July 28, 1931. G. A. McNEILL 1,816,601

ELECTRON DISCHARGE DEVICE

Filed March 26, 1926

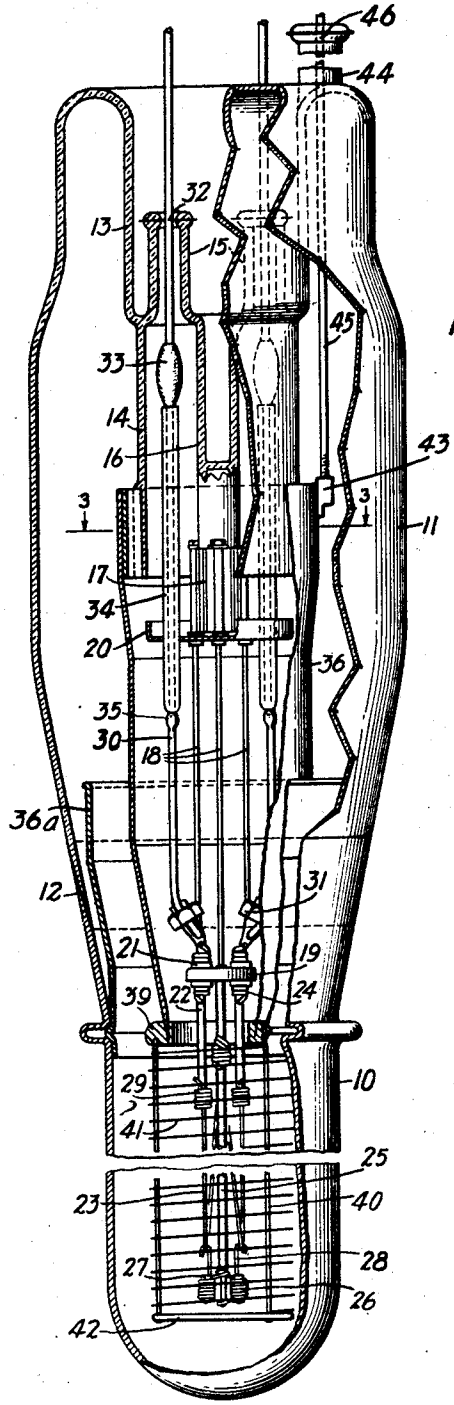


Fig. 1.

Fig. 2

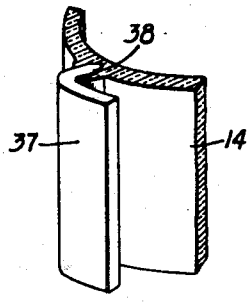
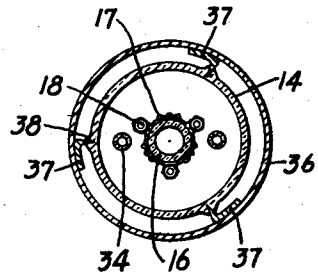


Fig. 3.



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UNITED STATES PATENT OFFICE

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ELECTRON DISCHARGE DEVICE

Application filed March 26, 1926. Serial No. 97,652.

This invention relates to electron discharge devices and more particularly to such devices of high power capacity.

In high power water-cooled electron discharge devices of the external anode type, it is found necessary to surround the filament supporting structure with a cylindrical metal protective shield to prevent arcing between the anode and filament structure. This protective shield is usually supported from a corrugated collar frictionally attached to the stem of the enclosing vessel of the device. The corrugated collar is subject to excessive heat generated in the device and due to the difference of expansion and contraction of the metal collar with respect to the glass stem with which it is in contact, there is a possibility of the collar becoming loose or injuring the glass stem, and thereby materially decreasing the operating efficiency of the discharge device.

An object of this invention is to provide an efficient shield support which will not be affected by temperature changes.

A further object of the invention is to eliminate the frictional contact between a metal support and an insulating supporting surface.

In accordance with this invention the protective metal shield surrounding the filament supporting structure is supported from an insulating portion, such as a glass stem, of the enclosing vessel, by means of metal angular spacers or ribs having an edge tapered and sealed into the glass stem. These spacers or ribs are preferably of a metal having approximately the same coefficient of expansion as glass and are positioned around the circumference of the glass stem with their free end surfaces engaging the inner surface of the cylindrical shield and are welded thereto to form a rigid supporting structure. This arrangement provides a support which will not be affected by temperature changes within the device and also maintains the shield in a fixed position. Furthermore, the strain on the refractory wall is eliminated, since there is no frictional contact between the metal and glass elements.

