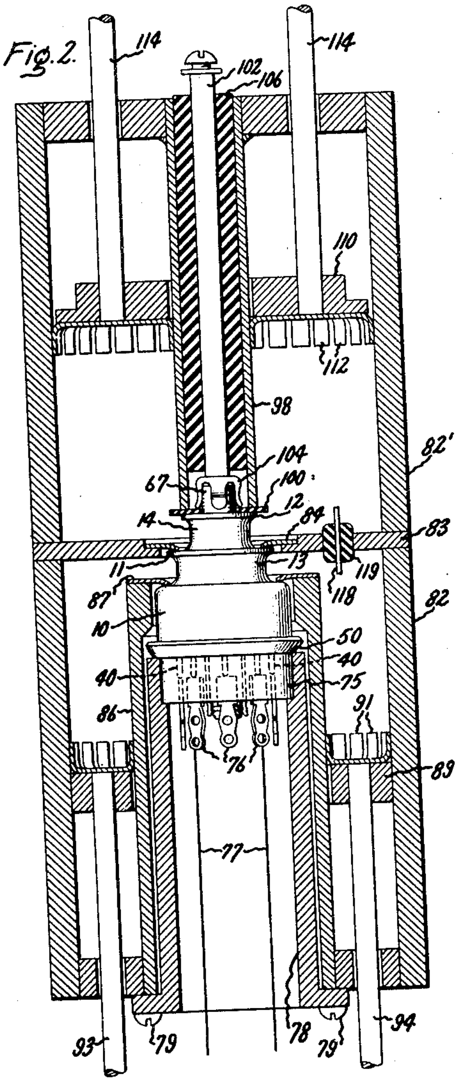

Fig. 3.

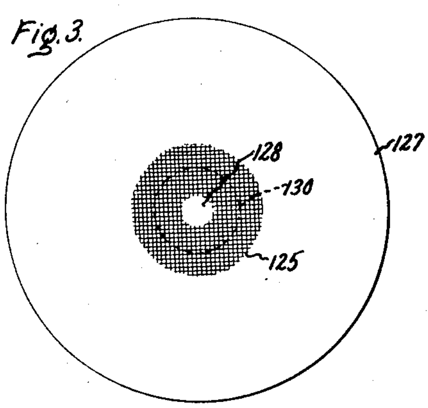

Fig. 4.

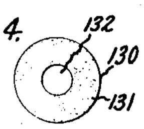

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Fig. 5.

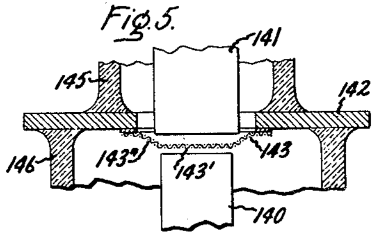


Fig. 6.

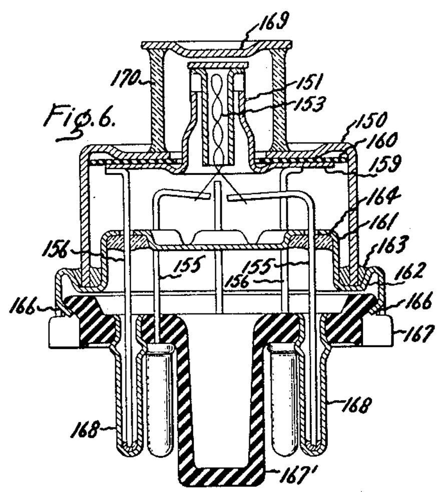
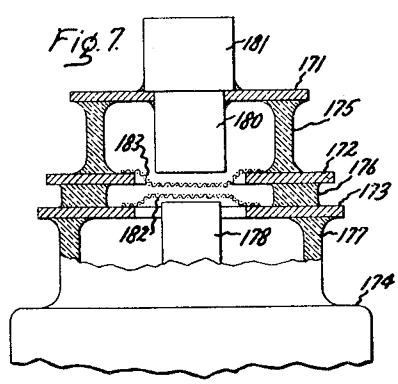


Fig. 7.



