Oct. 4, 1949. J. B. ADAMS, JR 2,484,004

CRYSTAL HOLDER

Filed Nov. 14, 1945 2 Sheets-Sheet 1

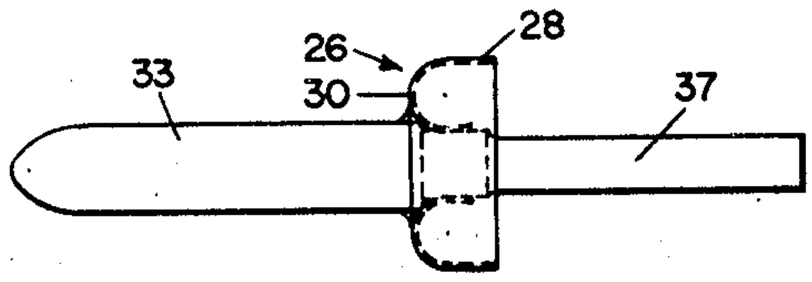


FIG. 6

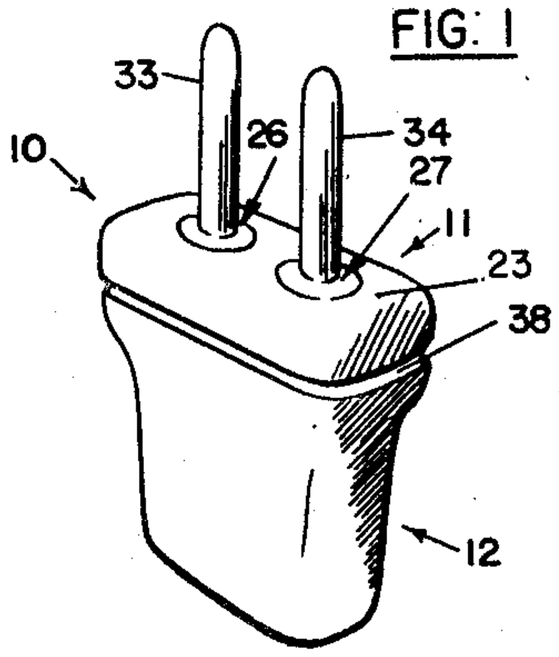


FIG. 1

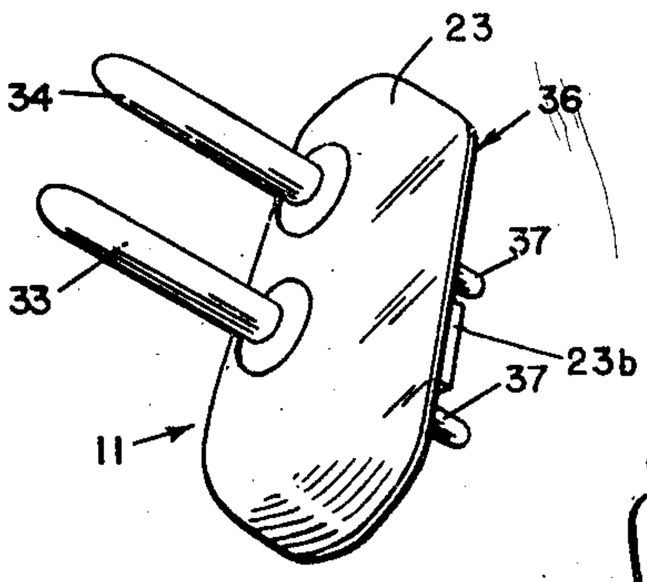
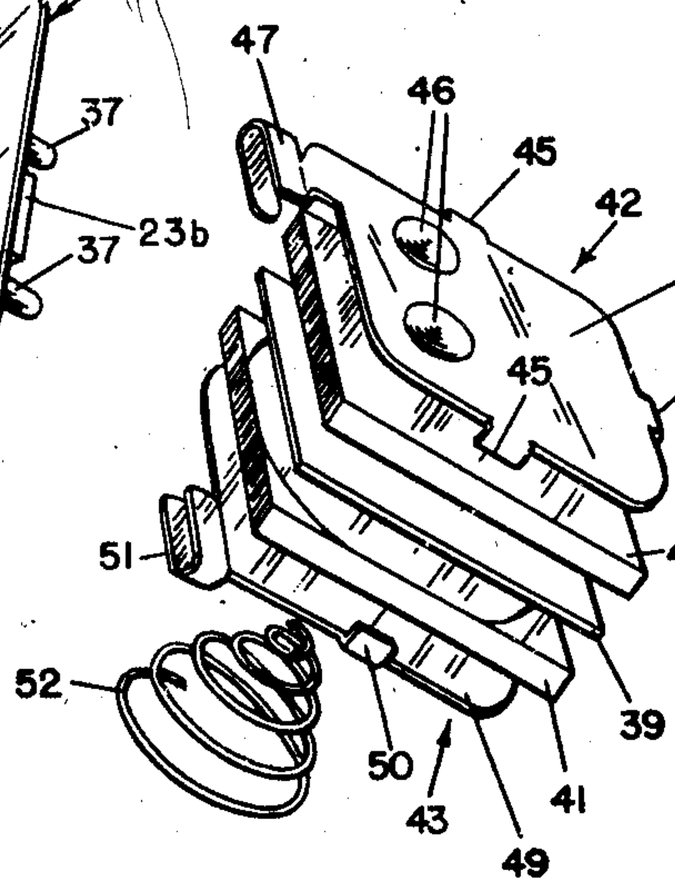


