Aug. 28, 1945. J. W. WEST 2,383,925

ELECTRON DISCHARGE DEVICE

Filed Nov. 1, 1944

FIG. 1

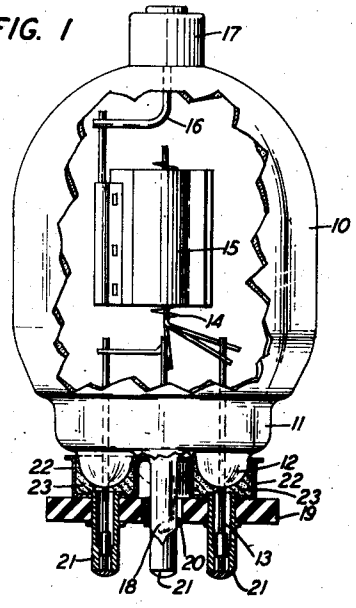


FIG. 3

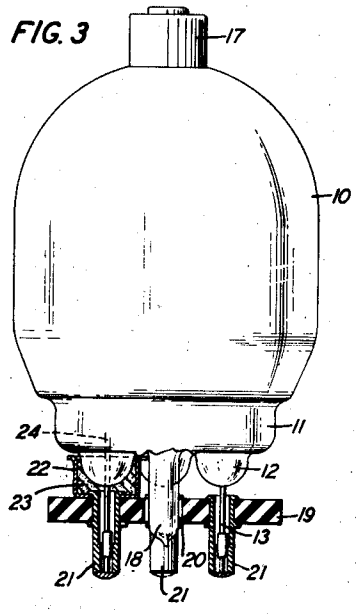


FIG. 2

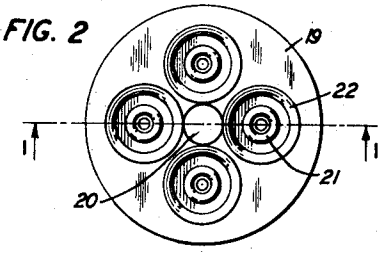


FIG. 4

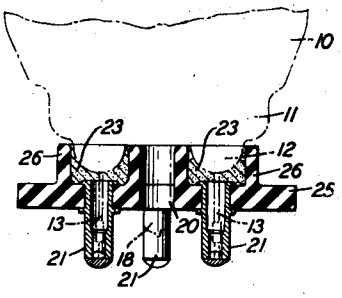


FIG. 6

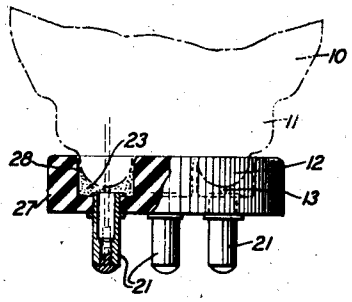
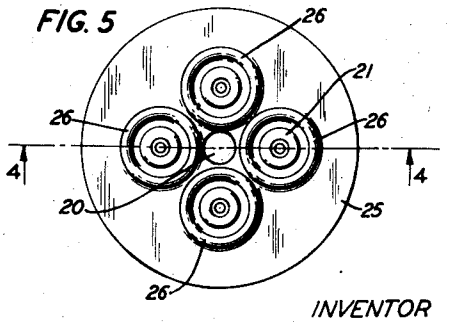


FIG. 5



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ELECTRON DISCHARGE DEVICE

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8 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to the terminal base for such devices.

In the mounting of electron discharge devices especially designed for use in ultra-high frequency radiation and reception it usually has been the practice to eliminate the metallic shell cemented to the stem of the device which supports the terminal base to overcome capacitance effects introduced into the operating circuit by the shell. Certain present forms of such devices have a molded glass stem with the electrode conductors sealed in individual bosses on the stem and in order to protect the fragile conductors and facilitate the insertion and removal of the device from associated apparatus it has been the custom to apply a ceramic disc having rigid terminals to the boss end of the device.

