July 17, 1934. V. L. RONCI 1,966,523

ELECTRON DISCHARGE DEVICE

Filed May 9, 1931

FIG. 1

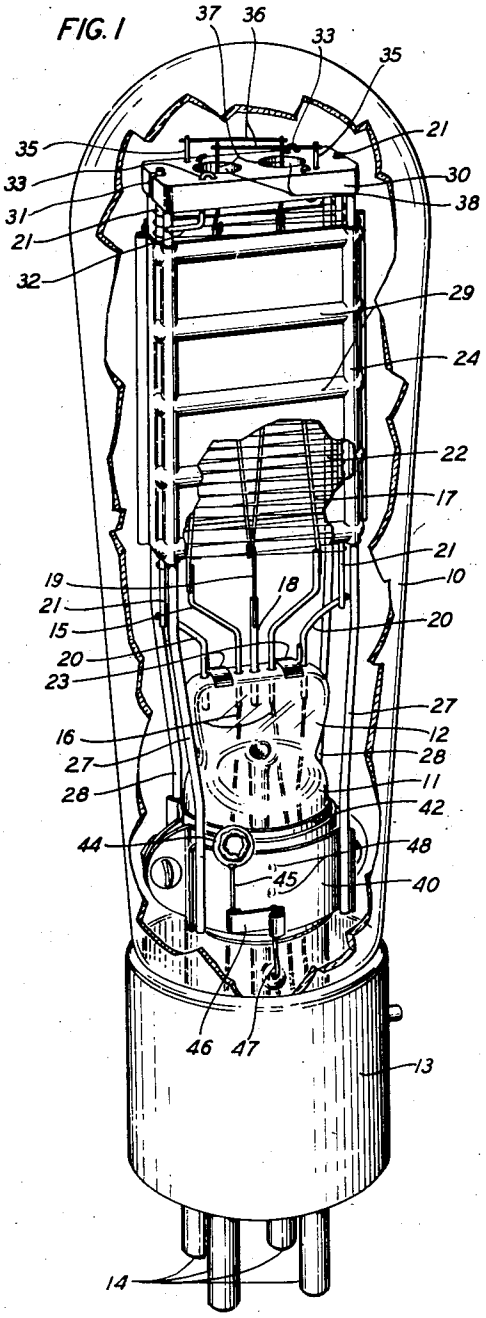


FIG. 2

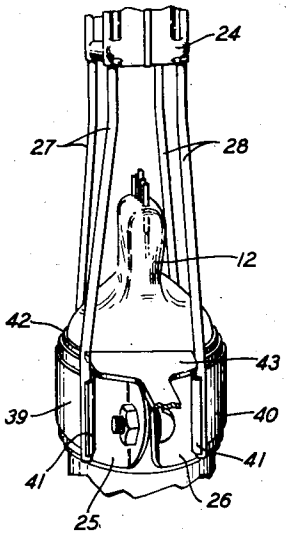
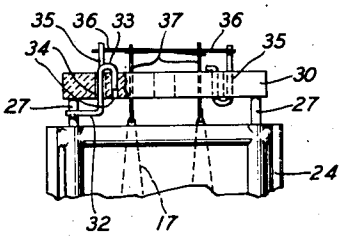


FIG. 3



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ELECTRON DISCHARGE DEVICE

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12 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to an electrode assembly in such devices.

In electron discharge devices, it is preferable to mount an electrode, usually the anode, on a reentrant stem of an enclosing vessel by a plurality of rods which are attached to a metallic collar clamped about the stem. In the assembly of such devices, the electrode structure is usually constructed independently and then mounted within the vessel by placing the collar about the stem and clamping the collar against the stem. Due to manufacturing tolerances, the dimensions of the stem vary over an appreciable range and as a result the ultimate diameter of the electrode supporting collar likewise varies over an appreciable range. This produces excessive stresses in the electrode supporting rods and there is danger of destruction of the electrode assembly. Furthermore, the high temperatures encountered in the evacuating processes of the device may cause undue strains of the electrode supporting rods to such an extent that distortion of the anode occurs or the supporting rods may be severed from the collar.

