June 24, 1958 S. J. CHERRY ET AL 2,840,748

COAXIAL FILAMENT CONNECTOR

Filed June 26, 1953

Fig.1.

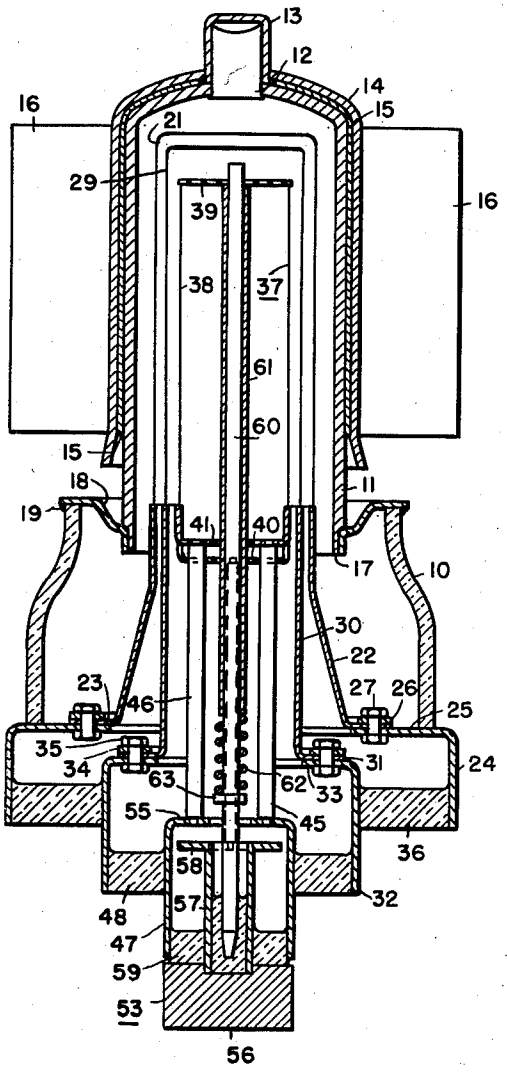


Fig.3.

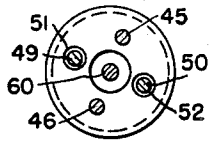
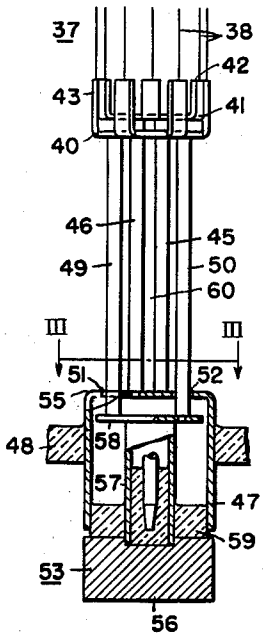


Fig.2.



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2,840,748

Patented June 24, 1958

2,840,748

COAXIAL FILAMENT CONNECTOR

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Application June 26, 1953, Serial No. 364,354

6 Claims. (Cl. 313—273)

Our invention relates to electric discharge devices, and more particularly to high frequency, high power discharge devices.

It is an object of our invention to provide a new and improved electric discharge device.

It is another object to provide an improved electric discharge device which is easily installed and removed from the cooperating circuit elements.

It is another object to provide an improved electric discharge device which permits ease of fabrication and assembly.

It is another object to provide an improved electric discharge device which will eliminate displacement of the cathode due to the expansion by the heating of the latter.

It is still a further object to provide an electric discharge device having an improved arrangement of electrode supports and electrode terminals.

These and other objects are effected by our invention as will be apparent from the following description taken in accordance with the accompanying drawing, throughout which like reference characters indicate like parts, and in which:

Figure 1 is an elevational view, in cross section, of a preferred embodiment of our invention;

Fig. 2 is an elevational view of the cathode structure of the device of Fig. 1, with parts broken away; and

Fig. 3 is a sectional view taken along the line III—III of Fig. 2.