The invention is disclosed in the following detailed description in connection with the accompanying drawings in which, Fig. 1 illustrates an electron discharge device with parts broken away to show the embodiment of the invention, Fig. 2 is an enlarged perspective view to illustrate the invention, and Fig. 3 is a cross-sectional view of a portion of Fig. 1 on the line 3—3.

Referring specifically to Fig. 1, an electron discharge device is shown consisting of an enclosing vessel having a cup-shaped metal anode portion 10, and a glass portion 11, hermetically sealed together as shown at 12, in accordance with the metal to glass seal disclosed in W. G. Houskeeper Patent 1,294,466, issued February 18, 1919, and entitled "Combined metal and glass structure and method of making same." A re-entrant stem 13 closes the open end of the glass wall 11 and is provided with a cylindrical supporting wall 14 which projects within the enclosing vessel. A pair of glass tubular extensions 15 are sealed to the inner end of the stem 13 and are re-entrant with respect to the stem.

A tubular extension 16, coaxial with respect to the supporting wall 14, extends from the stem 13 and supports a corrugated collar 17 which carries the supporting rods 18 to which is attached a metallic disc or block 19. This disc is provided with insulating bushings 21, through which extend metallic rods 22 to form connectors for the filament 23. The rods 22 are preferably affixed to the disc 19 by means of one or two turns of wire 24 being welded to the rods on either side of the insulating bushings 21. A central supporting rod 25 extends within the anode 10 from the metal disc 19, and carries at its free end a pair of wire helices 26 which support insulating inserts 27 through which extend metallic hooks 28. The filament 23 is preferably of M-shape and is supported at one end by the hooks 28 and at the other end by the wire helices 29 which bind the filament to the rods 22. The end of each connector 22 extending toward the stem is provided with a slot to receive a leading-in wire 30 which is rigidly fas-

tened to the connector by means of a nut 31. A heat deflecting shield 20 having the edge turned up is supported on the collar 17 and located adjacent the inner end of the supporting wall 14, to protect the glass seals from the excessive heat generated in the device and the upturned edge of the shield presents a surface parallel with a surrounding shield to be hereinafter described so that discharges therebetween are less likely to occur. The leading-in wire 30 extends through an aperture in the heat deflecting shield 20 and projects through the tubular extensions 15 on the glass stem and is sealed thereto by means of a copper disc seal 32 as disclosed in W. G. Houskeeper Patent 1,293,441, issued February 4, 1919. The leading-in wire 30 is also provided with a flexible connection 33, in the form of a copper braid, to prevent undue strain on the disc seal 32. A tubular glass insulator 34 surrounds the leading-in wire 30 adjacent the shield 20, and is prevented from shifting, by an enlargement 35 on the leading-in wire 30. This insulator prevents contact of the leading-in wire with the heat deflecting shield 20.

A metallic shield 36 composed of alternate cylindrical and tapered sections welded together surrounds the filament supporting structure and forms a barrier between the anode 10 and the filament supporting structure. This shield forms a large smooth surface over which the electric field within the device is dissipated and prevents the occurrence of arcing or corona effects.

A metallic shield 36*a* similar to the shield 36 but of larger diameter is concentrically arranged with respect to the shield 36, and adjacent to the seal 12 between the anode 10 and the glass portion 11. The small diameter end of the shield 36*a* is fastened to the anode by spinning the edge thereof into the ridge formed on the anode. This arrangement forms a good mechanical connection between the shield and the anode and forms an efficient structure for the protection of the glass seal made at the point 12.