This construction has proved satisfactory provided the device is not subjected to excessive shocks and concussions, such as are experienced on board ship during storms or under battle conditions. Such forces strike the large mass of the bulb of the device above the base and may either fracture the fragile conductors or cause cracking of the seals in the boss portions of the stem thereby rendering the device useless. Similar effects result under excessive vibration occurring in other mobile craft, such as land and sea vehicles and airplanes.

An object of this invention is to protect the seals and conductors of such devices against destructive effects of vibration and shock.

Another object of the invention is to provide a cushion coupling between the device and the base which does not introduce capacitance effects in the operating circuit.

A further object of the invention is to facilitate the assembly of the device to the base whereby strains on the seals are prevented.

A still further object of the invention is to prevent distortion of the fragile conductors during insertion and removal of the device from a socket mounting thereby avoiding damage to the seals of the conductors.

These objects are attained in accordance with the various aspects of this invention by incorporating one or more sockets or cups on or in the base to receive the boss seals of the device and providing a cushion material in the cup to protect the seals and conductors coupled to the terminals on the base.

In one specific embodiment of the invention individual metallic cups are secured to the base in line with the terminals and the bosses extending from the stem of the device are embedded in the cup by cushion material, such as plastic cement, the conductors projecting from the boss seals being extended into the terminals on the base and anchored in the ends thereof.

The advantages of this construction are more solid coupling of the device to the base and the protection of the fragile conductors from rupture strain caused by concussion forces directed at the large mass of the device above the base.

A feature of the cushion coupling of the bosses and conductors in the base is the distribution of the effects of the force over a larger area of the stem away from the immediate vicinity of the seals so that the force is dissipated without harmful results. Furthermore, the conductors are entirely enclosed and protected by the cement encasement so that strains are eliminated at the point of the seal in the glass boss of the device.

The invention also contemplates various modifications of the above construction such as integral recessed projections on the base or hollow cavities formed in a flush type base wherein the boss seals of the conductors are embedded by the cushion cement for protecting the coupling of the device to the base.

These and other features of the invention will become apparent from the following detailed description and the accompanying drawing.

Fig. 1 is a view in elevation of a three-electrode device embodying the base of this invention shown in cross-section;

Fig. 2 is a top plan view of the base of this invention showing the line 1—1 from which the sectional view of the base of Fig. 1 is taken;

Fig. 3 shows a similar device and base with a single cup for the mounting assembly;

Fig. 4 illustrates in cross-section another form of the base in which the bosses of the device, shown partially in dotted line, are seated in integral sockets extending from the top of the disc base;

Fig. 5 shows a top plan view of the base illustrated in Fig. 4 with the line 4—4 indicating the direction of cross-section of the base of Fig. 4; and

Fig. 6 is another form of the base of this invention, partly broken away, to illustrate the mounting of the device in the base.

Referring to Fig. 1, an embodiment of the invention is illustrated in connection with a three-electrode or amplifier type electron discharge device especially adapted for ultra-high frequency operation which comprises an enclosing vessel 10 sealed to a molded glass stem 11 which is pro-

vided with a plurality of depending bosses or protuberances 12 in which the conductors 13 for the electrodes are sealed. The vessel and stem are usually formed of high melting point glass, such as borosilicate glass, and the conductors sealed in the stem are formed of tungsten wires which form efficient seals with the borosilicate glass. Both the particular type glass and the conductor material are especially desirable for devices having a high power rating to overcome heating conditions in the seals of the conductors. The electrodes supported by the conductors in the stem are a thoriated tungsten filament or cathode, not shown, and a helical grid 14 with the filament supported by three conductors in the stem, namely, two conductors being attached to the terminations of the filament and the other being connected to the center point of the filament to facilitate various operating requirements. The helical grid 14 is supported and attached to the remaining conductor in the stem. A cylindrical anode 15 is coaxially mounted about the cathode and grid within the vessel and is connected to a bent wire 16 sealed in the top of the vessel 10, the conductor 16 being connected to a terminal cap 17 extending from the top of the vessel. The stem of the device is also provided with a central tubulation 18 which is sealed off after the device is completely evacuated. The discharge device is provided with a ceramic disc base 19 having a central aperture 20 for the depending tubulation 18 and a plurality of terminal pins or prongs 21 corresponding to the number of conductors sealed through the stem 11, the conductors 13 extending through the hollow terminals and being soldered in the ends thereof.

