Dec. 4, 1951 M. N. GLICKMAN ET AL 2,577,576

HERMETIC CRYSTAL HOLDER

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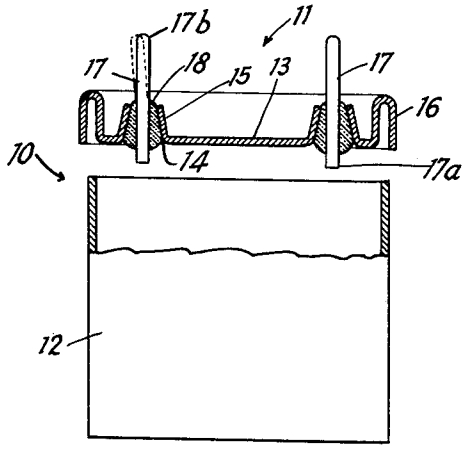

FIG. 1

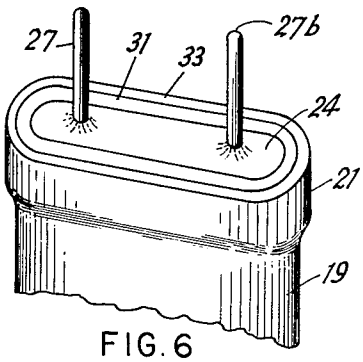

FIG. 6

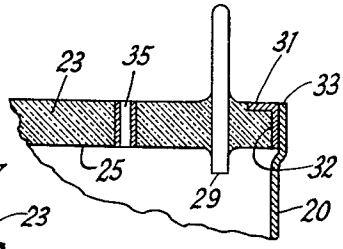

FIG. 4

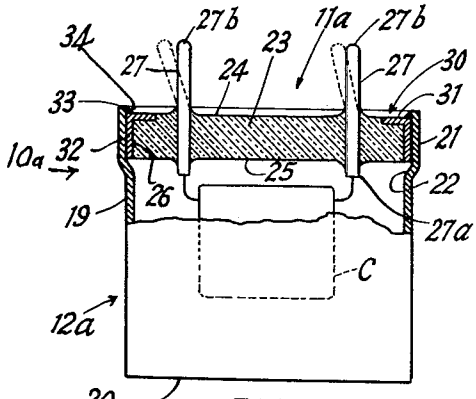

FIG. 2

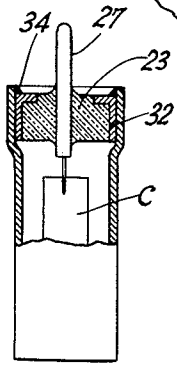

FIG. 3

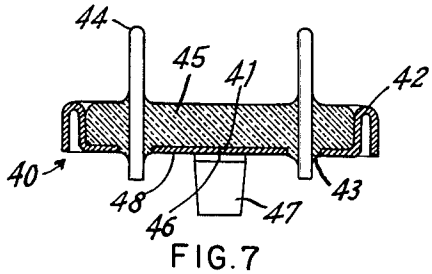

FIG. 7

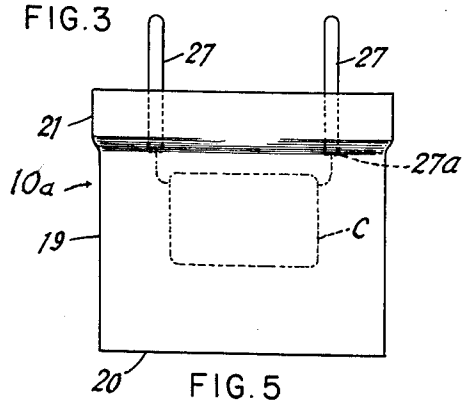

FIG. 5

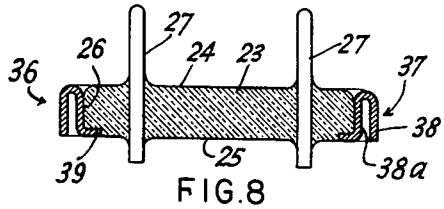

FIG. 8

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HERMETIC CRYSTAL HOLDER

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3 Claims. (Cl. 171—327)

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This invention relates to piezoelectric crystal units, and more particularly to holders for such crystals.