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UNITED STATES PATENT OFFICE

2,416,565

HIGH-FREQUENCY ELECTRONIC DEVICE

James E. Beggs, Scotia, N. Y., assignor to General Electric Company, a corporation of New York

Application March 28, 1942, Serial No. 436,633

15 Claims. (Cl. 250—27.5)

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The present invention relates to electronic devices and has as its primary object the provision of improved discharge devices useful in apparatus for receiving and converting signals on the order of a few (e. g. 1 to 10) centimeters in wavelength.

A property desired in devices of the class referred to is that they be suitable for use with certain high impedance, high Q tank circuits which have found application in the ultra-high frequency field, such circuits being represented, for example, by cavity resonators and coaxial transmission line arrangements. It is another object of the present invention to provide electronic tubes which are well adapted for combination with circuit means of this kind.

It is a still further object to provide high frequency tubes having characteristics which are highly reproducible even when the tubes are manufactured in large quantities and by mass production methods.

An important feature of the invention with reference to the attainment of the foregoing objects consists in the use of a tube construction which has a stepwise configuration as one proceeds from one end of the tube to the other. This is accomplished in a way which greatly facilitates the insertion of the tube into the structure of a resonant cavity oscillator or the like by arranging the electrodes of the tube in end-to-end relation, providing them with laterally extending terminals of progressively diminishing sizes, and supporting the terminals by insulating cylinders sealed between them, the cylinders also being of graduated dimensions.

A second important feature of the invention comprises a novel base structure especially adapted for use with a tube of the general configuration described above.

A still further important feature comprises an arrangement by which one of the electrode terminals is enabled to serve as a high frequency supply connection for its associated electrode while being insulated from it as far as unidirectional currents are concerned. This is found to be especially advantageous in certain types of high frequency apparatus in which the use of external blocking condensers is either not practicable or not convenient.

The aspects of the invention which I desire to protect herein are pointed out with particularity in the appended claims. The invention itself, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection

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with the accompanying drawing, in which Fig. 1 represents in partial section a three-element discharge tube suitably embodying the invention; Fig. 2 shows a tube of the construction illustrated in Fig. 1 in combination with appropriate circuit apparatus and serves to illustrate the utility of the invention; Fig. 3 is a plan view of a modified form of grid useful in connection with a construction such as that of Fig. 1; Fig. 4 shows the active surface of a cathode adapted for use in connection with a grid construction such as that of Fig. 3; Fig. 5 is a fragmentary view illustrating a further modification of grid structure; Fig. 6 illustrates in partial section a two-element discharge tube embodying certain features of the invention; and Fig. 7 represents the application of the invention to a four-element tube.

Referring particularly to Fig. 1 it will be seen that the discharge device there illustrated includes a series of three circular metal members **10**, **11** and **12** which are arranged in spaced relation and which are mutually separated by vitreous (e. g. glass) cylinders **13** and **14** sealed between them. Both the metal members **10** to **12** and the cylinders **13** and **14** are of progressively decreasing diameter from one end of the tube to the other so that the tube as a whole presents a stepwise construction, a feature the utility and importance of which will be more fully explained at a later point. The metallic part **10** includes a planar portion **18** having a central opening **19** and a circular rim **20** which extends away from the main body of the discharge device. Within the opening **19** and extending through it there is provided a cathode structure which includes a flanged sleeve **24**, a cylinder **25** which is preferably constituted of extremely thin metal (e. g. metal foil) and a disk **26** supported at the upper end of the cylinder **25**. The disk **26** is preferably constituted of nickel and may bear on its surface an activating coating of barium and strontium carbonates. Within the interior of the cathode there is a relatively long sleeve **28** which is supported at its upper end by a flange **29** secured to an inwardly directed rim formed on the cylinder **25** and fixedly joined to the disk **26**. At the axis of the sleeve **28** there is arranged a filamentary heater **32** having its ends secured to transversely extended support wires **35** and **36**. In the operation of the tube, it is the purpose of the filament **32** to maintain the disk **26** at an emitting temperature say, at a temperature of 800 degrees C. In this connection it is the function of the part **28** to conduct heat to the disk **26** and it is the further function of the foil **25** to minimize the conduction of heat away from the disk 26 to the other parts of the structure. With the latter function in mind, the foil part 25 may suitably be formed of nickel-iron-cobalt alloy (fernico) since this alloy has very low thermal conductivity. Fernico has the further advantage of possessing a low coefficient of thermal expansion, whereby changes in its temperature do not produce any significant displacement of the disk 26.