In accordance with this invention the shield 36 is supported from the tubular wall 14 by means of metallic spacing members or ribs 37, of angular cross-section and having one edge 38 tapered to a sharp point. The angular ribs 37 may be of copper, iron, nickel or platinum alloy to provide a supporting rib of metal to which the shield 36 may be rigidly fastened. While the above metals may be used to advantage to obtain an efficient support, it is preferable to use a nickel-iron alloy, commercially known as "meteor" metal, which has approximately the same co-efficient of expansion and contraction as glass and is relatively inexpensive when compared with platinum or a platinum alloy having the same characteristics. The tapered edge 38 of the angular rib 37 is sealed into the longitudinal outer surface of the wall 14, in accordance with the method disclosed in W. G. Houskeeper Patent 1,293,441, issued February 4, 1919. This arrangement is clearly shown in the enlarged detail of Fig. 2. The intimate contact of the glass around the knife edge 38 provides a secure joint between the metal and glass and since the amount of metal embedded in the glass wall is relatively small, the expansion of the metal is immaterial. The use of a metal, such as "meteor" metal, having the same coefficient as glass further reduces the difference of expansion and contraction. A plurality of the spacers or ribs 37 are arranged around the outer circumference of the wall 14 as shown in Fig. 3 to form a tripodal support for shield 36. It will be seen from Fig. 3 that the three angular ends of the ribs 37 engage the inner surface of the shield 36 and may be securely fastened thereto by any suitable means, such as spot welding. This arrangement forms a rigid support for the protective shield 36 and overcomes the difference of expansion between the metal parts and the glass wall 14.

Attached to the end of the shield 36 and projecting within the anode 10, is a metal collar 39 which supports metallic rods 40. These rods form supporting members around which the helical wire grid is wound. Attached to the free end of the rods 40, is a metallic disc 42, which forms a shield between the end of the anode 10 and the insulating inserts 27, of the filament supporting structure. Attached to the end of the shield 36 adjacent to the stem 13, is a threaded socket 43 which is substantially in alignment with a tubular extension 44, sealed to the juncture between the glass wall 11 and the stem 13. A metallic rod 45 extends through the extension 44 and is threaded to the socket 43, the outer end of the rod 45 being sealed to the tubular member 44 by means of a disc seal 46. This arrangement forms the leading-in wire for the grid 41.

What is claimed is:

1. In an electron discharge device, an enclosing vessel having a stem of insulating material, a metallic L-shaped angular member having a longitudinal edge embedded in said stem, and a tubular member surrounding said stem and metallic member, said metallic member spacing and supporting said tubular member from said stem.

2. In an electron discharge device, an enclosing vessel having a stem, a tubular metal member surrounding said stem, and a supporting member between said stem and tubular member, said supporting member having a longitudinal edge embedded in said

stem and a surface in contact with said tubular member.

3. In an electron discharge device, an enclosing vessel having a stem, a tubular member surrounding said stem, and an angular supporting member of sheet-like material having a surface parallel with said stem engaging said tubular member and having a portion extending lengthwise of said stem and embedded therein.

4. In an electron discharge device, an enclosing vessel having a stem, a tubular member surrounding said stem, and a supporting member of flat material having a tapered edge extending lengthwise of and sealed into said stem, said member having a surface parallel with said stem engaging the inner surface of said tubular member.

5. In an electron discharge device, an enclosing vessel having a stem of insulating material, a tubular metal member surrounding said stem, and an angular supporting rib adjacent to, and extending longitudinally of and embedded in said stem and supporting said tubular member, said supporting rib being composed of a nickel-iron alloy having approximately the same co-efficient of expansion as glass.

6. An electron discharge device, comprising an enclosing vessel having a glass portion and a metal portion, said metal portion acting as the anode of said device, an inwardly projecting stem on said glass portion, a tubular wall extending from said stem, a plurality of metallic angular ribs sealed into the outer surface of said tubular wall, a supporting structure on said stem and extending within said anode, a filament supported thereon, a tubular metallic shield surrounding said supporting structure, said shield being supported by said angular ribs, and a wire grid surrounding said filament and coaxial with said anode, said grid being supported on said shield.

7. An electron discharge device having a stem of insulating material, electrodes therein, a tubular member for holding one of said electrodes, and a support for said member comprising a plurality of metallic members spaced around said stem, each of said members having one end embedded in said stem and the other end bent over to form a curved surface to which said tubular member is welded.

8. In an electron discharge device comprising an enclosing vessel having a stem, a cylindrical wall extending from said stem, a tubular metallic member surrounding said wall, and means for supporting said member from said wall comprising a metallic angle bracket having approximately the same coefficient of expansion as said wall, one leg of said bracket being affixed to said member and disposed parallel to said stem and the other leg of said bracket having an edge extending lengthwise of said stem and embedded therein.

In witness whereof, I hereunto subscribe my name this 24 day of March, A. D. 1926.

GEORGE A. McNEILL.