The present invention is concerned with crystal holders of the type comprising a metal base and a hollow metal cover which is soldered to the base. The base is formed with extrusions in which metal pins are located and maintained in insulated relation to the base by means of glass seals. The crystal unit is mounted and electrically connected to the inner ends of the metal pins. The mounted crystal is protected against the deleterious effect of moisture, dirt, and the like, by the metal cover which is soldered to the base to provide a hermetically sealed unit for the crystal. The externally projecting portions of the metal pins provide electrical connecting means which are insertable in socket type connectors which form part of the electronic circuit in which the crystal unit is to function.

Conventional crystal holders of the type described are utilized in spaces of restricted dimensions, are subjected to rough treatment when being inserted into socket type connectors, and otherwise must be capable of precision performance under varied conditions. Accordingly, it has been necessary to set up standards relating to dimensions, tolerances, materials, minimum mechanical and electrical specifications, and the like, in order to assure the production of a high quality product which insures optimum operational characteristics of the electronic circuits with which such crystal units are associated. Such standards have been formulated by the Radio Manufacturers Association and the Armed Services Procurement agencies and are recognized and observed by suppliers of such electronic components.

One of the disadvantages of crystal holders known in the art, relates to the low mechanical strength of the glass seal at the metal pins of the holder. In many instances, the receptacle portions of the socket connector make an overtight fit with the pins on a holder, or there may be a very slight misalignment between one or more pins and the corresponding receptacle portions of the socket connector. In either case, the glass seal at the pins is severely strained when the holder is plugged into the socket connector. The strain may be sufficient to fracture the seal, thereby leaving the crystal within the holder subject to the adverse effects of moisture, dirt or the like.

In addition, it has been found that the glass-metal seals in conventional crystal holders, when

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inserted into the socket connector, fail to withstand stresses due to vibration. Such stresses are difficult to avoid in cases of mobile electronic equipment installations which must include crystal frequency stabilizing means.

It has been found that the relatively low resistance of glass-metal seals in conventional crystal holders, to mechanical strains is attributed to the form and distribution of the vitreous material in relation to the metal base member and metal pins of the holder.

Accordingly, an object of this invention, is to provide in crystal holders of the type described, an improved form of base, wherein the vitreous material used to seal the metal pins to the base, is distributed in a manner to render the glass-metal seal at the pins highly resistant to mechanical stresses or strains, however induced. In particular, the pins on the base of the instant invention may be considerably bent without affecting the glass seal. In addition, such seals are adapted to pass the rigorous vibration tests set out in the specifications of the Armed Services Procurement agencies.

Since the dimensions of the crystal holders of the type described, must be held within standard dimensions and close tolerances, any changes in design must come within such dimensional tolerances. Accordingly, another object of this invention is to provide a crystal holder base wherein the location and spacing of the metal pins is unchanged; the overall dimensions of the holder including the base, is unchanged; the base may have its peripheral portions selectively modified to engage alternative forms of covers, keeping within standardized dimensions and allowing the use of alternative soldering procedures for securing the base to the cover.

A further object of this invention is to provide an improved crystal holder base which includes an extended, flat body of vitreous material of substantially uniform thickness, in combination with spaced metal members sealed within the body, and a metal rim portion sealed to the periphery of the body, the metal members, vitreous body, and metal rim having substantially the same thermal coefficient of expansion, and the thickness and extent of the vitreous body being such as to provide substantial resistance to mechanical stresses and strains which may be applied to the metal members.

In conventional crystal holders, the base is made of a stamped metal alloy having substantially the same thermal expansion coefficient as the vitreous material used to seal the metal pins

on the base, as well as the pins themselves. Such alloy bases cannot be readily soldered to the metal cover of the holder unless the bases are precoated or plated with metals or alloys which allow the soldering operation to be performed. The base is soldered to the cover after the sensitive crystal blank has been mounted on the base. At the soldering temperature there is a release of gases occluded when the metal alloy base is precoated or plated, as described. Such gases, when released within the holder, load the crystal blank and since the crystal blank is exceedingly sensitive and delicate, the gases contaminate the blank so as to adversely affect the performance of the crystal unit.

Accordingly, still another object of this invention is to provide an improved base for a crystal holder which comprises primarily, an extended, flat vitreous body having metal pins or terminals sealed therein, for mounting a piezo crystal in opposed relation to a central portion of the vitreous body, in combination with a limited amount of metal alloy having the same thermal expansion coefficient as the vitreous body and taking the form of a rim member confined to the periphery of the body and sealed thereto, the rim providing means for soldering the base to the cover and exposing a minor amount of precoated metal alloy on the interior of the holder around the exposed inner surface of the vitreous body, thereby substantially eliminating a possible source of crystal contamination during the soldering operation.

