

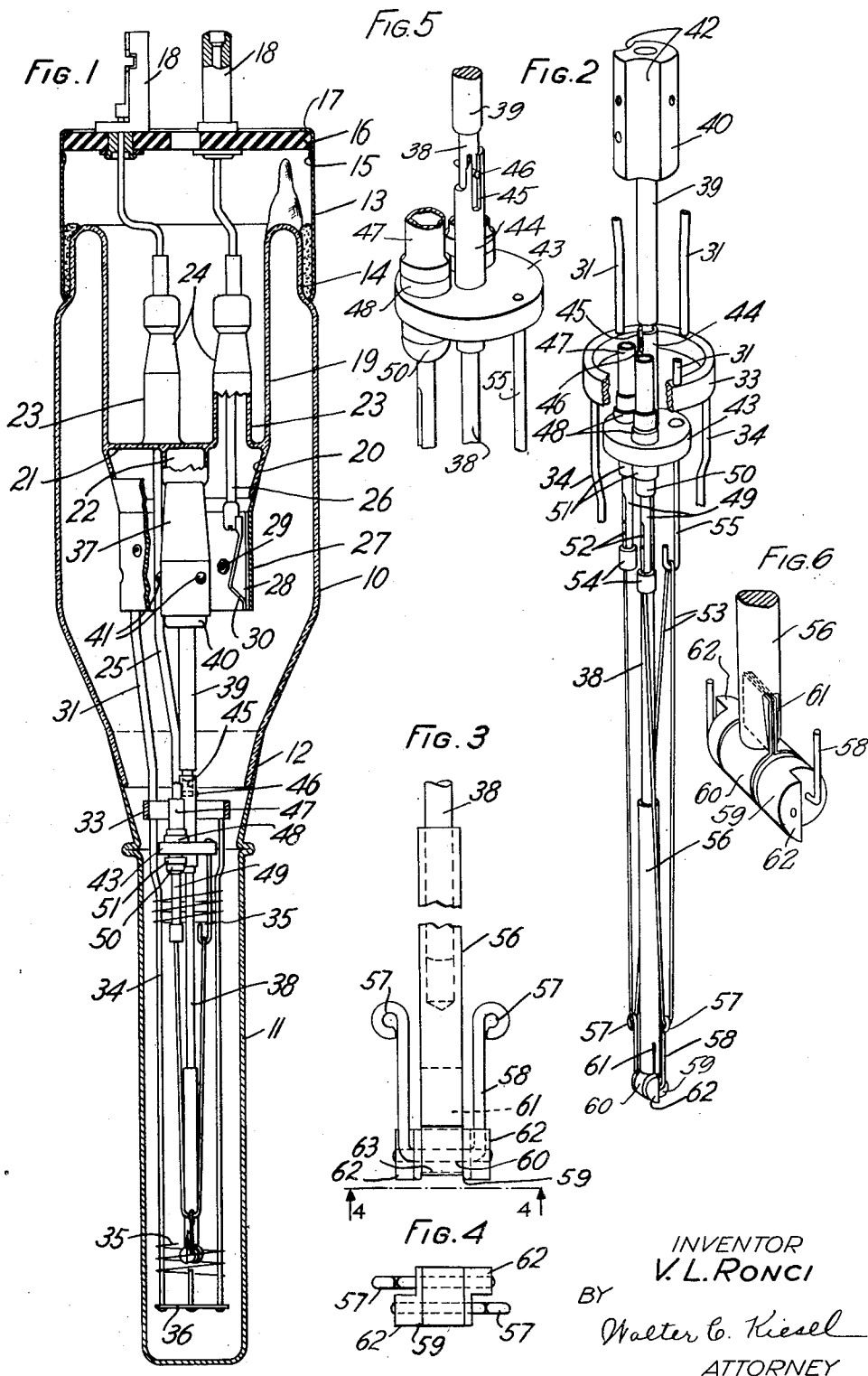
Oct. 18, 1932.

