May 23, 1950 R. A. SYKES 2,508,551

SHOCKPROOF TERMINAL SEAL

Filed June 18, 1946

FIG. 1

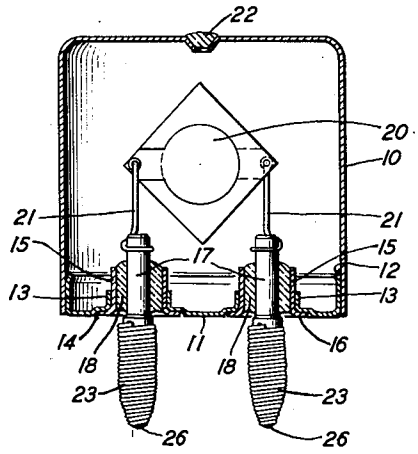


FIG. 2

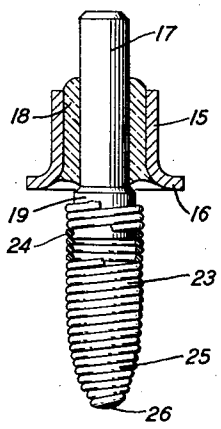


FIG. 3

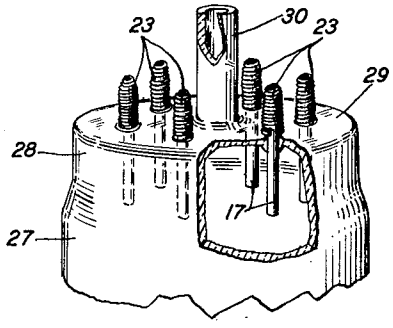


FIG. 4

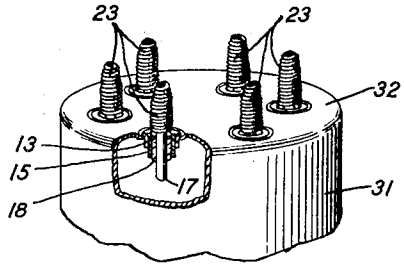
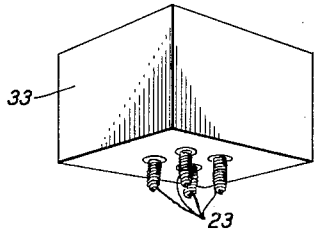


FIG. 5



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SHOCKPROOF TERMINAL SEAL

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1 Claim. (Cl. 174—152)

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This invention relates to contact terminal prongs and more particularly to terminals associated with vitreous seals in electrical apparatus.

In the electrical arts, the employment of hermetically sealed units, such as condensers, transformers, quartz and other crystals, filters and similar apparatus, entails the provision of a plurality of conductors or terminals sealed through glass to provide a vacuum-tight joint at the terminal end of the unit. The sealed unit prevents the entrance of moisture into the casing or maintains the space in the unit at a controlled pressure and permits the unit to be utilized in climates where deterioration would otherwise destroy the internal elements of the unit or materially affect the operating efficiency thereof. When the unit is subjected to percussion effects, such as may be experienced in mobile equipment, and is designed for removable attachment in holding fixtures, such as sockets, the shocks to which the unit may be subjected may be so severe as to fracture the glass seals at the junction of the glass and terminal in the unit. The same effects may occur in electronic discharge devices employed in such equipment.

An object of this invention is to minimize strains in the glass seals of such units and devices.

Another object of the invention is to prevent shock being communicated to the fragile seals.

A further object is to prevent fracture of the seals at the juncture of the terminals entering the unit or device.

Another object of the invention is to dissipate percussion effects exerted upon the units and devices so that negligible strain is placed on the seals.

These objects are attained in accordance with features of this invention by providing cushion terminals on the unit or device in combination with the sealed joint so that the glass is protected from the initial shock imparted to the terminals. In a specific embodiment of the invention, the terminal assembly involves a base provided with apertures which receive eyelet seals in which a rigid conductor is hermetically affixed to an eyelet by a glass mass which combines the conductor and eyelet into a vacuum-tight joint at the terminal end of the unit. The inner ends of the terminals are connected to electrode assemblies or apparatus mounted within the unit and the outer ends terminate just beyond the exterior of the glass seals. The exposed stub is joined to a closely wound wire helix which is formed to continue the extension of the conductor and provide a flexible portion which yields with applied impact and absorbs shock imparted to the terminals of the unit.