Still another object of this invention is to provide a piezoelectric crystal holder having improved electrical characteristics, wherein the holder base includes a pair of spaced metal pins adapted to be electrically connected to a piezo crystal and mount the same within the holder, the pins being maintained in spaced relation by an extended, integral vitreous body, the total amount of metal other than the pins, being kept at a minimum by limiting such metal to a rim member sealed to the peripheral portions of the vitreous body, whereby to substantially reduce the electrical capacitance of the holder, thereby improving the operational characteristics of the piezo crystal unit.

Still a further object of this invention is to provide an improved base for crystal holders which comprises a metal wall having a peripheral rim for engaging the holder cover, the wall being formed with spaced openings for positioning metal pins therein, the pins being maintained in such positions by an extended vitreous body of substantially uniform thickness which is sealed to the wall and rim, thereby providing maximum resistance to mechanical stresses which may be applied to the pins, the inner surface of the metal wall providing means for attaching a crystal mounting bracket or the like.

Yet another object of this invention is to provide in a crystal holder, an improved base comprising an extended vitreous body with at least one metal member extending transversely of the body in sealed relation thereto and metallic means engaging at least the peripheral portions of the body to provide means for soldering the base to the holder cover, at least one of the metal members being hollow to provide conduit means for the passage of conductors into the interior of the holder and/or means for exhausting the interior of the assembled holder.

A further object of this invention is to provide an improved piezoelectric crystal holder which

comprises components which are economical to manufacture, such components being quickly and economically assembled; which is adapted to pass the most rigorous mechanical and electrical test requirements standardized in the art; which is rugged and which result in improved operational characteristics for the crystal mounted therein.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts, which will be exemplified in the constructions hereinafter described, and of which the scope of application will be indicated in the following claims.

In the accompanying drawings:

Fig. 1 is a side elevational view of a conventional crystal holder, the base being separated from the cover, with parts in section;

Fig. 2 is a side elevational view of a crystal holder embodying the invention, the base and cover being assembled with parts broken away and parts in section;

Fig. 3 is an end elevational view thereof;

Fig. 4 is a partial side elevational view thereof showing a modification;

Fig. 5 is a side elevational view similar to that of Fig. 2, showing the crystal mounted within the holder;

Fig. 6 is a perspective view of the upper portion of the holder shown in Fig. 2;

Fig. 7 is a side elevational view of a holder base embodying the invention and showing a modification thereof;

Fig. 8 is a side elevational view of a further modification of a holder base embodying the invention.

Referring in detail to the drawing and particularly to Fig. 1, 10 designates a conventional holder for a piezo crystal. The same comprises a stamped metal base member 11 and a hollow cover member 12. The member 11 is made of metal alloys known in the art which may be composed of nickel, iron and cobalt, or other suitable alloys known in the glass-metal sealing art. The member 11 includes a flat wall portion 13 which is formed with spaced openings 14. The openings 14 are defined by drawn metal as at 15 and which is substantially cylindrical in form. The member 11 further includes an upstanding peripheral flange 16 which has an inverted U-shaped cross section.

Metal pins or terminals 17 are located within the openings 14 and are maintained in spaced relation to the metal 15 by means of glass seals 18. It is understood that the metal member 11, the pins 17 and the glass seals 18 have substantially the same thermal expansion coefficient.

The cover 12 may be drawn from a suitable metal such as brass, nickel silver, or the like. After a piezo crystal, not shown, is suitably mounted on the inner portions 17a of pins 17 and electrically connected thereto, the mounted crystal is housed in cover 12. This is accomplished by engaging the upper portions of the cover walls with the flange 16 on base 11 with a sliding fit. The base and cover are then soldered together at contacting portions in order to hermetically seal the assembly. Since the metal alloys of which base 11 are formed, do not lend themselves to soldering, the base members are provided with selected metal coatings or platings which make soldering easier.

It has been found that in bases of standard dimensions, the limited cross section of vitreous

material 18 at pins 17 has very little resistance to mechanical strains. This is particularly noted when the holder is inserted or withdrawn from a socket connector having tight fitting receptacles, or when the pins are slightly misaligned with their respective socket receptacles, in which case, a pin may be slightly bent, as indicated in dotted lines in Fig. 1, when the holder is inserted into the socket connector. Also, the glass seal 18 has no resistance to vibratory stresses when the holder is inserted into the socket connector.

