

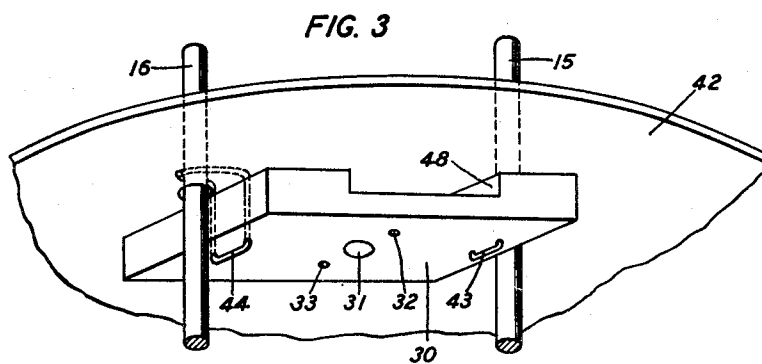
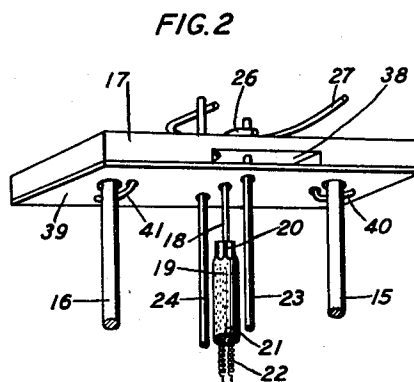
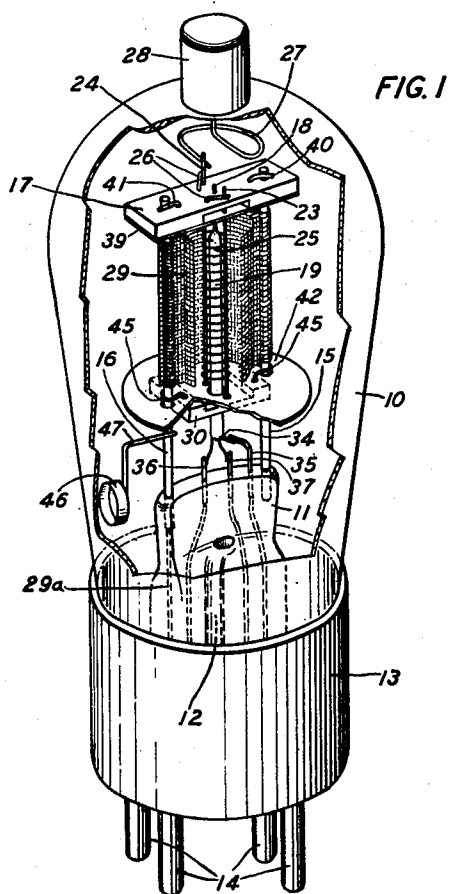
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ELECTRON DISCHARGE DEVICE

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ELECTRON DISCHARGE DEVICE

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15 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to such devices in which a diffusible substance is present.

Heretofore considerable difficulty has been experienced in controlling diffusible material, for instance, highly emissive substances coated on or combined with a core material which is usually heated to initiate the flow of electrons from the substance. Usually the emissive substance is coated on a cathode of a discharge device and cooperates with other electrodes to perform various functions relating to the amplification or rectification of feeble electrical currents. The electrodes are generally combined in a unitary structure with the electrode supports held in close relationship by spacers or bridging members usually of insulating material. The close proximity of the supports for the electrodes and the danger of the emissive material being thrown off the cathode during operation and being deposited on the spacers to form a conductive path between the supports cause irregular functioning of the electrodes and materially reduce the operating life of the discharge device.

One object of this invention is to prevent the formation of conductive paths between electrodes of discharge devices.

