July 17, 1934. W. L. KRAHL 1,967,208

ELECTRON DISCHARGE DEVICE

Filed April 25, 1931

Fig. 1.

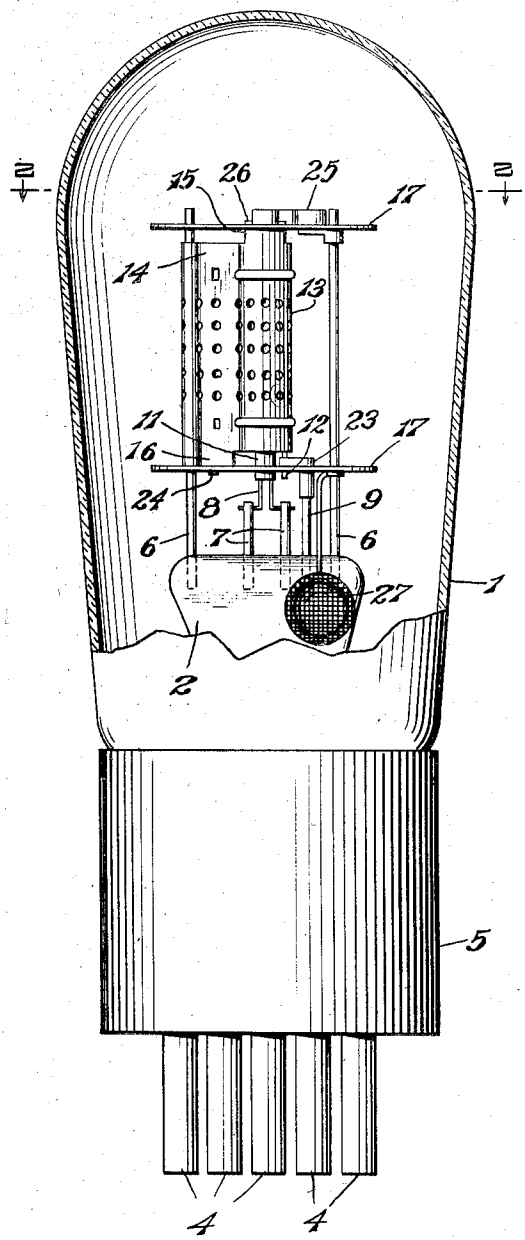


Fig. 2.

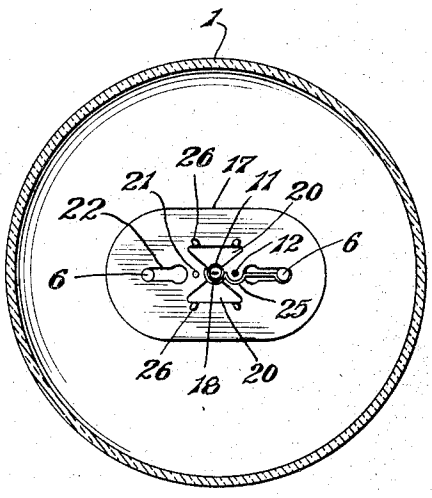
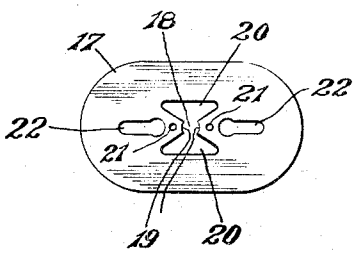


Fig. 3.



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ELECTRON DISCHARGE DEVICE

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Application April 25, 1931, Serial No. 532,723

6 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to the structure of the insulators employed in holding the electrodes in spaced position and supporting them, and has for its object the provision of an improved insulator which will reduce electric leakage, promote the circulation of gases within the envelope enabling the residual gases to be more thoroughly removed, and to obtain other advantages and results as may be brought out in the following description.

It will be obvious to those skilled in the art to which this invention appertains and upon becoming conversant with the details thereof, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted as showing a preferred exemplification of the invention.

Referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views:

Fig. 1 is a side elevation of an electrode assembly shown mounted in an envelope broken away to disclose the assembly;

Fig. 2 is a sectional view on line 2—2 of Fig. 1 showing the upper insulator;

Fig. 3 is a plan view of the lower insulator.