In such electron discharge devices, the cathode is usually supported from an insulating member rigidly mounted on the anode. It has been found that due to non-uniform expansion and contraction of the insulating member and the anode during the preliminary heat treatment and subsequent operation of the device, excessive stresses are produced in the anode or insulating member which may cause destruction thereof.

An object of this invention therefore is to reduce the stresses in the electrode assembly of discharge devices and to prevent deleterious distortion of the assembly by temperature variations.

Another object of this invention is to maintain the proper space relation of the electrodes during the operating life of the device.

In accordance with one feature of this invention, adjustable links are interposed between the metallic collar and the electrode supporting rods to allow accurate adjustment of the spacing of the rods during the assembly of the device and thereby prevent the setting up of excessive and deleterious stresses in the rods. In a specific embodiment, the adjustable links comprise arcuate metallic bands fixed intermediate their ends to the metallic collar. Each band supports two of the electrode supporting rods which are attached to opposite ends of the band. The electrode assembly is constructed independently of the stem and then positioned in the device by clamping the collar about the stem. A gauge is inserted between the adjacent rods on the collar and the links are adjusted until the desired spacing of the rods is obtained in which the stresses will be a minimum.

In accordance with another feature of this invention, an insulating member for supporting an electrode such as a cathode from a second electrode, such as an anode, is in abutting relation to the ends of rods or the like forming a part of the anode assembly and is positioned by tie wires welded to the rods and extending through bores in the insulating member. In this construction as the rods vary in length with temperature changes, the insulating member moves vertically and slides along portions of the tie wires passing through the member and is maintained in its proper seating position on the rods.

These and other features of this invention will be understood more clearly from the following detailed description with reference to the accompanying drawing, in which:

Fig. 1 is a perspective view of an electron discharge device made in accordance with this invention with portions of the enclosing vessel and the anode broken away to show the electrode assembly more clearly;

Fig. 2 is a fragmentary detail view of the supporting structure of the anode illustrating the method of properly adjusting the spacing of the supporting rods in accordance with one feature of this invention; and

Fig. 3 is a fragmentary detail view partly in cross section showing the sliding links between the insulating support and the anode in accordance with another feature of this invention.

Referring now to the drawing, the electron discharge device, in one embodiment of this invention, comprises an evacuated enclosing vessel 10 having a reentrant stem 11 terminating in a press 12. The enclosing vessel 10 is attached to a base 13 of insulating material carrying terminal prongs 14 for associating the device with an electrical circuit. A pair of bent rigid wires 15 embedded in the press 12 are connected to two of the terminal prongs 14 through leading-in wires 16 and are attached to the ends of an M-shaped filamentary cathode 17. The cathode 17 may comprise a nickel ribbon coated with oxides of alkaline earth metals, for example, barium and strontium. A straight rigid wire 18 likewise embedded in the press 12 carries a metallic hook member 19 which engages the mid-point of the cathode 17.

Another pair of bent wires 20, one of which is

electrically connected to one of the terminal prongs 14, support metallic upright rods 21 extending lengthwise of the vessel 10, upon which a rectangular helical grid 22, preferably of nickel, is wound and uniformly spaced about the cathode 17. Metallic shields or plates 23 are welded to the wires 20 and located above the press 12 between the supporting wires 20 and the filament wires 15 to prevent the deposit of the cathode coating material upon the press 12 and thereby overcome leakage paths between the wires 15 and 20. A flattened cylindrical anode 24 preferably of carbonized nickel, surrounds the filament and grid and is supported from a two-part metallic collar comprising two semi-circular sections 25 and 26 clamped about the stem 11. The anode is supported from the collar by two pairs of metallic rods 27 and 28 which are welded within the corners of the anode and extend beyond the end thereof remote from stem 11. The anode is preferably formed with longitudinal and transverse corrugations or ribs 29 which increase the rigidity of the anode and prevent buckling and distortion thereof by temperature variations during the operation of the device. An insulating block 30 of "lavite", "isolantite", or the like, rests upon the extended ends of the rods 27 and 28 and is provided with recesses or guideways 31 in alignment with the grid supporting rods 21 in which the ends of the supporting rods 21 are loosely disposed.