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1,882,936

ELECTRON DISCHARGE DEVICE

Filed May 21, 1930



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ELECTRON DISCHARGE DEVICE

Application filed May 21, 1930. Serial No. 454,210.

This invention relates to electron discharge devices and more particularly to such devices capable of handling a large amount of power.

5 In electron discharge devices operating with high power the relatively heavy filamentary cathode is subject, during normal use, to expansion and contraction due to alternate heating and cooling and, further-
10 more, is sometimes subject to progressive contraction during a considerable portion of its normal life. This repeated expanding and contracting action sets up deleterious stresses within the filament and materially
15 decreases the normal life thereof. Heretofore, the filament was rigidly anchored to its supporting structure and there resulted because of the heating and cooling, a disturbance in the space relation of the cathode
20 to the other electrodes and a consequent change in the static and dynamic characteristics of the discharge device. The filament leading-in wires are likewise subject to expansion and contraction and there is a tendency
25 for these wires to buckle and come in contact with other metallic parts of the structure of the device and cause failures.

An object of this invention is to increase the operating life of filamentary cathodes in
30 electron discharge devices.

In accordance with this invention the heavy filament wire or cathode of an electron discharge device is suspended between a base member and a sleeve member, both of which
35 are telescopically supported or slidably mounted upon a metallic guide rod supported from a re-entrant stem of the enclosing vessel. The base member is supported by the filament leading-in wires and the sleeve
40 member is supported by the filament wires. Any expansion or contraction of either the filament or filament leading-in wires is accompanied by a movement of the base and sleeve along the guide rod. In this manner
45 excessive stresses in the filament and leading-in wires are eliminated, the space relation of the cathode and the other electrodes is maintained constant and the operating characteristics of the discharge device are maintained
50 uniform for high operating efficiency.

The various features of this invention will be apparent from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is a view in elevation partly in cross-section of an electron discharge device made in accordance with this invention with a portion cut away to show the detailed construction of the interior parts of the device;

Fig. 2 is an enlarged perspective view illustrating the assembly of the filament on the support and the relation of the filament and grid structures;

Fig. 3 is an enlarged view of a portion of the filament support illustrating the slidable sleeve and insulator for supporting one end of the filament;

Fig. 4 is an enlarged end view of the support shown in Fig. 3 to illustrate the shape of the insulator;

Fig. 5 is an enlarged perspective view of a partial assembly illustrating the correlation of the filament supporting platform and the guide rod; and

Fig. 6 is an enlarged perspective view of the insulator construction shown in Figs. 3 and 4.

Referring to the drawing the electron discharge device comprises an enclosing vessel having a glass portion 10 and a metallic cup-shaped portion 11, which serves as the anode of the discharge device, hermetically sealed at 12 in accordance with the method disclosed in U. S. Patent 1,294,466, issued February 18, 1919, to W. G. Housekeeper. During the operation of the device the cup-shaped anode is supported in a cooling jacket (not shown) so that the discharge device is in the position shown in Fig. 1. A tubular metallic shell 13 is cemented to the glass portion 10 of the enclosing vessel at 14 and is provided with an inwardly projecting ridge 15 which holds an annular disc 16 of insulating material, such as "micarta", against a flange portion 17 of the shell 13 and fastens the disc 16 in the outer end of the shell. The insulating disc 16 supports terminals 18 which serve as external connections for the electrodes of the discharge device.