In the specific embodiment of the invention illustrated in said drawing, reference numeral 1 indicates an envelope, usually constructed of glass and providing in the finished item an upstanding stem 2 within the envelope and having a press by which a plurality of upstanding rods are sealed-in, the lower ends of certain of the rods being connected to prongs 4 exterior of the envelope and carried as usual by a base 5 mounted at the lower end of the envelope. This structure, as so far described, is common in the art and may be varied in accordance with desired or common practice.

As here shown, the sealed-in rods upstanding from the press are all in a common plane, being positioned in a row and the two extreme rods 6, 6 of the row are much longer than the other rods, extending the full height of all of the electrodes. Between the extreme rods 6, 6 are three other rods, two of which, as 7, 7 are preferably disposed symmetrically with respect to the longitudinal axis of the envelope and form supporting connections for the ends of a hair-pin filament 8. The third intermediate rod, disposed between one of the filament rods and one of the said extreme rods 6 constitutes a support 9 for the lower end of the grid (not shown).

The electrodes utilized in the present construction of electron discharge device comprise in addition to the upstanding hairpin filament 8, a tubular cathode 11 which surrounds the hair-pin filament and is heated thereby. Suitable insulation, such as surface coating on one of the parts is provided between the filament and cathode so as to electrically separate the two parts and prevent short circuiting of the filament. The grid is preferably of a cylindrical character coaxial with the cathode and carried by a longitudinal rod 12 within the grid and to which each convolution thereof is secured as by welding. Outside of the grid is arranged a cylindrical anode 13, this part also being coaxial with the grid and cathode. The anode is preferably made of sheet metal with the marginal ends of the metal brought together after forming the cylinder and extending radially from the cylindrical portion as a longitudinal radial flange 14 and with the extreme edge of the flange encircling and secured to one of the extreme upstanding rods 6.

It will be noted that the anode provides a pair of extensions 15 at its upper end on opposite sides of the cylindrical part of the anode, the upper edges of these extensions forming upwardly facing shoulders. The lower end of the flange 14 extends below the lower edge of the cylindrical portion of the anode, as at 16, and the lower edge of this extension likewise provides a downwardly facing shoulder. Above and below the anode, transverse to the axis thereof, are a pair of parallel insulators 17—17. The improvement in structure of these insulators constitutes an important feature of this invention.

The insulators here shown are of any suitable material, such as mica, are somewhat oval in shape, that is, are elongated with rounded ends, and are preferably duplicates of each other. The center of each insulator provides a cutaway portion or opening 18. Assuming the insulator to have a longitudinal axis, the said opening is symmetrical with respect to the said axis and with respect to the short axis perpendicular to the longitudinal axis at its center. The said central opening 18 provides arcuate engaging portions 19 having a radius substantially equal to that of the outside radius of the cathode. It is a feature of the present invention to make these arcuate edges of the insulator that engage the cathode as short as possible and yet obtain proper support for the cathode. From the ends of the arcuate edges just mentioned, the opening flares outwardly, thereby forming substantially triangular openings 20 on opposite sides of the longitudinal axis, the sides of the triangular openings furthest from the axis preferably being parallel thereto and to each other.

By the construction thus described, it will likewise be observed that substantially triangular portions of the insulating material are directed toward the cathode longitudinally of the axis of the insulator, these triangular portions being diametrically opposed in relation to the cathode. Within the substantially triangular portions of the insulator thus formed I provide holes 21 for

receiving the end of the grid support rod 12. Beyond the holes 21 and also along the longitudinal axis of the insulator are provided other openings or slots 22 through which the extreme rods 6—6 may pass other connections made. Where the insulator is used at the bottom of the anode, the grid connection 23 attached to grid support rod 12 may pass through one of these slots and tabs 24 from the lower edge of the extensions 16 of flange 14 of the anode may pass through the other slot. Where the insulator is used at the top of the anode the slots 22 will receive the upper ends of the extreme rods 6—6 from the press and one of the slots will accommodate passage of a connection 25 therethrough from one of said extreme rods to the cathode. The anode is secured to this upper insulator by tabs 26 projecting from the upper edge of the tubular portion thereof through the triangular openings 20—20 adjacent the edges thereof which are parallel to the longitudinal axis of the insulator as clearly shown in Fig. 2.