It has been found in using insulators mounted from the anode and supporting another electrode such as the cathode, that it is not practical to extend the rods 27 and 28 through bores in the block 30. Where the rods extend through the block, the insulating block expands and contracts non-uniformly during the evacuation or preliminary heat treatment of the device, and as a result stresses are produced in the rods which may result in distortion or tearing of the anode 24 or fracture of the insulator.

In accordance with a feature of this invention the insulating block 30 is positioned on the rods 27 and 28 by tie wires, the tie wires each having a shank portion 32 attached to rods 27 and 28 and a U-shaped portion 33 loosely positioned within twin bores 34 in the insulating block 30. During the operation of the device or in the preliminary heat treatment thereof, the rods 27 and 28 expand and contract with temperature changes and the insulating block 30 continually rests upon the rods and slides along the U-shaped portions 33 of the tie wires and the proper disposition of the block 30 with respect to the anode 24 is thereby maintained. A pair of bent wires 35 is rigidly fixed in the insulating block 30 and each of these wires has welded thereto a flexible wire 36. The wires 36 have in turn affixed thereto hook members 37 which extend through apertures 38 in the insulating block 30 and engage the apices of the M-shaped filamentary cathode 17.

Due to manufacturing tolerances the diameter of the stem 11 varies appreciably and as a result the spacing between the anode supporting rods 27 and 28 is not always the same. In an assembly of a device in which the anode supporting rods are attached directly to the collar, when the collar is clamped about the stem, a stress is consequently introduced therein which may be of sufficient magnitude to cause buckling of the anode 24 with subsequent temperature variations. This difficulty is overcome by mounting the supporting rods on separate arcuate-shaped flexible members or bands 39 and 40, each having flanged or curved ends 41. The band 40 is affixed at its center, for instance, by spot welding as shown at 48, to the section 26 of the collar and the rods 28 are affixed to opposite ends of the band. Similarly, the band 39 is attached at its center to the section 25 of the collar and carries at its ends the rods 27. In the assembly of the device the split collar is clamped about the stem 11 in the usual way with a thin sheet 42 of insulating material, such as mica or the like, interposed between the collar and the stem. The insulating sheet 42 increases the friction between the collar and the stem and also increases the insulation between the collar and the grid and the cathode leading-in wires. A gauge 43 is then inserted between opposite rods 27 and 28, as shown more clearly in Fig. 2, the bands 39 and 40 are flexed until the proper spacing between the rods 27 and 28, is obtained so that a minimum stress is produced in the rods. Thus spaced, the rods 27 and 28 will not produce deleterious stresses in the anode by temperature variations and warping or destruction of the anode during the operation of the device is eliminated.

A flat metallic disc 44 having a shank 45 attached thereto and carrying a strip of getter material for fixing residual gases in the enclosing vessel 10 is supported from a metallic strip 46 affixed to one of the bands 39 or 40. A leading-in wire 47 for the anode 24 is secured to the strip 46, sealed in the side of the stem 11 and electrically connected to one of the terminal prongs 14.

Although a specific embodiment of the invention has been disclosed and described herein, it is to be understood that the invention is not limited thereto and that modifications may be made therein without departing from the scope of this invention as defined in the appended claims.

What is claimed is:

1. An electron discharge device comprising an enclosing vessel having a stem, a collar encircling said stem, an electrode assembly, and means for supporting said electrode assembly including a band member mounted on said collar and extending peripherally thereof, said member being flexible to adjust the spacing between portions of said member and said collar.

