Feb. 2, 1943. H. J. DAILEY 2,310,147

ELECTRON DISCHARGE DEVICE

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Fig. 1.

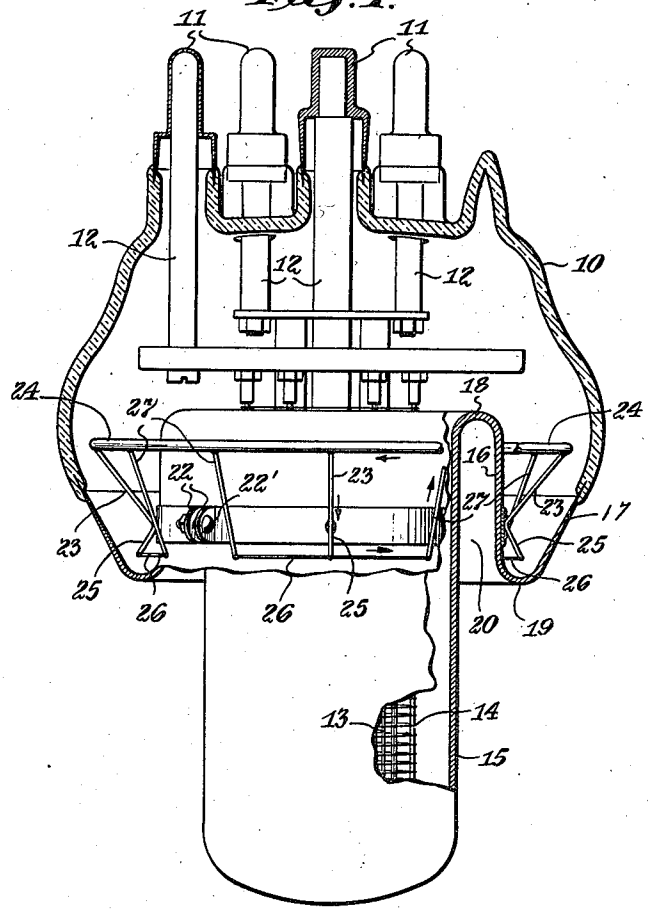
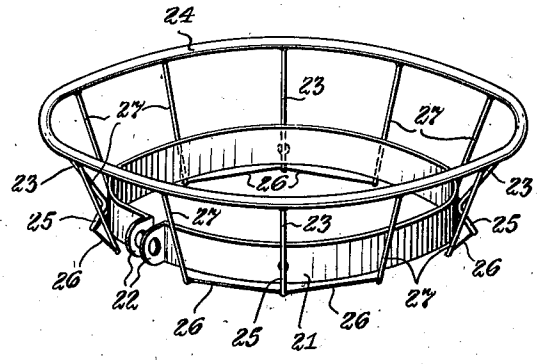


Fig. 2.



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ELECTRON DISCHARGE DEVICE

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9 Claims. (Cl. 250—27.5)

In the manufacture of electron discharge devices, one of the important steps of fabrication consists in the removal of occluded gases present within the envelope and within the material comprising the same as well as in that of other physical parts enclosed thereby. If such occluded gases are not removed, they will gradually be released within the envelope and impair the exhausted condition in which the device is designed to operate. There are several methods of removal of the occluded gases, of which the one most generally used involves the application of a high frequency induced current which will "flash" a suitable getter, the result being that the getter thereupon absorbs or otherwise combines with the occluded gases or places them in such condition that they may be withdrawn while the device is still upon the evacuating pump. Some difficulties have arisen in connection with flashing a getter in electron discharge devices. The flashing is similar to an explosion, exhibiting sudden occurrence and marked violence. There is consequently a tendency for a flashed getter to spatter, thereby introducing ill effects principal among which is the fact that the getter material will deposit upon metallic, glass and other surfaces. If the flashing is performed in the vicinity of the cathode, grid or anode which are subject in use to electron emission, control or reception, the resultant deposit finding refuge on those parts is apt to seriously affect the characteristics of the discharge device. Deposit sputtered upon glass portions of the envelope may also introduce undesired capacitance, conduction, discoloration, may cause electric or discharge leakage, may even result in breakage of the glass, and injects possibility of thereby or otherwise lessening the desirability or effectiveness of the device. Another difficulty encountered has been the fact that the high potential induced current applied for flashing purposes has also been effective upon the electrodes themselves to overheat the electrodes and thereby distort or otherwise damage the same.