Referring to the drawing and particularly to Fig. 1, our improvements are illustrated in a high power tetrode type tube. The tube comprises an envelope **10** including an anode **11** of suitable material in the form of a tubular member closed at one end. The closed end of the anode **11** is provided with a tubulation **12** for the evacuation of the envelope and is pinched off after exhaust and a cap **13** is placed over the tubulation. The anode **11** is provided with a radiator core **14** surrounding the anode **11** and attached to the anode **11** by solder **15**. Radiator fins **16** are attached to a part of the radiator core **14** and are utilized for air cooling of the tube.

The lower end of the anode **11** has its outer surface slightly reduced in diameter to provide a positioning seat **17** for the inner edge of an anode ring **18** which is brazed to the anode **11**. The outer edge of the anode ring **18** is sealed to the top of the envelope **10** as indicated at **19**.

A screen **21** of cylindrical shape is disposed within and coaxial with the anode **11**. A screen support **22** is provided in the form of a frustro-conical surface. The top of the screen support **22** has the same diameter as the screen **21** and is attached to the bottom of the screen **21**. The lower portion of the screen support **22** has a larger diameter than the top and has an outturned flange **23**. A screen terminal **24** in the form of an annular member having an inturned flange **25** and coaxial with the screen **21** and of greater diameter is positioned so that the flange **23** of the screen support **22** may be attached to the flange **25** of the screen terminal **24**. The

screen support **22** is connected to the screen terminal **24** by a terminal ring **26** which is clamped by bolts **27**. The envelope **10** is also sealed to the flange **25** of the screen terminal **24** and encloses the screen support **22**.

A grid **29** of cylindrical shape is disposed within and coaxial with the screen **21**. The grid **29** is supported by a cylindrical member **30** which has an outturned flange **31** at the bottom. The member **30** is of similar diameter and coaxial with the grid **29**. The top of the grid support **30** is connected to the lower portion of the grid **29** while the flange **31** of the grid support **30** is connected to a grid terminal **32**. The grid terminal is in the shape of a cylindrical member having an inturned flange **33** at its top. It is of smaller diameter than the screen terminal **24** and is disposed within the screen terminal **24**. The outturned flange **31** on the bottom of the grid support **30** is fastened to the inturned flange **33** of the grid terminal **32** by means of a clamp ring **34** and bolts **35**. A preformed glass seal **36** is positioned between the screen terminal **24** and the grid terminal **32** with the grid terminal **32** extending below the screen terminal.

A filamentary cathode **37** which is cylindrical in shape is positioned within and coaxial with the grid **29**. The cathode wires **38** are supported at the top by support member **39** which is transverse to the axis of the tube and of disc-like shape with suitable filament holding means attached around the circumference. The cathode wires **38** are supported at the bottom by lower and upper platforms **40** and **41** which are transverse to the axis of the tube and disc-like in shape.

The lower and upper platforms **40** and **41** are formed with peripheral tabs or anchors **42** and **43** alternately arranged in a circle and which defines the circumference of the cathode **37**. The tabs **43** are longer on the lower platform **40** than the tabs **42** on the upper platform **41** so that the tops of both sets of tabs **42** and **43** are at the same height along the axis of assembly. The cathode wires **38** are in the form of a hairpin loop. One end of each wire **38** is welded to a tab **42** and then the middle of the wire is fastened to the top support **39** and then the other end of the cathode wire **38** is welded to the tab **43**. The cathode wires **38** may be held or retained by the top support member **39** in any suitable manner.

The upper cathode support platform **41** is connected to the upper end of two upper support leads **45** and **46** which are parallel to the axis of the assembly and located at an equal distance from the axis and positioned 180° apart. The lower end of the upper support leads **45** and **46** is connected to an upper cathode terminal **47**. The upper cathode terminal is an inverted cup-shaped metallic member having its cylindrical surface coaxially located with respect to the tube assembly. The upper cathode terminal is disposed within and the lower portion extends below the grid terminal **32** and a preformed glass seal **48** is positioned between the grid terminal **32** and the upper cathode terminal **47** for stability and insulation.