2. An electron discharge device comprising an enclosing vessel having a stem, a collar encircling said stem, an electrode, spaced members for supporting said electrode extending at one end to points adjacent said collar, and adjustable means extending peripherally of said collar to which said members are secured.

3. An electron discharge device comprising an enclosing vessel having a stem, a unitary electrode assembly supported from said stem including a collar clamped about said stem, an electrode, a plurality of pairs of rods for supporting said electrode, and a plurality of members mounted on said collar, one member for each pair of supporting rods, said members having a flexible portion to allow accurate space adjustment between certain rods in different pairs.

4. An electron discharge device comprising an enclosing vessel having a stem, a collar encircling said stem, a plurality of flexible members mounted on said collar and extending circumferentially thereof, a pair of rigid members mounted on each of said flexible members, and an electrode mounted on said rigid members.

5. An electron discharge device comprising an

enclosing vessel having a stem, a collar encircling said stem, a metallic member attached intermediate its ends to said collar, a plurality of rods projecting from the ends of said metallic member, and an electrode mounted on said rods.

6. An electron discharge device comprising an enclosing vessel having a stem, a collar encircling said stem, a pair of flexible metallic bands attached intermediate their ends to said collar, a rod attached to each end of each band, and an electrode mounted on said rods.

7. An electron discharge device comprising an enclosing vessel having a stem, an electrode assembly mounted on said stem, an insulatory member abutting against one extremity of said electrode assembly, means separate from said assembly rigidly secured at one end to portions of said assembly and at the other end extending loosely into said insulatory member for maintaining said member in contact with said electrode assembly, and an electrode supported from said insulatory member.

8. An electron discharge device comprising an enclosing vessel having a stem, an electrode above said stem and parallel thereto, a plurality of rods supporting said electrode from said stem, each of said rods having an end extending beyond the end of the electrode remote from the stem, an insulating member seated on the projecting ends of said rods, tie wires attached to said rods for positioning said insulating member on said rods, and an electrode supported from said insulating member.

9. An electron discharge device comprising an enclosing vessel having a stem, a collar encircling said stem, members having flexible end portions extending peripherally of said collar, rigid rods supported by the end portions of said members and extending lengthwise of said vessel, an electrode mounted on said rods, an insulating member in engagement with the ends of the rods remote from said stem, tie wires positioning said insulating member on said rods, and an electrode supported from said insulating member.

10. An electron discharge device comprising an enclosing vessel having a stem, a plurality of rods extending above said stem, an electrode mounted on said rods, said rods each having an end projecting beyond the end of said electrode remote from said stem, an insulating member having a plurality of bores therein seated on the projecting ends of said rods, and a member having portions loosely positioned in said bores attached to certain of said rods.

11. In the manufacture of an electron discharge device comprising an enclosing vessel having a stem, a unitary electrode assembly supported by said stem including a collar, flexible members secured to said collar, and a plurality of spaced rods attached at one end to said flexible members and at the other end to said electrode assembly, the method of relieving undue stress in said electrode assembly when subjected to temperature variations which comprises, attaching said flexible members to said collar on opposite sides thereof with the ends of the flexible members free from said collar, joining said rods to said electrode assembly and to the ends of said flexible members, fastening said collar on said stem, and adjusting the flexible members to space said rods with respect to said collar.

12. An electron discharge device comprising an enclosing vessel having a stem, an anode, a cathode and a grid, means for supporting one end of said cathode and grid from said stem, a plurality of rods for supporting said anode, an insulating member at one end of said rods for supporting the other end of said cathode and grid, a collar surrounding said stem, comprising two semi-circular members secured together, and a pair of arcuate-shaped metallic members secured to said collar at opposite sides of said stem, said arcuate members having flanged ends, said rods being secured to said flanged ends.

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