The glass portion 10 is formed with an

inwardly extending stem having a cylindrical wall portion 19, a tapered portion 20 and a partition 21 at the junction of the cylindrical and tapered portions. The partition 21 is formed integrally with an inwardly extending hollow hub or cup 22 and outwardly extending tubular portions 23 to which are sealed copper caps 24 and which enclose portions of the filament and grid leading-in wires 25 and 26 respectively. A copper collar 27 is sealed to the tapered portion 20 of the stem and has an inner metallic ring or sleeve 28, preferably of nickel attached thereto by the bolts 29. A flexible conducting link 30 is welded to the grid leading-in wire 26 and to the ring 28 and establishes an electrical connection therebetween. A plurality of rigid metallic rods 31, only one of which is shown in Fig. 11 are welded to the metallic ring 28 and support another metallic ring 33 which carries a plurality of rods 34 welded thereto and extending lengthwise and parallel to the axis of the cup-shaped anode 10. The rods 34 support a helical wire grid 35, only the end portions of which are shown, concentrically arranged within the anode 10. A metallic disc 36 which is welded to the free ends of the rods 34 and disposed adjacent the base of the anode 10 serves as a shield between the base of the anode 10 and the cathode to prevent arcing and subsequent destruction of the insulating support suspended from one end of the cathode.

A tapered open-ended metallic thimble 37 is sealed to the hub 22 and supports the filament structure which comprises a central upright metallic rod 38, preferably of molybdenum, having an integral enlarged end portion 39 fitted into an axial drilling in a metallic plug 40. The plug 40 is of a diameter to fit easily in the metallic thimble 37, being held therein by screws 41, and is provided with longitudinal slots or cut-out portions 42 to allow the removal of gases from the hub 22 during evacuation of the device and thereby insure a high vacuum. A circular metallic disc or platform 43, preferably of nickel, has a tubular sleeve 44, also of nickel, welded thereto and passing through the center thereof. This sleeve is of a diameter to slide easily along the upright rod 38, as clearly shown in Fig. 5, and is provided with two rectangular diametrically disposed slots 45 in one end. A guiding pin 46 extends through the upright rod 38 and into the slots 45 to prevent rotation of the sleeve 44 and the platform 43.

The platform 43 is held freely suspended by the filament leading-in wires 25, the ends of which are welded in tubular metallic connectors 47 each spaced from the platform 43 by flanged insulating bushings or eyelets 48 which are seated in an aperture in the disc 43. The tubular connectors 47 are tapped to accommodate a threaded portion of the shanks 49 which extend through the disc 43 and are

provided with a shoulder 50 threaded to the shanks and insulatingly spaced from the disc 43 by flanged bushings or eyelets 51. The shanks 49 are further provided with slots 52 extending lengthwise thereof in which the ends of a heavy wire filament 53, preferably of tungsten, are held by metallic collars 54 forced over the ends of the shanks 49 to clamp the ends of the filament 53 in place. A metallic hook 55, the shank of which extends through the disc 43 and is welded thereto, forms a third supporting element engaging the filament 53. The construction and assembly of the platform and associated parts are disclosed more fully in my copending application, Serial No. 396,034, filed September 30, 1929. Since the platform 43 is slidably mounted on the rod 38 it is free to move longitudinally by the action of gravity when the filament leading-in wires 26 expand or contract, thereby preventing displacement or buckling of the leading-in wires 26 and also preventing contact thereof with other metallic elements in the device.

A metallic sleeve 56 is slidably mounted on the free end of the upright rod 38 and held suspended by the filament wires 53 which pass through eyelets 57 in L-shaped hook members 58 embedded in an insulator 59 disposed adjacent the outer end of the sleeve 56. The insulator 59 is held in place by a metallic strip or band 60 which passes around the substantially cylindrical central portion of the insulator 59 and has its ends fastened in a narrow slot 61 in the sleeve 56, as clearly shown in Fig. 6. The insulator 59 is also provided with semi-cylindrical oppositely faced extensions 62, one at each end of the insulator, against which the shanks of the hook members 58 rest to prevent rotation of the hook members. In order to prevent rotation of the insulator 59 as a whole, the central portion is provided with a flat face 63 against which the band 60 bears. The sleeve 56, being slidably mounted on the rod 38, is free to move as the heavy wire filament 53 expands and contracts and is of sufficient weight to maintain the filament under a constant tension by the action of gravity and thereby maintain the space relation of the filament with respect to the grid 35 and the anode 11 substantially fixed throughout the operating life of the device. Since the space relation of the electrodes is maintained the internal impedance of the device will be substantially constant and the static and dynamic characteristics of the device will be maintained uniform thereby insuring efficient operation.