In accordance with this invention the electrodes of an electron discharge device, such as a cathode, a grid and an anode, are held rigidly in spaced relation by an insulating member at one end, or a plurality of insulating members at opposite ends, of the electrodes. In order to overcome the formation of conductive paths on the insulating spacing member, which, if present, prevent the electrodes from performing their proper function, a shield or baffle is positioned between the electrodes and the insulating member, the shield having apertures of suitable diameter so that the supports from the electrodes may freely pass through the baffle or shield without contacting therewith and the insulating member engaging the supports to maintain the electrodes in proper spaced relation.

In a specific aspect of the invention the insulating member comprises a block having a central undercut portion and extending end projections which engage a parallel baffle member to form a space between the insulating member and the baffle member. The baffle or shield is provided with slightly larger apertures than the insulating member through which the electrode supports extend without coming in contact with the baffle member and the supports extend into smaller apertures in the insulating member

which maintain the supports in proper spaced relation. This arrangement substantially eliminates the formation of conductive paths between the closely adjacent electrode supports since any conductive material thrown off the cathode will be deposited on the baffle member. Therefore, the baffle or shield materially increases the operating life of the device by preventing the formation of conductive paths between the electrode supports which are directly in contact with the insulating member or spacer.

Another feature of the invention relates to the support of the insulating spacer or member adjacent the stem to prevent the deposition of conductive material on the insulator which aligns the several electrodes and also on the glass stem in which the leading-in wires for the electrodes are embedded. In this arrangement a block insulator is positioned between the parallel supports for the anode and is provided with a cut out portion through which the cathode and grid extend, the cathode and grid being positioned coaxially in the axis of the vessel. A large diameter circular baffle or shield extends across the cut out portion of the insulator, the baffle and insulator members being held together by suspension hangers which extend therethrough and are joined to the anode supports. The circular baffle member is also provided with apertures through which the electrode supports extend to the insulator member without engaging the baffle member.

These and other features of the invention will be more clearly understood from the following detailed description in connection with the accompanying drawing.

Fig. 1 is a perspective view of one embodiment of the invention showing a discharge device with the enclosing vessel broken away to clearly illustrate the electrode assembly;

Fig. 2 is an enlarged perspective view of the spacing insulator and baffle member adjacent the free ends of the electrodes, the grid and anode being removed from the supports to clearly illustrate the invention; and

Fig. 3 is an enlarged perspective view of the insulator and baffle adjacent the stem, with the baffle member shown partially, in order to illustrate the details of the supporting structure for the insulator and baffle.

Referring to the drawing, the invention is disclosed as applied to a three-electrode equipotential discharge device as shown in Fig. 1 which comprises a highly evacuated enclosing vessel 10 having an inwardly projecting stem

and press 11 in which is located a thin tubulation 12 communicating with the interior of the vessel for evacuating the device. The portion of the vessel adjacent the stem is affixed or seated in a cup-shaped base 13 carrying a plurality of terminals 14 to which the leading-in wires of the electrodes are attached. The electrodes of the device are mounted beyond the stem by a rigid frame assembly comprising heavy parallel upright wires 15 and 16 embedded in the ends of the press on the stem 11 and a bridging insulating member or spacer 17, in the form of a rectangular block, which extends across the free ends of the rigid wires 15 and 16.

The insulating member 17 is provided with three aligned small diameter apertures in the central portion of the insulating block, the center aperture providing a sliding fit for a pin support 18 which engages one end of a cylindrical cathode 19 by pinching the cathode sleeve around the wire as shown at 20, Fig. 2. The cylindrical cathode is provided with the usual coating of emissive material to insure a copious emission of electrons to the other electrodes. A cylindrical insulator 21 provided with twin bores is enclosed within the cylindrical cathode and serves as a spacer between the cathode and a helically wound hair-pin heater element 22 located in the twin bores of the insulator. The outer apertures in the insulating block 17 receive upright wires 23 and 24 supporting a helical wire grid 25 which surrounds the cathode and is closely spaced therefrom. The supports for the grid are rigidly positioned in the insulating block 17 by anchor wires 26 which are seated in the block and are bent over and welded or otherwise secured to the grid supporting wires. One of the grid supporting wires 24 extends beyond the insulating block 17 and is attached to a flexible loop wire 27 which is sealed through the top of the enclosing vessel and attached to a terminal cap 28. An anode 29 formed of two strips of metallic mesh cloth and shaped into a cylinder having flanged portions which engage the rigid upright wires 15 and 16, surrounds the cathode and grid and serves as the output electrode of the discharge device. A leading-in wire 29a is connected to the rigid supporting wire 16 and one of the terminals 14 to enable the connection of an operating potential on the anode.