In connection with electron discharge devices wherein the anode is directly sealed with respect to the ceramic or glass portion of the envelope, it has been found desirable to provide a featheredge for the anode for better sealing thereof with respect to the glass. However, functioning of the electron discharge device produces an electrostatic field originating within the device and effective upon the metallic part sealed to the ceramic part of the envelope. Inasmuch as an electrostatic field is inversely proportional to the square of the radius, the field at the featheredge, which is usually for copper approximately .002" in diameter, very high indeed. The problem sought to be solved in this connection by the present invention is accordingly directed to the control of this electrostatic field as well as to the elimination of the occluded gases.

An object of the present invention may accordingly be expressed as provision of means for solving the problem of heretofore unsatisfactory arrangement and flashing of a getter.

A further object of the invention is to provide a closed circuit including a getter wire situated remotely from the electrodes and also away from the glass part of the container so as to eliminate deleterious effects of the flashing of the getter.

A further object of the invention, more specifically stated, is to provide a construction wherein the getter, when flashed, will deposit on a part where it will not be harmful and will not deposit on parts where deleterious effects may occur.

A further object of the invention is to provide an arrangement of getter wires and supports which will effectively function in their capacities as a means for eliminating occluded gases, and at the same time to provide as part of the support for the getter wires a means comprising a shield for the featheredge of the metal rim of the envelope where sealed to the glass portion of the envelope.

A still further object which the invention has in view, is the provision of means for substantially eliminating electrostatic field from inside the device becoming effective in any substantial amount with respect to the featheredge seal between the metallic and glass portions of the envelope.

Still further objects of the invention will appear to those skilled in the art as the description progresses, both by direct statement thereof and by implication from the context.

In the accompanying drawing, wherein like numerals of reference indicate similar parts throughout the several views, and wherein a preferred embodiment of the invention is disclosed by way of example—

Figure 1 is a view partially in elevation and partially in longitudinal section showing an electron discharge device, inclusive of its envelope, embodying the present invention; and

Figure 2 is a perspective view of the combined getter and shielding means employed in connection with said invention.

In said drawing I have illustrated an elec-

tronic discharge device, generally identified as a transmitting tube, with the same in the position as ordinarily employed in use. It should be understood, however. that the invention is applicable to other electronic devices than the particular transmitting tube here selected for illustrative purposes, and that use of the tube is not necessarily limited to positioning the same with its electrodes directed downwardly, as here shown, but the invention may be employed in any desired electronic device and the device employed in any desired position. The reference as to direction of location of parts, as hereinafter employed, is accordingly merely a matter of convenience for reference purposes and is not to be understood as a limitation from a fabrication standpoint or from consideration of its use.

The specific electron discharge device here shown, comprises a glass or other ceramic portion having general configuration and position characterizing it as an inverted bowl 10 of which the bottom of the bowl is toward the top of the device and with the sides of the bowl depending therefrom. The glass or bowl portion of the envelope is provided with appropriate prongs 11 protruding therefrom in an upward direction vacuum sealed with respect thereto and with suitable posts 12 depending from the said prongs into the interior of the bowl for properly supporting electrodes or other parts and for making proper electric connection from the prongs to the electrodes. As illustrated, the said devices provides a cathode 13, grid 14 and anode 15, thereby comprising the electrode triode. Specific mention need be made only of the anode, the shape and characteristics of which bear particular relation to the present invention.

Anode 15 also constitutes a part of the enclosing envelope, the other part of such envelope being constituted by the inverted ceramic bowl 10. A cylindrical portion of the anode is disposed around the other two electrodes and thereby constitutes the anode proper. At the upper part of the anode, the same is integrally formed with outwardly and downwardly and then upwardly folded portions of the metal thereof shaped to provide a peripheral trough exterior of the anode proper shielded by an upper portion thereof in spaced relation thereto. The trough-like structure accordingly has peripheral flanks 16, 17 of which the inner flank 16 is substantially cylindrical and in parallelism to the anode proper, connected thereto by a rounded or curled portion 18 of hollow semi-toroidal shape constituting a ridge. The construction thus described constitutes flank 16 and corresponding part of the anode wall 15 and connecting rounded portion 18 a ridge separating the trough from the electrodes within the anode. At the bottom of the cylindrical inner flank 16, the metal curls outwardly and then upwardly, as at 19, constituting the bottom of the trough and connecting the metal integrally with the flaring and upwardly extending flank 17 heretofore mentioned. This flaring flank is feather-edged peripherally at its upper margin and is of less height than the cylindrical flank 16. The downwardly directed margin of bowl 10 is sealed upon the upwardly directed featheredged margin of the outer flank of the trough.