It will be observed by the construction described above that the triangular openings 20—20 in both insulators not only permit desired circulation enabling thorough exhaustion of the tube to be effected, but also enables the flashing of the tube to be effective upon residual gases within the anode. It will be understood that it is common practice in manufacture of electron discharge devices to provide a capsule 27 of magnesium or other material which is ultimately heated to high temperature, or flashed for obtaining a combination with gases remaining in the tube to eliminate the same as gases. In order to fully accomplish this elimination of residual gases effectively the same must be eliminated from within the anode as well as elsewhere, and I have therefore provided an anode which is open at its end nearest the capsule and open particularly at its lower end to encourage the downward movement of the gases as the same become affected by the flashing of the magnesium or other material.

Furthermore, I have as before mentioned, provided the triangular openings in the insulator, thereby furnishing a free passage for the gases therethrough.

These openings have the further advantage and beneficial effect according to my invention of greatly reducing the electrical leakage over the insulator between the anode and cathode. It is known that the process of flashing may form a conductive deposit on the surface of the insulator resulting in leakage between the electrodes in use and thus changing the characteristics of the tube. These openings in the insulator increase the electrical path between the electrodes and also reduce the possible area over which leakage may occur, thus reducing electrical leakage.

Obviously detail changes and modifications may be made in the construction and use of my improved electron discharge device without departing from the spirit or scope of the invention, and I do not wish to be understood as limiting myself to the exact construction shown or described except as set forth in the following claims when construed in the light of the prior art.

Having described my invention I claim:

1. In an electron discharge device having a cathode and grid, a pair of supporting rods on opposite sides of said cathode and grid, and an anode carried solely by one of said rods, an insulating plate at one end of said anode secured thereto at separated points, means for securing said plate to said other supporting rod, said cathode passing through the center of said insulating plate and supported at two points thereby, said plate having an opening the edge of which forms a contact surface for engagement with both the anode and cathode.

2. In an electron discharge device having a cathode, a grid, an anode, and supporting rods offset from said grid, a pair of insulatory plates transverse to said cathode receiving the end portions thereof, said support rods projecting through both said plates, the anode disposed between said plates and having extensions at opposite ends thereof for engaging said plates, said plates having relatively large dual openings therein joined by a relatively small opening shaped to receive and hold said cathode, the anode extension at one end engaging the corresponding plate on the large opening edges farthest removed from said small opening.

3. In an electron discharge device having an anode, cathode and grid, a pair of insulatory plates transverse to said cathode receiving the end portions of the same, said anode disposed between said plates and having extensions at opposite ends engaging said plates, said plates having relatively large dual openings therein joined by a relatively small opening shaped to receive and hold said cathode, the anode extension at one end engaging the corresponding plate on the large opening edges farthest removed from said small opening.

4. In an electron discharge device a cathode, an anode, means for supporting said cathode and anode and separate means for maintaining said cathode and anode in fixed position relative to each other, said separate means including an insulatory plate provided with an opening the cathode contacting with said plate on opposite sides of the opening and said anode contacting with said plate on opposite sides of said opening along a line at right angles to a line joining said first mentioned opposite sides.

5. In an electron discharge device a cathode, an anode, means for supporting said cathode and anode within said device and separate means for maintaining said cathode and anode in fixed position relative to each other, said separate means including an insulatory plate provided with triangular openings the bases of which are parallel and the apexes of which are superimposed to form a constricted opening adapted to receive the cathode and hold the same, the anode being secured to said plate along said parallel bases of the opening.

6. In an electron discharge device a tubular cathode, an anode, means for supporting said cathode and anode and separate means for maintaining said cathode and anode in fixed position relative to each other, said separate means including an insulatory plate provided with an opening, the cathode contacting with curved contacting edges of said plate on opposite sides of the opening and said anode contacting with said plate on opposite sides of said opening along a line at right angles to a line joining said first mentioned opposite sides.

WALTER LOUIS KRAHL.