An insulating block 30 is also supported beyond the stem of the vessel at the end of the electrodes opposite the block 17 and is provided with a central aperture 31 through which the cylindrical cathode 19 extends, said aperture having a diameter slightly larger than the diameter of the cathode. Adjacent the cathode aperture 31 in the block 30 are two smaller size apertures 32 which receive the grid upright wires 23 and 24 to maintain uniform spacing between the cathode and the grid. The apertures in the block 30 merely act as guides for the cathode and grid since these electrodes are not held rigidly in the block 30. Therefore these electrodes may expand longitudinally without affecting the relative spacing between the electrodes. The cylindrical cathode 19 is provided with a tab 34 adjacent the stem, the tab being attached to a leading-in wire 35 which is connected to one of the terminals 14 on the base 13. Two leading-in wires 36 and 37 are also provided in the press and are connected to the terminations of the heater element 22 in order to supply heating current to the heater to energize the cathode material deposited on the cathode.

Due to the close spacing of the electrode supports in the insulating blocks at opposite ends of the electrodes and the large area of the cathode surface for emitting thermionically active material in the space between the electrodes, there is considerable danger of the emissive material from the cathode depositing on the insulating blocks where it forms conductive paths between adjacent electrodes and eventually destroys the proper functioning of the device. In order to overcome this difficulty in accordance with this invention, a baffle or shield is interposed between the electrodes and the insulating members, the baffle having apertures surrounding the electrode supports so that the supports are out of physical contact with the baffle. The deposition of active material on the baffle will not affect the electrodes and will not form conductive paths between the electrodes since the supports for the electrodes extend through the baffle without engagement therewith and the baffle prevents active material being deposited on the insulating support in which the electrode supports are held.

The invention is disclosed in a three-electrode electron discharge device in which the insulating block or spacer 17 is provided with a central undercut portion 38 in the region of the cathode and grid supports. The plane surfaces of the insulating block 17 adjacent the undercut portion serve as bearing surfaces for a baffle or shield 39, preferably of insulating material, such as mica, which may be of approximately the same size as the block 17 and is supported parallel thereto and rigidly affixed to the block 17 and the rigid upright wires 15 and 16 by tie wires 40 and 41 respectively. These tie wires extend through similar size apertures in the block 17 and the baffle 39 and are bent outwardly above and below the block and baffle and attached to the rigid wires 15 and 16. The baffle 39 is provided with apertures through which the electrode supports extend without engaging the baffle. This arrangement securely maintains the enlarged apertures in the baffle member in alignment with the apertures in the spacing block 17 so that the supports for the electrodes freely pass through the baffle without contacting therewith. The undercut portion 38 of the insulating spacer 17 forms a local area surrounding the closely spaced electrode supports of the cathode and the grid to insure adequate insulation between these elements. The baffle or shield interposed between the electrodes and the insulator prevents the deposition of active material from the cathode on the insulator where the electrode supports are held in position. Any material thrown off the cathode and deposited on the baffle member does not affect the insulation between the electrode supports, due to the free space surrounding each electrode support which extends through the baffle member. Therefore, even if conductive material deposited on the baffle member forms a conductive path thereon, this path will be discontinuous between the electrode supports and will not cause any serious difficulty with regard to the continued operation of the device. Due to the positioning of the baffle or shield between the electrodes and the insulating member in which the electrode supports are relatively fixed, the formation of conductive material on the insulating member, should any of said material pass through the space between the electrode supports and their corresponding openings in the shield, is limited to a substantially small area in the immediate vicinity of each support and will

not form a continuous path between adjacent supports.