For the purpose of supporting the cathode structure it is connected to a circular plate-like element 39 which is itself supported by a series of relatively rigid conductors 40, these being attached to the element by means of metal eyelets 41 which are welded or otherwise secured to the engaging parts. The element 39 is arranged in face-to-face relation with the lower surface of the part 18, but is maintained at a fixed spacing with respect to this part by the interposition of a sheet or layer of a dielectric substance 42 consisting, for example, of mica or other inorganic insulating material. As a result of this arrangement the cathode structure is insulated from the part 10 with respect to unidirectional currents, while being effectively connected to it (e. g. through the capacity between the opposed surfaces of the parts 18 and 39) as far as high frequency currents are concerned. As a consequence, the part 10 is adapted to serve as a high frequency terminal for the cathode structure.

Unidirectional potential may be applied to the cathode and heating current may be supplied to the filament 32 which forms a part of the cathode structure by means of the lead-in conductors 40 and additional conductors 45 connected to the wires 35 and 36. In the illustrated arrangement these lead-in conductors are supported by being sealed through a closure member 50 which is hermetically joined to the lower edge of the circular rim 20. The closure member includes a centrally depending tubular part 51 which may serve as a guide pin for locating the tube in a cooperating socket, and further includes a series of glass bead seals 53 which may be of the character described in my copending application S. N. 408,315, filed August 26, 1941. Each of the sealed-in conductors includes an upset flange 55 which serves to equalize thermal stresses set up in the various seals due to heat flow along the conductors and thus to minimize seal breakage attributable to this cause. The joint between the closure member 50 and the rim 20 is formed by means of a quantity of soft solder, indicated at 57, and may be produced in accordance with the general procedure described in my prior Patent 2,229,436, granted January 21, 1941. As is explained in the aforementioned patent, the sealing operation may be combined with the procedure of evacuating the tube, the removal of contained gases being carried out through the space between the parts 50 and 10 before these parts are soldered together.

The vitreous cylinder 13 is sealed to the upper surface of the planar wall part 18 in a region surrounding the cathode structure, the joint between these parts being necessarily vacuum tight. In order to facilitate the production of a joint of this kind it is expedient to form the part 10, as well as the disks 11 and 12, of iron and to use for the cylinders 13 and 14 a glass which is capable of being sealed to iron, such glasses being described, for example, in Hull and Navias Patent 2,272,747, granted February 10, 1942. To make the sealing process easier the various metallic parts in question are preliminarily coated with

copper, which also has the effect of increasing the surface conductivity of these members with respect to high frequency currents. The copper is to some extent oxidized during the sealing procedure, and it is desirable to remove this oxide before putting in place the cathode structure and the closure member 50 upon which the cathode structure is mounted. As a further preliminary to evacuation of the device and sealing-in of the closure member, it has been found helpful in some cases to silver or gold plate both the interiorly exposed and the exteriorly exposed surfaces of the parts 10, 11 and 12 to assure that these surfaces shall be perfectly clean and resistant to corrosion.

The disk 11, which is sealed to the upper extremity of the cylinder 13, is provided with a central opening 59 and supports a mesh grid 60 covering this opening, the grid being spaced only a few mils from the active surface of the cathode cap 26. Above the grid and in cooperative relation with respect to the grid and cathode, there is supported an anode in the form of a solid cylinder 65. This extends through an opening formed centrally in the disk 12 and connects above the disk with a cylindrical terminal block 67, which, as shown, is of smaller diameter than the disk 12 although of larger diameter than the hole formed in the disk. A fused metal joint produced between the terminal block 67 and the disk 12 as indicated at 69 renders this end of the tube vacuum-tight and completes the enclosure of the device. In the use of the tube the terminal block 67 may serve the secondary function of conducting heat from the anode to a suitable dissipating means.

Apart from the obvious advantages of its structural simplicity, the tube construction illustrated in Fig. 1 has been found extremely useful in connection with high frequency tank circuits of the resonant cavity or resonant transmission line type. This is well illustrated by the arrangement of Fig. 2 in which the externally visible parts of such a tube are indicated by numerals corresponding, to the numerals applied to similar parts in Fig. 1.