The rigid tungsten conductors sealed in the bosses 12 and soldered in the ends of the terminals 21 being formed of highly refractory metal are brittle or fragile and may be fractured when subjected to intensive percussive strain occasioned by concussion forces striking the large mass of the enclosing vessel 10 and concentrating the effect of the forces at the weakest points of the conductors where they are sealed in the glass bosses 12. Even if one or more conductors are not fractured the strains produced by the forces are apt to cause cracking of the seals in the glass bosses thereby causing leakage of air into the highly evacuated container with a resulting loss of efficiency in the operation of the device and the complete deterioration of the internal electrodes which can only be remedied by replacing the device.

In accordance with this invention these difficulties are overcome by surrounding the individual glass bosses 12 with metallic cups or sockets 22 which are secured to the top of the base 19 in alignment with the terminals 21. These cups enclose the protruding glass boss seals 12 and the conductors 13 extending into the terminals 21 and the individual boss seals are rigidly fixed in the cups by a basing cement 23, for example of marble flour, rosin and shellac, which solidifies in the cups and completely embeds the boss seals and conductors within the cups so that the cups and cement form a cushion absorption coupling between the stem and the base to dissipate the percussive force directed toward the device and prevent or cut off further transmission of the force to endanger the junction of the glass seals or damage the fragile conductors protected by the cup members.

Fig. 3 shows a modification of the base as applied to a form of device such as a half wave rectifier having an internal electrode assembly similar to Fig. 1 except that the grid is omitted. In this form of construction the mounting of the device on the base 19, in which the three conductors of the cathode extending into the terminals 21 would provide an unbalanced support of the device, is strengthened by a dummy lead-in wire 24, which is sealed in the remaining glass boss 12 to equalize the supporting connections of the device on the base. In this construction it may be desirable to anchor the device to the base by a single metallic cup 22 which surrounds the boss seal having the dummy lead-in wire 24 so that the cement filling 23 within the cup firmly anchors the device to the base. It will be noted in this construction that the mounting of the device on the base 19 exposes the remaining conductors 13 extending into the terminals 21. However, the localized anchoring provided by the single cup 22 and the cement around the dummy seal of the device provides sufficient rigid coupling of the device and base so that excessive strains do not endanger the exposed conductors connected to the other terminals in the base. The four seals are spaced away from the end surfaces of the terminals 21 in the base to prevent frictional contact between the glass and metal which would be apt to cause cracking of the glass at the sealing point if the device were subjected to sudden jars impacting the device in a downward axial direction.

While the construction shown in Fig. 3 utilizes a single cushion coupling member surrounding a dummy lead-in wire, it is, of course, understood that a similar construction may be applied to the amplifier type of device, shown in Fig. 1, in which the single coupling member would surround an active conductor extending through the stem. Furthermore, while the invention has been described with respect to fragile conductors, such as tungsten, sealed in high melting point glass with the depending boss seals, it should be understood that the invention is not limited to such a construction since the protective coupling cups may embrace the boss seals of different types of devices in which the conductors for the internal elctrodes are formed of other materials than tungsten, for example, alloys or composite conductors which are readily sealed in various compositions of glass.