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A feature of the invention relates to the combined construction of the terminal assembly whereby the conductor extending through the seal is rigid to insure a strain-free joint in the glass mass coaxially filling the space between the eyelet and the conductor, and the exposed end of the conductor is cushioned by a resilient sleeve terminal portion which directly engages the socket contacts to mount the unit in operational equipment. The hollow spiral wire terminal is open at one end to embrace the stub conductor extending through the seal and is rigidly affixed thereto and the other end is tapered to form a closed contact point which provides a bearing surface against the interconnecting spring contact of the socket assembly. The closely wound sleeve insures a substantially rigid thrust terminal along the axis of the seal under normal conditions so that it performs the same function as if the terminal were solid. However, when excessive shock is imparted to the terminal end of the device the flexible wire helix is temporarily deformed for the duration of the percussion impact so that the shock is dissipated in the spring material of the terminal and is prevented from being transmitted to the seal. The eyelet terminal construction also may be employed in the metal casing type of electronic discharge device in which the conductors for the electrode assembly extend through the casing.

In one embodiment of the invention, the rigid portion of the terminals may be sealed directly in a glass stem of an electronic discharge device and the external resilient sleeve terminal portions connected to the rigid portions, to relieve strains and stresses in the glass stem at the sealing points, occasioned by shock or impact incident to testing or operational use of the device.

The various objects, features and advantages of the invention will be more clearly apparent from the following detailed description when considered in connection with the accompanying drawing, in which:

Fig. 1 shows in elevation a cross-section view of a crystal casing embodying features of this invention;

Fig. 2 is an enlarged view, partly in section, of a terminal construction illustrative of this invention with a part of the exterior terminal portion broken away to show details of assembly;

Fig. 3 illustrates, in a perspective view, the stem portion of an electronic discharge device embodying features of this invention;

Fig. 4 shows in a perspective view a portion of the terminal end of a metallic discharge device constructed in accordance with this invention; and

Fig. 5 is a perspective view of an apparatus casing employing a hermetically sealed terminal construction in accordance with this invention.

Referring to the drawings and particularly to Figs. 1 and 2, the terminal assembly of this invention is embodied in a quartz crystal casing 10, for example formed of a metal shell to constitute a protective enclosure for a unit mounted within the casing. The casing is closed at the open end by a terminal base 11, for example also of metal, and having a peripheral flange portion reentrant with respect to the casing so that the flat portion of the base 11 is flush with the end of the casing 10. The base 11 is secured to the casing 10 by an internal soldered joint 12 which seals the conjoint surfaces of the casing and base to enclose the space within the casing.

The base 11 supports a pair of insulated terminals which extend into the casing for connection to the unit mounted therein and for this purpose the base is provided with integral sleeve portions 13, preferably formed by a pressing or drawing operation, to form socket openings which are reentrant with respect to the casing. The sleeves 13 and the annular recess seats 14 formed on the base 11 receive metallic eyelets 15, shown more clearly in Fig. 2, which fit into the sleeve portion 13, the eyelet having a flange portion 16 which registers with the annular seat 14 in the base. The eyelet is secured in the sleeve portion in any suitable manner, for example by soldering. A pair of cylindrical metallic conductors 17 extend axially through the metallic eyelets 15 and are supported therein by a vitreous annular bead 18 which is fused in the space between the eyelet and conductor to form an hermetic seal along the length of the conductor extending through the eyelet.

The sealed insulating joint is produced preferably by forming the eyelet 15 and conductor 17 of a low expansion metal alloy such as nickel, cobalt and iron of an alloy composition commonly known as "Kovar" and employing a vitreous material, such as borosilicate glass, as the fusible material of the seal, since the metal and glass have substantially the same coefficient of expansion whereby a tight union is effected between the glass and metal elements involved in the seal after the glass bead is sealed or fused thereto. Accordingly, no temperature strains occur in the seal and a hermetically tight joint is realized at the sealing point of the conductor 17. The rigid stub conductor 17 extending through the seal in the base or terminal end of the casing is provided with a slightly larger diameter head 19 closely adjacent to the termination of the glass seal 18 in the eyelet to form a terminal anchor portion for the conductor. The inner ends of the conductors 17 within the casing are connected to a quartz crystal unit 20 by support wires 21, preferably by welding the support wires to the conductors 17. The casing is usually filled with dry air to maintain the electrical characteristics of the crystal constant and after the desired filling is obtained in the device the outlet hole in the top of the casing is sealed by a solder pellet 22.