It will be noted that the lead-in terminals 40 provided for supplying heating current and fixed potential to the cathode of the tube are inserted in a socket 75 which is of more or less conventional form and which bears a number of convenient terminals 76. Current supply conductors 77 are shown as being connected to certain of these terminals. The socket is held in place with respect to the remaining structure illustrated by means of a long tubular sleeve 78 which is screwed to the bottom of the structure as indicated at 79.

The high frequency system includes a pair of resonant coaxial transmission lines respectively connected in the grid-cathode and grid-anode circuits of the tube. The grid-cathode line comprises an outer hollow conductor 82 which is connected directly to the grid by means of a transverse disk 83 bearing a ring of flexible terminal fingers 84. These terminal fingers make symmetrical contact with the grid-supporting disk 11.

Within the tubular conductor 82 there is a second tubular conductor 86 which bears a ring of resilient contact fingers 87 at its upper extremity. These fingers bear upon the upper contour of the metal part 10. As has been previously explained in connection with Fig. 1, the part 10 is effectively at cathode potential as far as high frequency currents are concerned, due to its capacitive coupling to the cathode-supporting part 39 (Fig. 1). Consequently, one end of the transmission line formed between the conductors 82 and 86 is connected across the gap existing between the cathode structure and the grid of the tube so that this gap may, under appropriate conditions, represent the voltage loop of the transmission line. In order to cause this condition, or some equivalent condition favorable to the desired operation of the apparatus as a whole to exist there is provided a movable ring 89 which bears a large number of U-shaped contact fingers 91 bearing symmetrically upon the opposed surfaces of both the tubular conductors 82 and 86. These contact fingers constitute a short circuiting termination for the line, and it is clear that the resonant characteristic of the line is determined in large part by the position of the ring 89. This may be controlled by appropriate motion of externally accessible actuating rods 93 and 94, and in the intended operation of the apparatus the adjustment of the ring 89 is preferably made such that the effective length of the transmission line 82, 86 corresponds to an odd number of quarter wave lengths at the operating frequency of the apparatus.

The grid to anode resonant circuit is of generally similar character and includes an outer conductor 82′ (in effect an extension of the conductor 82) and an inner cylindrical conductor 98. The conductor 98 extends into close proximity to the anode-supporting disk 12 but is slightly separated from it by means of a dielectric (e. g. mica) spacer 100 so that no direct-current connection between the anode and the cylinder 98 exists. However, the D. C. potential of the anode is fixed by a separate conductor 102 which is coaxial with the conductor 98 and which terminates in a resilient contact cap 104 fitted over the end of the anode terminal 67. Fixed spacing between the conductors 98 and 102 may be maintained by means of an insulating bushing 106.

It will be seen that in spite of the absence of a conductive connection between the cylinder 98 and the anode terminal structure these elements are capactitively coupled (i. e. through the dielectric 100) to a degree which justifies the assumption that they are directly connected as far as high frequency currents are concerned. Accordingly, the gap between the grid and anode provides an open circuit termination for the transmission line formed by the conductors 82′ and 98. The length of this line and its condition of resonance are determined by means of a slidable ring 110 which bears U-shaped contact fingers 112 and which is operated by means of actuating rods 114.

An advantage of the arrangement just described which results in part from the construction of the tube of Fig. 1 lies in the fact that the whole resonant structure, including the elements of the two transmission lines, may be maintained at a common D. C. potential, since all its parts are mutually conductively connected as shown. (With the arrangement illustrated the operating potential of the entire structure is obviously the same as the potential of the grid of the discharge tube, since the structure as a whole is conductively connected to the grid terminal 11.)