The insulating block 30 aligns the cathode and grid in coaxial relation to the cylindrical anode and is also provided with a cut out portion 48 in the central portion of the block in which are located apertures for receiving the grid supports and cathode. A large diameter circular baffle 42, of insulating material, such as mica, is placed over the block 30 and is seated on the bearing surfaces of the block 30 projecting on opposite sides of the undercut portion 48. The insulating block 30 and the large baffle 42 are maintained in relative position by U-shaped hangers or suspension members 43 and 44 which extend through the block 30 and baffle 42 with the free ends bent outwardly and embracing the rigid supporting wires 15 and 16, respectively. The suspension members 43 and 44 support the insulator and baffle as a unit with the enlarged apertures in the baffle being held in alignment with the apertures in the insulating block 30 so that the supporting wires of the grid and the cylindrical cathode extending through the insulating block 30 are free and clear of the baffle member 42. The baffle member is also provided with enlarged apertures for the upright wires 15 and 16. A feature of this construction is that the cathode and grid assembly may be easily aligned in coaxial relation to the rigidly supported anode and the central apertures for the electrode supports and the cathode serves as a guiding member for the supports whereby these electrodes may expand longitudinally without distortion.

Another feature of the invention is the large diameter of the baffle or shield 42 which prevents the glass press receiving any deposit of cathode material projected through the fine interstices of the mesh anode 29. A getter support in the form of a metallic cup 46 is supported from the rigid wire 16 by a bent arm 47, the getter material being vaporized in the final evacuation of the vessel to fix residual gases in the device.

While the invention has been disclosed in a specific embodiment of a discharge device, it is of course understood, that various modifications may be made in the structure shown. Therefore, the invention is intended to cover other types of devices in which a diffusible material may form a conductive deposit on a surface in which electrode supports are held, to prevent the conductive material affecting the operation of the device. Furthermore, while a specific embodiment of the particular baffle has been disclosed it is intended that the invention may take other forms and need not necessarily be formed of separate layers. Therefore, the invention includes all modifications within the scope of the appended claims.

What is claimed is:

1. An electron discharge device comprising an enclosing vessel having a stem, a plurality of electrodes supported beyond said stem, separate means for spacing said electrodes in operative relation, and means interposed between said electrodes and spacing means to prevent the deposition of conducting material on said spacing means.

2. An electron discharge device comprising an enclosing vessel having a stem, a plurality of electrodes beyond said stem, supports for said electrodes extending from said stem, a spacing member connecting said supports, and shielding means between said electrodes and spacing member and free from engagement with at least one of said electrode supports.

3. An electron discharge device comprising an enclosing vessel having a stem, electrodes spaced from said stem, parallel supports extending from said electrodes, double insulating members on at least one end of said supports, and means extending on the outer surfaces of said members engaging said supports, only one of said members being in intimate contact with said supports.

4. An electron discharge device comprising an enclosing vessel having a stem, a plurality of electrodes supported from said stem, an insulating member spacing said electrodes in operative relation, and a shield carried by said insulating member adjacent said electrodes, said shield having portions free from contact with said electrodes.

5. A discharge device comprising an enclosing vessel having a stem, cooperating electrodes supported from said stem, individual projections extending from said electrodes, an insulating member extending across said electrodes engaging said projections to space said electrodes, and a baffle member between said insulating member and said electrodes, said baffle having apertures through which said projections extend without being in physical contact with said projections.

6. An electron discharge device comprising an enclosing vessel having a stem, a plurality of electrodes supported from said stem, projections on said electrodes extending in parallel relation, and a combination unitary baffle and insulating member extending across said electrodes, said insulating member having parallel portions and aligned apertures through which said projections extend, said projections being in contact with one of said portions and out of physical contact with said other portion of said insulating member.