Accordingly, there is provided an improved crystal holder assembly 10*a*, as shown in Fig. 2, comprising a base 11*a* and a cover 12*a*. The cover 12*a*, which may be drawn from brass, nickel silver, or the like, comprises a peripheral wall 19 upstanding from a bottom wall 20. The wall 19 is formed at its open end with an outwardly offset peripheral portion 21 which provides a seat 22 for the purpose hereinafter appearing.

The base 11*a* comprises an extended, integral body 23 of vitreous material such as borosilicate glass or other glass known in the glass-metal sealing art. The body 23 is of uniform thickness and has a marginal outline complementary to the opening in cover 12*a*. The body 23 includes opposite surfaces 24, 25 and a peripheral edge 26. A pair of spaced metal pins or terminals 27 are sealed transversely of the body 23, inwardly of edge 26. It will be apparent from a consideration of the figure, that the body 23 at the portions thereof immediately adjacent pins 27 has a thickness substantially equal to the thickness of other portions thereof.

The body 23 is provided with an endless metal rim member 30, which is sealed to the periphery and marginal portions of one surface thereof. The member 30 is formed of a glass-metal sealing alloy well known in the art and has a thermal expansion coefficient substantially equal to that of the metal pins 27 and the glass of body 23. The member 30 has a section in the form of a right angle, providing a continuous horizontal portion 31 and a continuous vertical portion 32. As shown in Fig. 2, the portion 32 has a depth substantially equal to the thickness of body 23 and is sealed to the edge 26 thereof. The rim portion 31 extends toward the pins 27 but the inner edge thereof terminates in spaced relation to the pins. The rim portion 31 is sealed to marginal portions of surface 24 of body 23. The member 30 is provided with a coating of metal so as to allow the member to be soldered.

A piezoelectric crystal generally indicated at C, is mounted on the inner portions 27*a* of the pins 27, in a manner known in the art, the crystal being electrically connected to the pins. The mounted crystal is positioned within cover 12*a*, the rim 30 being received within offset wall portions 21 of the cover and seated on seat 22 thereof. With the base and cover in assembled relation, the upper edge 33 of cover wall portion 21 projects slightly above rim portion 31. A continuous solder seal 34 applied between adjacent portions of the rim 30 and cover wall portion 21 hermetically seals the crystal C within the holder 10*a*, as shown in Fig. 5.

In the event that it is desired to evacuate the holder assembly, the body 23 has a short tubular metal member 35 sealed transversely thereof, as shown in Fig. 4. The metal of member 35 has the same thermal expansion coefficient as the glass of body 23. After withdrawing air from the interior of the holder 10*a*, the open end of member 35 is sealed by means of a spot of solder, a soldered rivet, or the like.

It has been found that the pins 27 of holder 10*a* which provide frictional circuit contact members for the mounted crystal C, may be subjected to severe treatment without affecting the glass seal. Thus, the pins 27 may be bent or otherwise strained without cracking or otherwise impairing the vitreous body 23. Such crystal holders may be used with socket connectors having tight fitting receptacles or receptacles slightly misaligned with the pins, so as to require great force for inserting the holder in, or withdrawing the same, from the socket connector, without adversely affecting the glass-metal seals.

It will be noted from a consideration of Figs. 2, 3 and 6, that the base member 11*a* is predominantly of a vitreous material, the metal other than pins 27, being confined to the rim member 30. The member 30 has its portion 32 only, disposed within the interior of the holder, the body surface 25 presenting a non-metallic surface. Accordingly, with the precoated metal exposed within the holder, so limited, the chances of crystal blank contamination by gases released from precoated metal surfaces, during the soldering operation which seals the cover to the base, are materially reduced.

In addition, it has been found that the electrical capacitance of the holder 10*a* is substantially reduced inasmuch as the metal present in the base member is at a minimum. The reduced capacitance of holder 10*a* considerably improves the operational characteristics of the crystal C.