A further advantage of the construction of Fig. 1 as applied in an apparatus arrangement such as that shown in Fig. 2 consists in the ease

with which the tube may be inserted in the resonant cavity forming structure. It will be seen that as a result of the stepwise configuration of the discharge tube it may be put in place by insertion lengthwise through the tube 86, e. g. before or concurrently with the insertion of the sleeve 78. Since the various terminal elements of the tube are of progressively decreasing diameter starting from the anode terminal 67, this method of assembly is readily carried out, and conversely, the discharge tube may easily be removed for replacement purposes when this becomes necessary. Certain features of the combination of a discharge device and concentric resonator, as described above, are described and claimed in the copending Jensen and Keister application, Serial No. 448,206, filed June 24, 1942 and assigned to the assignee of the present invention. The subject matter generic to these two applications is not my invention but the invention of Jensen and Keister.

It is found that with appropriate coupling between the two resonant transmission line sections of Fig. 2 the apparatus shown is capable of generating self-sustained oscillations. (This assumes, of course, that the various electrodes are maintained at appropriate D. C. potentials by proper connections to their D. C. terminals and that the two transmission line sections are tuned to a suitable operating frequency.) With the arrangement illustrated, the desired feedback coupling may be accomplished by means of a conductor 118 extending through the transverse partition 83, the conductor being supported in an insulating bead or bushing 119. Alternatively, one may employ for this purpose a pair of interconnected coupling loops (not shown) respectively arranged on opposite sides of the part 83.

It is desirable in some cases that the feedback coupling be supplied by the internal capacity of the tube itself without the need for external coupling means. Where the inherent anode to cathode capacity is not sufficiently great to make this possible, it may be augmented in the manner illustrated in Fig. 3, which shows a mesh grid 125 supported at the center of a conductive disk 127 corresponding to the disk 11 of Fig. 1. The grid is provided with a central opening 128 through which the cathode (indicated by the dotted line 130) may "see" the anode to an extent greater than would be possible without the opening. By the provision of the opening the capacity between the anode and the cathode is materially increased.

Where a grid construction such as that of Fig. 3 is used, it is desirable to employ a cathode having an active surface of the character indicated in Fig. 4. In the arrangement there shown, the cathode, which is designated as a whole by the numeral 130, has its active surface coated with emitting material (e. g. alkaline earth material) in an annular ring as indicated at 131. The central portion of the cathode, however, is devoid of coating over an area 132 corresponding in diameter to the grid opening 128 (Fig. 3). This has the effect of avoiding a variable mu characteristic which would otherwise result if the portion of the cathode opposite the grid opening were made emissive. An alternative arrangement for increasing feedback consists in the provision of a series of openings in the grid supporting disk rather than in the grid itself. (This modification is not illustrated in the drawing.)

A further modification of the grid which is advantageous from the standpoint of controlling the tube operating characteristics (not necessarily the inter-electrode capacitance) is illustrated in Fig. 5, which shows only the central portion of a tube assumed to be of the general character of that illustrated completely in Fig. 1. The elements specifically depicted include a cathode 140, an anode 141, a grid supporting disk 142 and a grid 143. The latter element, which consists of fine nickel mesh, for example, has an outline corresponding approximately to a frustro-conical section and includes a flattened central part 143′ and a tapering portion 143″. (The latter portion is actually somewhat concave in the upward direction.) A grid of this character may be produced by deformation of a plane grid and has an advantage over a plane grid in that it is less subject to sagging when heated to high temperatures. It is found, moreover, that by shaping the grid in situ, that is, by forming it from an initially plane piece of mesh after the grid-bearing disk has been sealed in place between cooperating glass cylinders 145 and 146 and after the anode and cathode disks (not shown) have been joined to these cylinders, an exact spacing may be established between the surface 143′ of the grid and the opposed surfaces of the cathode 140 and the anode 141. The method of production of a structure of this kind is fully described and claimed in my copending application, S. N. 449,391, filed July 2, 1942.

Fig. 6 represents the application of the invention to a diode form of tube which is useful in high frequency systems because of its low internal capacity. In this case the base structure includes an apertured circular part 150 having an indirectly heated cathode 151 extending through its central opening. As in the arrangement previously described, a filamentary heater 153 is provided within the interior of the cathode, being supplied with heating current by means of lead-in terminals 155. Additional lead-in conductors 156 are provided for the purpose of supporting the cathode structure and supplying it with unidirectional potential. Close capacitive coupling between the cathode structure and the part 150 is provided by means of a flat metallic member 159 which is connected to the cathode and which is insulatingly spaced from the part 150 by means of a mica spacer 160.