From the foregoing description it will be seen that a space exists peripherally between the anode proper and the vertical flank of the trough, thereby providing a downwardly opening pocket 20 into which any suitable cooling mechanism may be inserted or removed without affecting the vacuum seal of the envelope.

In carrying out the present invention, I provide a unitary basket-like structure which, after fabrication can be applied within the envelope as a unit prior to sealing the glass portion to the metallic portion of said envelope. This unitary structure is illustrated in its entirety in Figure 2. From that illustration, it will be observed that a split collar 21 is provided at the ends of which are protruding parallel ears 22 adapted to receive a bolt 22' by which the collar can be squeezed into tight frictional engagement upon the appropriate metallic part of the envelope. As shown, the collar is of substantially the same diameter as the cylindrical flank portion 16 of the trough, and is slid into place toward the lower part of the trough and there permanently clamped for obtaining a rigid mounting of the unitary structure in place.

At intervals around the collar are provided a plurality of wire or other supporting means 23 functioning as brackets for a shielding ring 24. Preferably the shielding ring 24 is continuous, of larger diameter than said collar and supported by said wires or brackets 23 at a level above the collar in a plane parallel thereto, said wires 23 sloping outwardly upward for that purpose and being welded or otherwise secured to the ring and to the collar. The lower ends of the said supporting wires, or brackets 23, below the area where welded or otherwise secured to the collar, slope downwardly outward, thereby providing a bottom or foot portion 25 to which the midpoint of a getter wire 26 is attached. The said getter wire is disposed in a direction approximately parallel to the next adjacent part of the collar, and the far ends of the getter wire are attached to connecting wires 27, 27 which depend from the ring at suitably spaced distances from the said bracket wires 23 and out of contact from said collar. The portion of the ring between attachment of the bracket wire 23 and the supporting connections 27 constitute therewith part of a circuit, completed by the intervening portion of the getter wire, for an induced current imposed for purposes of flashing the getter wire. The course of this induced circuit or current is indicated by arrows in Figure 1 in connection with one bracket wire and supporting connection.

From the above description of the construction of the unitary structure, and by reference to the showing of said structure in its assembled position in Fig. 1, it will now be apparent that the getter wire 26 is situated closely adjacent to, but out of contact from the bottom of the trough of the metallic part of the envelope, and within the evacuated portion of the envelope. It will also be noted that the getter wire is at a considerable distance from the junction between the metallic and glass portions of the envelope. When the getter is flashed, the metallic deposit resultant therefrom will find refuge on the adjacent metallic part and will not form a coating upon the glass part of the envelope in view of the distance intervening between the getter wire and the glass part. The metallic part upon which the product of getter flashing deposits, while physically an extended part of the anode, is, in fact, not functioning with respect to the other electrodes as an electron receiving surface, and accordingly will not affect the characteristics of the electron discharge device. The fact that the getter wire is far distant from the other electrodes, prevents the flashing of the

getter wire from applying any deposit upon the other said electrodes. The fact that the inner flank 16 of the trough is vertical or cylindrical, not only enables the collar 21 to be applied and to fit properly, but also constitutes said flank as a shielding wall for the products of flashing of the getter wire, said wall being situated between the getter wire and the said electrodes.

The outer flank 19 of the trough slopes outwardly, thereby situating the featheredge at a distance from the central axis of the device greater than the radius of ring 24. Accordingly, in assembly, the glass portion 10 of the envelope is moved downwardly so the rim portion thereof passes the ring and is brought into engagement with the featheredge of the metallic part and sealed thereto. It should be particularly noted that the said outer flank is shorter than the inner flank of the trough and that the said featheredge terminates at a level below the level of ring 24, but considerably above the elevation of the getter wire. The elevation of the junction of the featheredge and the glass part 10 above the getter wire is ample to prevent sputtering from the getter wire depositing on the glass notwithstanding the fact that the junction is below the level of the ring. Inasmuch as an electron discharge device produces an internal electrostatic field, and inasmuch as such electrostatic field at a surface is inversely proportional to the square of the radius, the intensity of such field upon a featheredge of approximately .002" thickness such as here employed, is very high. According to my invention, however, ring 24 is electrically and physically connected to flank 16 of the anode structure, and is thereby at the same potential as the anode. Said ring likewise is disposed at a position in proximity to the featheredge within the evacuated envelope, and by virtue of this location thereof acts as a shield for said featheredge from the electrostatic field.