The lower cathode platform **40** is connected to the upper ends of two lower support leads **49** and **50** which are parallel to and of the same length as the two upper support leads **45** and **46** disposed 90° from the upper support leads **45** and **46** and at an equal distance from the axis as the support leads **45** and **46**. The lower support leads **49** and **50** pass through apertures **51** and **52** located in the top **55** of the upper cathode terminal **47** and are attached to a lower connector assembly **53**. The lower connector assembly **53** is composed of a lower cathode metallic terminal **56** in the form of a cylinder, and a metallic flared connector **57** in the form of a cylindrical member having its lower portion brazed to the lower cathode terminal **56** and the upper portion having

an outturned flange 58. The connector 57 is coaxially disposed within and extends below the upper cathode terminal 47. The two lower support leads 49 and 50 are connected to the flange 58 of the connector 57. A preformed glass seal 59 is positioned between the connector 57 and the upper cathode terminal 47 and rests on the lower terminal 56. The lower cathode terminal 56 may be of the same diameter as that of the upper cathode terminal 47 and is positioned slightly below the upper cathode terminal 47.

A cathode center support rod 60 is centrally located with the assembly and has its lower end embedded within a vitreous material within the inside of the connector 57. The center support rod 60 carries on its upper end the top cathode support 39 mounted for axial movement. The top cathode support is insulated from the cathode center rod 60. The cathode wires 38 are tensioned by pusher sleeve 61 and a spring 62 surrounding center rod 60. A collar 63 is located near the lower part of the center rod 60 and the spring 62 is interposed between the collar 63 and the pusher sleeve 61. The upper part of the pusher sleeve 61 pushes against the bottom of the top cathode support 39. A centrally located aperture is provided in the top of upper cathode terminal 47 for passage of the center support rod 60.

Our invention, by providing for the equal length cathode support leads and equal distance of positioning of the leads from the axis of the assembly, results in a rugged mechanical cathode connection and support and alleviates the expansion problem due to the heat of the cathode assembly. The simple tube assembly also permits the making of the metal-to-glass seals in a furnace in one operation. This insures the alignment and relative position of all the parts in the assembly. The design of the cathode assembly also permits the use of a larger diameter cathode terminal than that previously known which permits the use of a spring type socket contact.

Another advantage of the support leads 50, 46, 45 and 49 is that when they are heated, being the same length and subject to same temperature and temperature gradients, they will expand equally. It is also an advantage that the cooling on each set of support leads is equal. If the cathode terminal is placed below the other in coaxial connecting type tube, some inequality in the length of the support structure must result. Our invention is such that inequalities occur in the cooler portion of the tube where the differences in expansion due to heating is small.

While we have shown our invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit and scope thereof.

We claim as our invention:

1. An electron discharge device comprising an envelope enclosing a plurality of electrodes including a cathode, a support for said cathode including a metallic cup-shaped upper terminal having a central aperture, a first set of equal length support leads connecting said cathode to said cup-shaped terminal, a tubular member having an outturned flange disposed within said cup-shaped terminal, a second set of equal length support leads of the same length as said first set extending through apertures provided in said cup-shaped terminal connecting said cathode to said tubular member and a solid cylindrical terminal connected to said tubular member of similar diameter as said cup-shaped terminal, said first and second set of support leads extending from said terminals to which they connected in the same direction.

2. An electron discharge device comprising an envelope enclosing a plurality of electrodes including at least a cathode, a support for said cathode including a first cylindrical member having an inturned flange on the top thereof, a second cylindrical member having an outturned flange on the top thereof, said second cylindrical member disposed within and extending below said first cylindrical member, a third cylindrical member attached to the lower end of said second cylindrical member and separated from said first cylindrical member, a center support rod for said cathode having its lower end embedded within said second cylindrical member, means attached to said center support member for tensioning said cathode, a first set of cathode support leads of equal length connected to said cathode and to the inturned flange of said first cylindrical member, and a second set of equal length support leads of the same length as said first set extending through apertures provided in said cup-shaped terminal and disposed at 90° with respect to said first set of support leads, said second set of support leads being connected to said cathode and to the flange of said second cylindrical member, said first and second sets of support leads extending from the terminal member to which they are connected in the same direction.