The lower opening of the circular member 150 is closed by means of a generally cup-shaped part 161 which is reversely bent to provide a circumferentially extending trough portion 162. This latter portion is adapted to receive the extreme edge of the member 150 and when filled with solder as indicated at 163 provides a vacuum-tight seal for the tube enclosure. The lead-in wires 155 and 156 are sealed through the part 161 by means of a plurality of glass-to-metal seals shown at 164.

The lower edge of the cup-shaped part 161 is provided with bent-in tabs 166 which serve to engage and retain a socket adapter 167 which is constituted of a suitable insulating material, such as a synthetic resin. The adapter is provided with a centering lug 167′ and supports a number of hollow contact prongs 168 to which the extremities of the conductors 155 and 156 are attached.

The anode of the device comprises a flat disk 169 which is supported in fixed spaced relation with respect to the active surface of the cathode 151 by being sealed to the end of a glass cylinder 170. Both the anode disk 169 and the cylinder

170 are of materially smaller diameter than the part 150 so as to permit the tube to be inserted in a high frequency tank structure after the manner described in connection with the construction of Fig. 2.

Fig. 7 illustrates the further application of the invention to a high frequency tetrode. Here the envelope structure is made up of a series of four mutually spaced metallic elements 171 to 174 in combination with three glass insulating parts 175 to 177. The metallic part 174 comprises the base of the tube and affords a high frequency terminal for a cathode structure indicated at 178. An anode 180 having an externally accessible terminal 181 is supported from the disk 171.

A first grid indicated at 182 is mounted in an opening formed centrally in the disk 173 and is slightly spaced with respect to the active surface of the cathode 178 so as to be able to control the current flow from the cathode. A second grid 183, useful as a screen grid or the like, is provided in connection with the disk 172.

The insulation of the grid 182 with respect to the grid 183 comprises the relatively thin ring of glass 176 sealed between the disks 172 and 173. The thickness of the glass ring is sufficiently small so that close capacitive coupling exists between the two grid structures. Accordingly, in a system in which the grid 182 is grounded as far as radio frequencies are concerned, the screen will also be at R. F. ground, although it may be maintained at any desired D. C. potential above or below ground.

While the invention has been described by reference to particular embodiments thereof, it will be understood by those skilled in the art that numerous modifications may be made without departing from the invention. I, therefore, aim in the appended claims to cover all such equivalent variations as come within the true spirit and scope of the foregoing disclosure.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A high frequency electronic device comprising a metallic part which constitutes a high frequency terminal for the device, said part having a planar wall provided with a central opening, a hollow vitreous member sealed to said wall around the said opening and providing lateral enclosure for the device, a cathode structure projecting through the said opening into the said enclosure, an anode within the device in cooperative relation with respect to the said cathode, an element connected to the said cathode structure and positioned in face-to-face relation with said wall in a region surrounding said opening, and a thin layer of dielectric material maintaining a fixed separation between said element and said wall, whereby the element and the said metallic part are capacitively connected as far as high frequency currents are concerned but are effectively insulated with respect to unidirectional currents.

2. An evacuated electronic discharge device including a vitreous enclosure-forming part, an anode mounted at one end of said part, a metallic base part joined to the opposite end of said vitreous part and having a planar portion with a central opening, a cathode structure projecting through said opening and extending within said vitreous part, a metallic element forming a part of said cathode structure and supported in face-to-face relation with said planar portion of the said base part, a sheet of dielectric material separating said element from said base part whereby

the base part is insulated from the cathode structure as far as unidirectional currents are concerned while being effectively connected to it with respect to high frequency currents, means hermetically joined to said base part and forming a vacuum-tight compartment which completes the enclosure of the device, and a lead-in conductor sealed into said compartment for supplying unidirectional potential to said cathode.