Since the hermetically sealed crystal may be mounted, in one application, in a socket so that it can be readily removable for replacement or substitution, it is usual to provide push type terminal prongs or contacts as continuations of the

conductors in the seals for engagement with spring contacts of the socket member. If the crystal assembly is employed in mobile equipment or in other environments where the crystal unit is subjected to percussive impact due to shock or vibrations, it will readily be realized that the mechanical strains imposed on the vitreous seals may cause fracture of the glass mass 18 or set up stresses which result in fracture with consequent deterioration of the hermetic joint and resultant impairment of the atmosphere within the casing. Similarly, in order to determine the adaptability of the crystal unit for usage in specific operational equipment, it is necessary to subject the unit to preliminary mechanical tests before shipment to the customer to determine if the construction can meet the requirement of the test. One example of such a test is the "drop" test to observe the effects imposed on the glass seals and thereby avoid hazardous results to the seals during the operating life of the device.

The fragile glass seals are protected, in accordance with this invention, by providing flexible hollow extensions on the conductors extending through the seals exterior to the device, the extensions serving the purpose of the terminal prongs for connecting the unit in a socket mounting. The flexible extensions, in one aspect of the invention, take the form of a closely wound wire helix 23 of hollow construction and substantially tubular form in which the individual turns 24 of wire are in abutting contact to form a tubular sleeve having an internal portion at one end of substantially the same diameter as the head 19 of the rigid conductor 17. The other end is tapered to a point 25 which may be filled with a solder pellet 25 to form a contact surface. The closely adjacent turns of the open end of the extension contact embrace the head 19 of the conductor and are rigidly secured thereto, by soldering or welding, to provide a firm contact with the conductor 17. The closely wound wire helix beyond the head 19 of the rigid conductor is normally inflexible in an axial direction for small thrust impacts as would be occasioned upon mounting the crystal unit in the socket. On abnormal impact imposed on the helical extension 23, however, the helix is distorted and the strain set up is absorbed in the spring material of the flexible terminal so that the impact forces are not transmitted to the fragile glass seal and strains or stresses are prevented from producing fracture in the glass mass at the sealed joint to the conductor. This arrangement protects the fragile glass seal from rupture which would cause leakage in the casing and consequent impairment of the crystal unit. The composite conductor terminal for the seals of this invention provides a rigid portion in the vicinity of the seal, which insures a permanent hermetic joint entering the casing, and a flexible shock absorbing terminal portion 23 which is exposed to all the impact hazards incident to operation of the unit in mobile equipment, the flexible hollow terminal dissipating the effects of shock impact so that they never reach the fragile glass seal in the unit casing and, therefore, preserve the pressure condition within the casing.

The invention is also applicable to electronic discharge devices as shown in Figs. 3 and 4. Fig. 3 shows the base portion of an electron discharge device having an enclosing vessel 27 terminated with a cup-shaped vitreous stem or base 28 with a flat disc portion 29. A plurality of conductors 17 are sealed to the portion 29 in a circular bound-

ary about a central tubulation **30** which is sealed off after the device is completely evacuated. The conductors **17** are connected within the vessel **27** to a plurality of electrodes in an electrode unit, not shown, to supply potentials to the individual electrodes. The fragile seals in the base **29** may be protected, in accordance with this invention, by terminating the short stub conductors **17** with flexible terminal contacts **23** to absorb impact shock incident to the conductors and thereby prevent transmission of the shock to the fragile seals of the conductors.

In Fig. 4, the composite terminal assembly, as shown in Fig. 2, may be adapted to an electronic discharge device having a metallic casing **31** in which the base **32** is provided with apertures to receive the eyelets **15** of the sealed terminals.

In Fig. 5, the rectangular casing **33** may be the enclosure for a hermetically sealed unit therein, such as condensers, filters, transformers, switches, relays or other electrical devices which may be deteriorated by moisture or fungus in high temperature climates or subjected to various changes in temperature and pressure such as is present at high altitude. The hermetic seals in these devices are protected from injury by the composite terminal assembly as herein described.

While the invention has been set forth with respect to a particular embodiment of a push type terminal arrangement adaptable for socket connection, it is, of course, understood that various

modifications can be made in the construction to adapt the invention to other methods of connection without departing from the scope of the invention as defined in the appended claim.

What is claimed is:

A shock-resistant terminal assembly, comprising a rigid conductor hermetically sealed through a glass mass forming a sealed joint, and a wire wound hollow prong having a tapered point, the turns of wire being in contact throughout the length thereof, the open end of said prong being rigidly secured to said conductor adjacent said sealed joint.

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