3. In combination with an envelope of an electron tube, a first solid cylindrical terminal, a second hollow cylindrical terminal, said second terminal having an inturned flange at the top thereof, said first and second terminals being coaxial and having the same diameter, said first terminal being insulated from and positioned below said second terminal, a cylindrical surface connector having an outturned flange on the top thereof, said connector being coaxially disposed within said second terminal with the lower end of said connector extending below said second terminal and connected to the top of said first terminal, a seal between the lower portion of said first and second terminals, a plurality of equal length support leads vertically positioned coaxial with said first and second terminals and extending in the same direction from said terminals, a portion of said support leads being connected to the outturned flange of said connector and passing through apertures in the flange of said second terminal to a lower platform, the remainder of said support leads being connected to the inturned flange of said second terminal and to an upper platform, means of connecting filament ends to said upper and lower platform, and means for tensioning said filaments supported by said connector and electrically insulated therefrom.

4. In combination in an envelope of an electron tube, a cathode structure comprising a first terminal for said cathode in the form of a solid cylindrical member, a second terminal for said cathode in the form of a hollow cylindrical member having an inturned flange located at the top thereof, said first and second terminals being coaxial and substantially of the same diameter, said first terminal being insulated from and positioned below said second terminal, a hollow cylindrical connector member having an outturned flange on the top thereof, said connector being coaxially disposed within said second terminal, the lower end of said connector extending below said second terminal and being connected to said first terminal, a glass seal located between said first and second terminals, first and second support leads vertically positioned 180° apart and at equal distances from the axis of said tube, said first and second support leads being connected to the outturned flange of said connector and passing through apertures in the inturned flange of said second terminal, third and fourth support leads vertically positioned 180° apart and located at the same distance from the axis and 90° apart with respect to said first and second support leads and being of the same length as said first and second support leads, and means attached to the top of said support leads for attaching filaments.

5. A support structure for a cylindrical cathode comprising a lower solid cylindrical terminal, a tubular member, an outturned flange located at the top of said cylindrical member, said tubular member being coaxially disposed with respect to said lower terminal and having its lower portion attached to the top of said lower terminal, an inverted cup shaped metallic upper terminal having the same diameter as said lower terminal and

coaxially positioned with respect to said tubular member so as to enclose said tubular member with its lower portion positioned slightly above said lower terminal, a spacing ring of vitreous material interposed between said tubular member and said upper terminal and resting on the top of said lower terminal, a filament tensioning means having its lower portion imbedded within an electrical insulating material within said tubular member and its upper portion connected to a top cap of said cylindrical cathode, a first pair of equal length support leads connected to the outturned flange of said tubular member and to a lower support platform for said cylindrical cathode, a second pair of support leads of the same length as said first pair connected to the top of said upper terminal and to an upper support platform for said cylindrical cathode, and filamentary cathode wires having one terminal connected to said lower support platform and another terminal connected to said upper support platform and held in position by said top cap.

6. A support structure for a cylindrical filamentary cathode comprising a lower cylindrical metallic terminal, a tubular connecting member having an outturned flange near the top of said connector member, said connector member having its lower portion connected to the top of said lower terminal and coaxially positioned with respect to said lower terminal, an inverted cup like metallic upper terminal surrounding said connector and coaxially positioned above said lower terminal, a spacing ring of

vitreous material interposed between said connecting member and said upper terminal and resting on the top of said lower terminal, a support rod having its lower portion imbedded in a vitreous material within said connecting member and having a sleeve and spring surrounding said support rod pressing against a top cap of said filamentary cathode so as to tension the filamentary members of said cathode, vertically positioned equal length support leads disposed at equal distances from said support rod and at equal distances from each other, an upper support platform having tabs located around its circumference for connection to filamentary members of said cathode, alternate leads of said support leads having their lower portion connected to said upper terminal and upper portion connected to said upper support platform, a lower support platform having tabs located around its circumference for connection to filamentary members of said cathode, the remaining of said support leads passing through apertures in said upper terminal and connecting said lower support platform to said connecting member.

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