3. A high frequency electronic discharge device including a metal base having a circular planar portion, a cathode supported centrally with respect to said planar portion and having a portion of extended area positioned in spaced relation with respect to said base to connect said cathode to said base as far as alternating currents are concerned whereby said base provides a high frequency terminal for the cathode and is insulated from said cathode with respect to direct current voltages, a first vitreous cylinder sealed at one extremity to said planar portion in a region surrounding the cathode, a centrally apertured metal disk having one surface sealed to the remaining extremity of said cylinder, a grid extending across the aperture of said disk and supported by the disk in proximity to the cathode, said disk providing an externally accessible terminal for the grid, a second vitreous cylinder of materially smaller diameter than the first sealed at one extremity to the opposite surface of said disk, and means including an anode closing the other extremity of said second cylinder.

4. A high frequency electronic discharge device including a metal base part which comprises a planar portion provided with a circular rim, a heatable cathode supported centrally with respect to said planar portion, on the side thereof opposite to said rim, said cathode being symmetrically connected to said base as far as alternating currents are concerned whereby said base provides a high frequency terminal for the cathode, means hermetically joined to said circular rim providing a vacuum-tight compartment which forms part of the enclosure of said device, lead-in connections for supplying heating current to the cathode sealed into said compartment, a first vitreous cylinder sealed at one extremity to said planar base portion in a region surrounding said cathode, a grid-supporting disk having one surface sealed to the remaining extremity of said cylinder, said disk being of smaller diameter than said metal base part, a second vitreous cylinder of smaller diameter than the first cylinder sealed at one extremity to the opposite surface of said disk, and an anode-supporting disk sealed to the remaining extremity of said second cylinder, said anode-supporting disk being of smaller diameter than the grid-supporting disk whereby the device as a whole has a stepwise configuration.

5. An evacuated electronic discharge device comprising a hollow enclosure means having vitreous end portions, an anode mounted on one of said end portions, a metallic part including a circular wall surface joined to the opposite end portion of said enclosure means, a heatable cathode structure mounted centrally with respect to said circular wall surface and having an active portion extending from the side of said metallic part to which said enclosure means is joined, said cathode having an extended area positioned in spaced relation with respect to said metallic part whereby said metallic part is a high frequency terminal for said cathode which is insulated therefrom with respect to direct current voltages, means hermetically joined to said metallic part on the side thereof opposite to said cathode and providing a compartment which completes the enclosure of the device, and lead-in conductors sealed into said compartment for supplying heating current to said cathode.

6. A high frequency electronic discharge device comprising a hollow enclosure means having vitreous end portions, an anode mounted on one of said end portions, a metallic base part joined to the opposite end portion of said enclosure means, said base part comprising a planar portion with a central opening, a cathode structure projecting through said opening and extending within said enclosure means, said cathode having a portion of extended area positioned in spaced relation with respect to said metallic base whereby said metallic base part is a high frequency terminal for said cathode, means hermetically joined to said metallic base part on the side thereof opposite to said enclosure means and cooperating with said base part to provide a compartment which completes the enclosure of the device, and means sealed through the wall of said compartment supporting said cathode and for supplying potential thereto.

7. A high frequency electronic discharge device including a hollow enclosing means having vitreous end portions, an anode supported on one of said end portions, a metallic base part joined to the opposite end portion of said enclosure means and including a planar portion provided with a circular rim extending from the outer edge thereof in a direction opposite to said hollow enclosure means, a heatable cathode mounted centrally with respect to said planar portion on the side thereof opposite to said rim, said cathode having said metallic part as a high frequency terminal thereof, a closure member hermetically joined to the rim of said metallic part completing the enclosure of said device, and lead-in conductors sealed through said closure member for supplying heating current and unidirectional potential to the cathode.

8. A high frequency electronic device comprising a plurality of electrodes, a disk-like metallic part having relatively extensive surfaces respectively disposed internally and externally of the device, conductive means including a second disk-like part within the device insulatingly separated from the said internally disposed surfaces of said metallic part and closely capacitively coupled to it, said last named means being directly connected to one of said electrodes, whereby the externally disposed surface of said metallic part is enabled to serve as a high frequency terminal for said electrode while being insulated from it as far as unidirectional currents are concerned, and a conducting means connected with said second disk-like part at a surface which is excluded from the path of high frequency currents by the capacitive coupling between said disk-like parts providing and externally acccessible unidirectional current terminal of the device which is independent of the high frequency circuits of said device.