FIG. 5



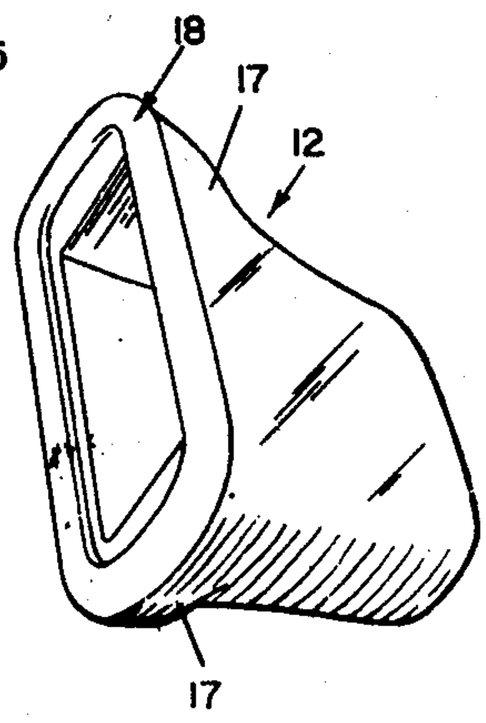


FIG. 7

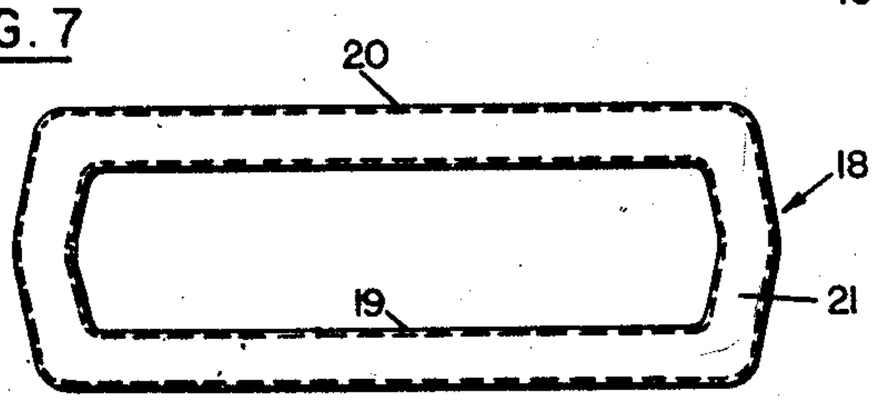


FIG. 9

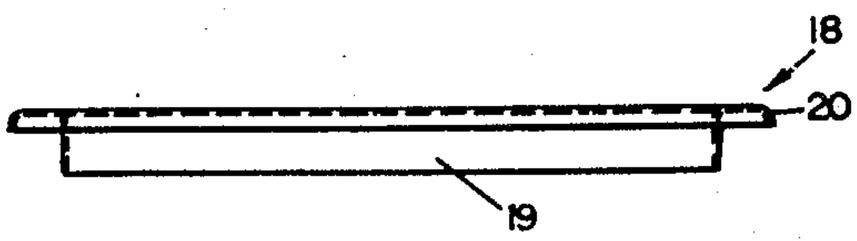


FIG. 8

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CRYSTAL HOLDER

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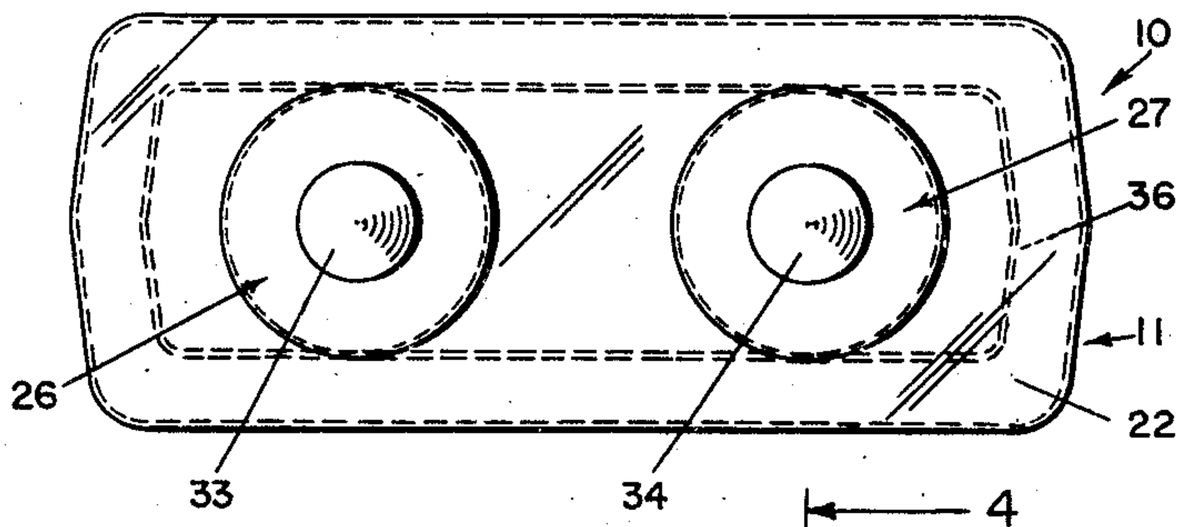