In the event that it is desired to provide a holder assembly using a straight wall cover, such as shown in Fig. 1, such cover has a base 36, shown in Fig. 8, associated therewith. Base 36 comprises a vitreous body 23 having surfaces 24, 25 and a peripheral edge 26, as previously described. Spaced metal pins 27 are sealed within body 23, inwardly of edge 26. A metal rim member 37 is sealed to the peripheral portions of body 23. Member 37 comprises an inverted U-shaped portion having downwardly extending arms 38, 38*a* and a short, horizontally disposed portion 39 extending inwardly from arm 38*a*. The inner surfaces of arm 38*a* and portion 39 are sealed to edge 26 and marginal portions of surface 25, respectively. Portion 39 terminates short of pins 27.

Thus, the base 36, having a crystal blank mounted on the inner ends of pins 27, may be assembled with a cover 12, the open end wall portions being received in the U-shaped flange of the base and sealed by soldering. The completed unit will show high resistance to mechanical strain and substantial freedom from crystal contamination.

The high strength glass-metal seal of an extended vitreous body, may also be used in combination with a walled metal base, as shown in Fig. 7. The base 40 comprises a metal wall 41 formed with a peripheral, upstanding flange 42, of inverted U-shaped section. The wall 41 is formed with spaced openings 43 in which are located the metal pins 44. The pins 44 are maintained in insulated relation to wall 41 by means of an extended, integral vitreous body 45 which is sealed to the surface 46 of wall 41 and the inner portion of flange 42. The body 45 is of substantially uniform thickness and permits the pins 44 to be severely strained without affecting the glass seal, as previously described.

The base 40 may be used with a cover as shown in Fig. 1, the flange 42 receiving the upper edge

of the cover 12 and being soldered thereto, as previously described. The wall 41 of base 40 affords means for mounting a bracket 47 by securing the same to surface 48 of the wall. The bracket 47 is secured to wall 41 in a manner to space the bracket from the pins 44 and the periphery of the wall. It will be noted that the metal of wall 41 does not have to be drawn at openings 43 to provide cylindrical portions for holding the glass seal, as indicated in Fig. 1.

It is understood that the solid metal pins 27, 44 may be replaced in whole, or in part, by tubular metal members which provide conduit means for conductors or the like which are to be introduced within the cover. Such conduits may also be used for evacuating an assembly. The assembly is completed by applying solder seals or the like, to the open ends of the tubular members.

It will be apparent that there has been provided a device in which the several objects of this invention are achieved and which is adapted to meet the conditions of use.

As various possible embodiments might be made in the above described invention, and as various changes might be made in the embodiments above set forth, it is understood that all matter herein set forth or shown in the accompanying drawing, is to be interpreted as illustrative and not in a limiting sense.

Having thus described our invention, we claim as new and desire to protect by Letters Patent:

1. A piezoelectric crystal device comprising a hollow metal casing open at one end, a hermetic seal for the open end of said casing comprising a thin flat vitreous body of substantially uniform thickness, a pair of spaced terminal members extending through and sealed to said body, a metal rim member sealed to peripheral portions of said body, said rim member including a portion sealed to the peripheral edge of said body and terminating at one face thereof so as to leave a maximal area of the vitreous body exposed to the interior of the casing, a crystal mounted on the ends of said terminal members extending from said last

mentioned face of the body, the portions of said terminal members extending from the other face of the body being frictional contact means for connecting said mounted crystal in an external circuit and subject to mechanical strains arising from supporting said device, said rim member engaging the open end of said casing and a solder seal uniting said rim member to said casing, said vitreous body, terminal members and rim member having substantially the same coefficient of expansion.

2. In a crystal holder as in claim 1, wherein said metal rim member comprises a portion of U-shaped cross section opening toward the crystal side of said body.

3. In a crystal holder as in claim 1, wherein the wall portions of said casing at the open end thereof are offset outwardly to provide a peripheral seat and said rim member is positioned in said seat.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,078,892	McCullough	Apr. 27, 1937
2,178,747	Espe	Nov. 7, 1939
2,178,826	Bowie	Nov. 7, 1939
2,206,516	Scharfnagel	July 2, 1940
2,404,445	Kuenstler	July 23, 1946
2,424,683	Eitel	July 29, 1947
2,429,414	Kuenstler	Oct. 21, 1947
2,455,851	Beggs	Dec. 7, 1948
2,472,865	Stutsman	June 14, 1949
2,482,451	Adams	Sept. 20, 1949
2,498,585	Seiden	Feb. 21, 1950

FOREIGN PATENTS

Number	Country	Date
592,132	Great Britain	Sept. 9, 1947