Although in the specific embodiment shown the invention is illustrated applied to a filament structure, it is to be understood that the principles of the invention are equally applicable to the grid structure and that various modifications may be made in the assembly as described 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 filamentary cathode, a grid and an anode mounted concentrically about said cathode, a member extending from said stem and coincident with the axis of said grid and anode, and cathode supporting elements slidably mounted in spaced relation on said member.

2. An electron discharge device comprising an enclosing vessel having a glass portion and a metallic portion, said metallic portion serving as the anode of said device, an inwardly extending stem on said glass portion, a filamentary cathode and a grid concentrically disposed within said metallic portion suspended from said stem, a member extending from said stem coincident with the axis of said grid and anode and supporting elements slidably mounted in spaced relation on said member engaging said cathode.

3. An electron discharge device comprising an enclosing vessel having a stem, a rod supported from said stem and extending lengthwise of said vessel, a filamentary cathode, and means slidably mounted in spaced axial relation on said rod supporting said cathode and allowing free expansion and contraction thereof while maintaining said cathode under a substantially uniform tension.

4. An electron discharge device comprising an enclosing vessel having a re-entrant stem, a central upright rod supported from said stem and extending lengthwise of said enclosing vessel, a platform slidably mounted on said rod, a filamentary cathode suspended from said platform, and gravity actuated means supporting said cathode slidably mounted on said rod for maintaining the cathode under a substantially uniform tension.

5. In an electron discharge device having a stem, an electrode structure comprising a rod supported from said stem and extending lengthwise of the device, a platform slidably mounted on said rod intermediate the ends thereof, a sleeve member slidably mounted on said rod at one end thereof, and an electrode suspended between said platform and said sleeve.

6. In an electron discharge device having a stem, an electrode structure comprising a rod supported from said stem and extending lengthwise of the device, a platform slidably mounted on said rod intermediate the ends thereof, a sleeve member slidably mounted on said rod at one end thereof, an electrode suspended between said platform and said sleeve, and means on said platform and sleeve for engaging said electrode.

7. In an electron discharge device having

a stem, an electrode structure comprising a rod supported from said stem, a filamentary cathode, means comprising a sleeve member slidably mounted on said rod, an insulator attached to said sleeve, and cathode engaging means embedded in said insulator.

8. In an electron discharge device, an electrode structure comprising a rod supported therein, a filamentary cathode, a sleeve member having a slot in one end thereof carried by said rod, an insulator disposed at right angles to said sleeve member, a metallic band encircling said insulator and having its ends fastened in the slot of said sleeve member, and a pair of hook members mounted on said insulator engaging said cathode.

9. In an electron discharge device having a reentrant stem, an electrode support comprising a rod extending from said stem, a disc slidably mounted on said rod, leading-in wires sealed in said stem and supporting said disc, and an electrode suspended from said disc.

10. In an electron discharge device, an electrode structure comprising a metallic support, an insulator mounted thereon, said insulator having a substantially cylindrical body portion and two semi-cylindrical extensions, metallic hook members having one portion embedded in said insulator body portion and the other portion resting against the flat face of one of said extensions, and an electrode carried by said hook members.

11. An electron discharge device comprising an enclosing vessel having a glass portion and a metallic portion, said metallic portion serving as the anode of the device, a grid electrode concentrically disposed within said metallic portion, an inwardly extending stem on said glass portion having a central projection and a plurality of eccentric tubular outwardly extending projections integral with said stem, leading-in wires sealed in said tubular projections, a metallic thimble sealed to said central projection, and a filament structure supported from said thimble comprising a plug fitted in said thimble, a rod embedded in said plug and extending lengthwise of said vessel, a platform and a sleeve slidably mounted on said rod, said platform being supported by leading-in wires, and a filamentary cathode supported between said platform and sleeve and concentrically disposed about the axis of said metallic portion.

In witness whereof, I hereunto subscribe my name, this 17th day of May, 1930.

VICTOR L. RONCI.