A modification of the invention is shown in Fig. 4 in which the individual boss seals are embedded in cups or sockets formed integral with the base and separate cup components are eliminated. In this form the base is provided with a disc portion 25 and a plurality of upwardly extending cup portions or sockets 26 which are formed integral with the disc portion either by molding or machining an insulating mass having high dielectric properties such as possessed, for example, by phenolic resins, ceramics and silicate compositions. After the base is molded or machined the only operation necessary is to affix the terminal pins 21 to the disc portion in alignment with the sockets formed on the opposite side of the disc and the boss seals of the device will be completely protected in the cup portions 26 of the base by the cement filling therein to attain the same advantages as described heretofore in connection with Fig. 1.

Similar results can be achieved with the modification of the base, as shown in Fig. 6, in which a thick block of moldable or machinable insulat-

ing material 27 is provided with a plurality of cylindrical recesses 28 to receive the boss seals of the device and anchor them therein by the cement filling so that the top of the base is substantially flush with the bottom wall of the stem 11.

While the invention has been described in various aspects and specific constructions of types of bases utilized in protecting the delicate seals and conductors of discharge devices against damage due to shock or excessive strain it will be apparent that various modifications may be made in the detailed construction of the base of this invention without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A base for a discharge device having a plurality of boss seals projecting from one end and conductors extending through the boss seals, comprising an insulating disc member, a plurality of terminals secured to said member for coupling to said conductors, a cup portion on said disc member associated with one of said terminals and embracing the boss seal of the respective conductor attached to the terminal, and a filling of cushion material in said cup portion embedding said boss seal and conductor therein.

2. A base for an electron discharge device having a plurality of boss seals projecting from one end and conductors extending through said boss seals, comprising an insulating disc member, a plurality of terminals secured to said member for coupling to said conductors, said boss seals and conductors being positioned in alignment with said terminals, a metallic cup interposed between one of said terminals and the stem of the device and surrounding the respective boss seal and conductor, and a cement filling in said cup affixing said boss seal therein.

3. A base for an electron discharge device having a plurality of boss seals projecting from one end and conductors extending through said boss seals, comprising an insulating disc member, a plurality of terminals secured to said member for coupling to said conductors, a plurality of metallic cups individually mounted on said disc member and coupled to the respective terminals, said cups enclosing said boss seals and conductors, and a cement filling in said cups securing said boss seals therein.

4. A disc type base for an electron discharge device having a plurality of conductors sealed through individual boss seals on one end thereof, comprising an insulating disc spaced from the boss end of said device and having a plurality of terminals to accommodate said conductors, and a cup portion on said disc base embracing one of said boss seals and being rigidly affixed thereto.

5. An electron discharge device comprising an enclosing vessel having a molded stem including a plurality of boss seals projecting therefrom, a plurality of parallel conductors extending through said seals, electrodes in said vessel supported by said conductors, a ceramic disc base adjacent said boss seals, terminals carried by said base and accommodating said conductors, metallic cup members between said base and said stem and surrounding said boss seals, and a filling of cement material rigidly affixing said boss seals within said cup members.

6. An electron discharge device comprising an enclosing vessel having a molded stem including a plurality of boss seals projecting therefrom, a plurality of parallel conductors extending through said seals, a cathode and anode supported in said vessel, said cathode being connected to a plurality of said conductors, one of the remaining conductors being a dummy and wholly insulated from the electrodes in said vessel, a disc base having terminal pins secured to said conductors, said base being located substantially flush with the ends of said boss seals, a metallic cup secured to said base and surrounding said dummy conductor, and a cement filling embedding said dummy conductor and the respective boss seal therein.

7. A base for an electron discharge device having conductors extending through boss seals, comprising a disc member having integral cup portions extending from one of the surfaces thereof, a plurality of terminal pins extending from the opposite surface in line with said cup portions, said cup portions and terminal pins accommodating said boss seals and conductors respectively, and filler means affixing said boss seals within said cup portions.

8. A base for an electron discharge device having conductors extending through boss seals, comprising a molded insulating disc having a plurality of depressions therein a plurality of terminal pins extending from said disc and coaxial with said depressions, said boss seals being located within said depressions and substantially enclosed by said base, and a filling of cement in said depressions embedding said boss seals therein.

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