7. An electron discharge device comprising an enclosing vessel having a stem, a plurality of electrodes supported beyond said stem, a plurality of insulating members positioned beyond the ends of said electrodes, supports between said electrodes and insulating members, and a baffle member between each insulating member and said electrode ends, the supports for certain of said electrodes being held in said insulating members and freely passing through said baffle member.

8. An electron discharge device comprising an enclosing vessel having a stem, a plurality of electrodes supported beyond said stem, extensions on said electrodes, an insulating member extending across said electrodes and connecting said extensions, and a perforated baffle parallel to said insulating member and surrounding a plurality of said electrode extensions in a single plane without engaging said extensions.

9. An electron discharge device comprising an enclosing vessel having a stem, a plurality of electrodes beyond said stem, supports for said electrodes extending therefrom, a plurality of insulating members positioned beyond the ends of said electrodes and engaging said supports, and mica shields between the electrodes and said insulating members, said shields having perforations sufficiently large so that the electrode supports extend freely therethrough.

10. In an electron discharge device, a plurality of parallel supports, electrodes carried by said supports, an insulating member adjacent one end of said electrodes connecting said support, a mica shield between said insulating member and said electrodes, and tie members extending through said insulating member and shield, said tie members engaging said supports.

11. An electron discharge device comprising an enclosing vessel having a stem, a plurality of electrodes including a cathode, a helical grid surrounding said cathode, a cylindrical anode surrounding said cathode and grid, insulating members extending across opposite ends of said electrodes, supports for said cathode and grid extending through said members, supports for said anode extending from said stem to one of said insulating members, said other insulating member being located between said anode supports, a perforated shield adjacent one of said insulating members through which said anode supports extend, and hanger members supporting said insulating member and associated shield from said anode supports. 80
12. An electron discharge device comprising an enclosing vessel having a stem, a plurality of electrodes including a cylindrical cathode, a helical grid closely surrounding said cathode, a cylindrical anode surrounding said cathode and grid, insulating members extending across opposite ends of said electrodes, supports for said cathode and grid extending through said insulating members, supports for said anode extending from said stem to one of said insulating members, said other insulating member being located between said anode supports, a perforated shield adjacent one of said insulating members through which said anode supports extend, and U-shaped suspension members extending through said insulating member and shield, said suspension members being bent outwardly between said shield and said electrodes and embracing said anode supports to prevent displacement of said shield. 85
13. An electron discharge device comprising an enclosing vessel having a stem, a plurality of parallel rigid wires extending from said stem, a cylindrical anode supported from said wires, a tubular cathode and a helical grid coaxially positioned within said anode, an insulating member extending across said cathode, grid and anode remote from said stem, said insulating member having a central undercut portion and plane end portions, an insulating strip engaging said plane portions, and means for holding said insulating member and strip together in rigid position on said parallel wires, said undercut portion of said insulating member forming a local area between said insulating member and strip surrounding said cathode and grid, whereby substantially no conducting material can accumulate to form a conductive path between said cathode and grid. 90
14. An electron discharge device comprising an enclosing vessel having a stem, a plurality of parallel rigid wires extending from said stem, an insulating member extending across the free ends of said wires, a cylindrical anode attached to said wires and interposed between said insulating member and stem, a cathode and grid coaxially positioned within said anode, said cathode and grid having extensions projecting into said insulating member, a perforated baffle carried by said supporting wires between said insulating member and electrodes, a second insulating member between said cathode, grid and anode and said stem, a perforated shield between said second insulating member and said anode, means for supporting said second insulating member and baffle from said rigid parallel wires, and a flexible wire beyond said first insulating member attached to said grid and extending to the exterior of said vessel. 95
15. An electron discharge device comprising an enclosing vessel having a plurality of electrodes including a cathode, an insulating member at each end of said electrodes for holding said electrodes in spaced relation, and a shield between each insulating member and the electrodes for preventing the deposit of diffusible material from said cathode on the insulating members. 100

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