The invention herein described accordingly provides a unitary structure which may be prefabricated and applied in position upon a metallic extension of the anode with the anode formed as reentrant through said extension whereby the said unitary structure shields the base portion of the anode, is spaced from the anode proper and is clamped upon the said extension. The said unitary structure both constitutes a supporting means for the getter wires and constitutes a shield for protection of the featheredge junction of the metallic and glass parts of the envelope. It likewise may be added that while I have described more particularly one bracket wire and two supporting connections for each getter wire, the basic necessity for flashing purposes is to provide a closed circuit of which the getter wire between the supporting bracket and the supporting connection constitutes a part. As indicated, the getter wire may be long enough, and two supporting wires may be provided, so as to obtain flashing circuits in pairs with the supporting bracket constituting a common leg of the two circuits. These supporting wires and brackets with associated getter wires may be duplicated around the periphery of the collar and ring as often as desired, and flashing of the several getter wires may be obtained successively and at any desired intervals of time, or they may all be flashed simultaneously or substantially so if preferred.

Since the various details of construction, as well as the precise relation and functioning of parts are subject to variation and change without departing from the inventive concept or scope of the invention, it is intended that all matter contained in the specification or illustrated in the drawing, shall be interpreted as exemplary and not in a limiting sense. It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein shown and described and all statements of the scope of the invention herein set forth as a matter of language which might be said to fall therebetween.

I claim:

1. An electron discharge device comprising metallic parts having areas constituting electrodes and an envelope formed partially by a metallic part and partially by a glass part with the metallic part sealed at a margin thereof to an edge margin of the glass part, one of said parts providing a trough physically remote from said electrode areas, said one part also providing a ridge interposed between said trough and electrode areas, and a getter situated in said trough on one side of said ridge out of direct emanating path to said electrode areas on the other side of said ridge.

2. An electron discharge device comprising an envelope formed partially by a metallic part and partially by a glass part with said metallic part shaped to provide an annular trough from the inner portion whereof said metallic part is reentrant and forms a ridge and the reentrant part below the ridge constitutes an anode with the trough on the outside thereof, a getter in said trough, and a cathode and grid projecting into said anode protected thereby and by said ridge from direct exposure to interception of sputtering and deposits from the getter in said trough.

3. An electron discharge device comprising an envelope formed partially by a metallic part and partially by a glass part with said metallic part shaped to provide an annular trough at an outer margin whereof the glass part is sealed thereto and from the inner portion whereof said metallic part is reentrant and constitutes an anode with the trough on the outside thereof, a getter in said trough, and a cathode and grid projecting into said anode protected thereby from forwardly emanating deposits from the getter in said trough.

4. An electron discharge device comprising an envelope formed partially by a metallic part and partially by a glass part with the metallic part shaped to provide an annular trough having inner and outer flanks of which the outer flank is of less height than the inner flank and is sealed to said glass part, and means in proximity to and providing an electrostatic shield for the sealed junction of said glass and metallic parts.

5. An electron discharge device comprising an envelope formed partially by a metallic part and partially by a glass part with the metallic part shaped to provide an annular trough having inner and outer flanks of which one flank is sealed to said glass part, and means in proximity to and providing an electrostatic shield for the sealed junction of said glass and metallic parts.

6. An electron discharge device comprising in combination with an envelope of which part is metallic and another part is glass with said parts having a featheredge seal therebetween, of a unitary structure supported within said envelope, said structure providing means in proximity to and for shielding the featheredge seal and providing means for supporting a getter, and a getter supported by said getter supporting means.

7. An electron discharge device comprising an envelope partially formed of glass and partially formed of metal with a featheredge seal between margins of said glass and metal, a portion of the said metal part projecting inwardly with respect to the glass part, and a unitary structure mounted upon said inwardly projecting metal part within the envelope and entirely below the innermost projecting portion of said metallic part, said unitary structure having portions thereof formed as a closed circuit, and a getter wire included in said closed circuit.

8. An electron discharge device comprising an envelope partially formed of glass and partially formed of metal with a featheredge seal between margins of said glass and metal, a portion of the said metal part projecting inwardly with respect to the glass part, and a unitary structure mounted upon said inwardly projecting metal part within the envelope and entirely below the level of the innermost projecting portion of said metallic part, said unitary structure having portions thereof formed as a closed circuit and said closed circuit including a getter wire, said getter wire being located at a position remote from the said innermost projecting portion of the metallic part and being substantially surrounded on three sides thereof by said metallic part.

9. A unitary structure for an electron discharge device, comprising a collar for attachment within said device, said collar having diverging brackets thereon, a ring of greater diameter than said collar, said ring being supported by said brackets, a connection depending from said ring physically out of contact from said collar, and a getter wire joining portions of said bracket and connection at a distance from the said ring for providing a closed circuit including a getter wire for purposes of flashing the getter wire by an induced current in said closed circuit.

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