9. A high frequency electronic device comprising a plurality of electrodes, means defining an enclosure for said electrodes, a circularly symmetrical metallic part extending laterally from the enclosure of the device and having separate surfaces respectively disposed internally and externally of the said enclosure, and means within the enclosure providing an exclusively capacitive connection between one of said electrodes and the said internally disposed surface of said me-

tallic part and including a second metallic part connected with s. id one of said electrodes, the externally disposed surface of said circularly symtrical part providing a high frequency terminal for the electrode while being effectively insulated from it as far as unidirectional currents are concerned, and conducting means connected with said second metallic part and extending from said enclosure providing an externally accessible terminal of said device which is effectively bypassed with respect to high frequency currents by the capacitive coupling between said parts.

10. A high frequency electronic device comprising an enclosure and a plurality of electrodes therein having parallel planar cooperating surfaces, a metallic part extending laterally from the enclosure of the device and having separately identifiable circularly symmetrical surfaces lying in a plane substantially parallel with the plane of said cooperating surfaces which separately identifiable surfaces are respectively disposed internally and externally of the enclosure of the device, a conductive element also within the said enclosure and symmetrically connected to one of said electrodes, said element having a circularly symmetrical surface lying in a plane substantially parallel to the surface of said metallic part and insulated from but in proximity to the said internally exposed surface of said metallic part, said externally exposed surface of said part providing a high frequency terminal to said one electrode.

11. A high frequency electronic discharge device comprising an enclosure including a base structure, a plurality of electrodes in said enclosure, said base structure including a planar metallic wall part extending transversely of the said enclosure and having a surface exposed externally of the enclosure, a cathode forming one of the said electrodes mounted centrally with respect to said wall part within the enclosure, and means providing an exclusively capacitive connection between said cathode and said wall part, said externally exposed surface of said part providing a high frequency terminal for the cathode.

12. An electronic discharge device comprising a vitreous enclosure-forming part, an anode supported at one end of said vitreous part, a metallic base member joined to the opposite end of said vitreous part and including a planar central portion, a cathode structure having a metallic element thereof positioned in face-to-face relation with said planar central portion of said metallic base member, a layer of dielectric material separating said metallic base member and said element whereby the metallic base member is insulated from said cathode structure with respect to unidirectional currents while being effectively connected to it as far as high frequency currents are concerned, means hermetically joined to said metallic base member and providing a vacuum-tight compartment which completes the enclosure of said device and lead-in conductors sealed into said compartment for supplying unidirectional potential and heating current to said cathode structure.

13. A high frequency electronic discharge device comprising an enclosure and a plurality of electrodes therein, means conductively connected with one of said electrodes including a first disk-like member in said enclosure symmetrically located with respect to said one electrode, means including a second disk-like member having a face portion within said enclosure and closely spaced with respect to one face of said first disk-like member constituting a capacitive connection between said one electrode and said second disk-like member, a portion of said first disk-like member substantially more remote from said one electrode than the said face portion of said second disk-like member providing a circuit connection for connecting said one electrode with an external circuit which is effectively bypassed with respect to high frequency currents by the capacitive coupling between said disk-like members.

14. An electric discharge device including a metal base member having a cylindrical portion provided with an inwardly directed flange at one end, a header closing the opposite end of said cylindrical portion, a cathode structure including a flange portion positioned within said base member and extending in closely spaced capacitive relation with respect to the flange of said base member, said cathode structure also including an active cathode portion positioned on the exterior of the compartment formed by said base member and said header, an anode, and means including an enclosure means sealed to the flange of said base member enclosing said anode and cathode and supporting said anode in spaced and insulated relation with respect to said active cathode portion.

15. An electric discharge device including an anode and a cathode, a metal base structure including a hollow cylindrical portion and an inwardly directed flange at one end, a cylindrical enclosure of vitreous material of smaller diameter than said cylindrical base portion sealed at one end to said inwardly directed flange, means supporting said anode from the other end of said vitreous cylindrical enclosure, said cathode having a portion extending within said vitreous cylindrical enclosure and mounted in spaced relation with respect to said anode and a second portion of extended area positioned within said cylindrical base portion and extending in closely spaced and insulated relation with respect to a wall of said base structure, and a lead-in conductor sealed through the end of said metal base structure opposite said flange and connected with said cathode.

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