FIG. 2

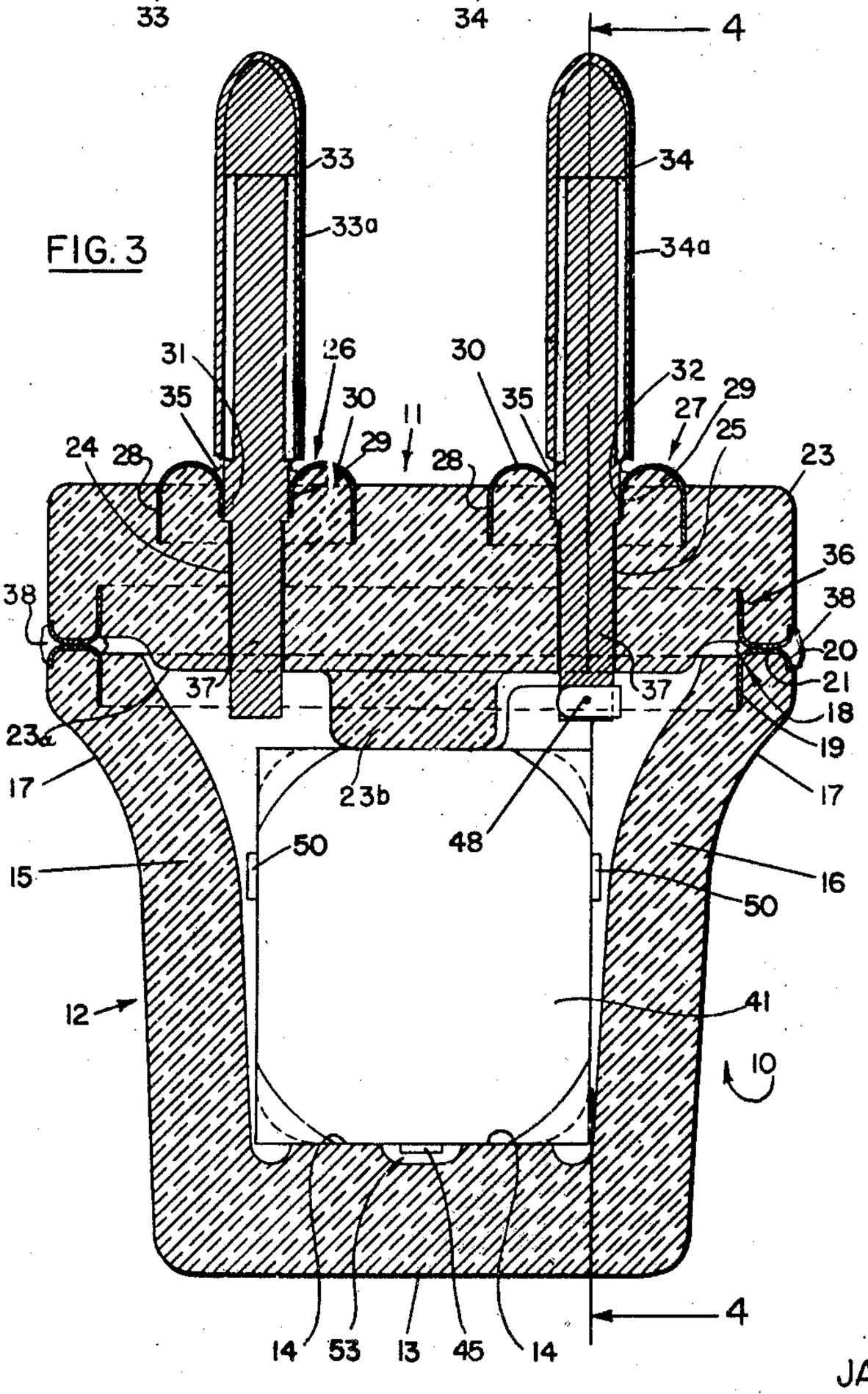

FIG. 3

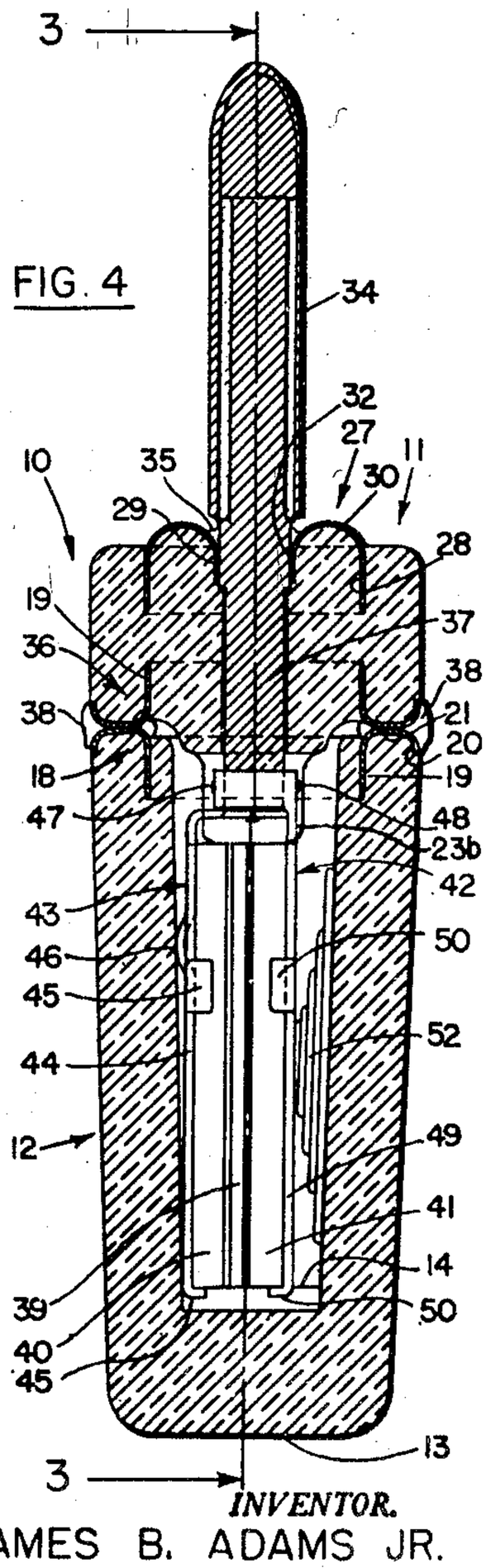

FIG. 4

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CRYSTAL HOLDER

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Application November 14, 1945, Serial No. 628,518

6 Claims. (Cl. 171—327)

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This invention relates to new and useful improvements in piezo-electric devices and has particular relation to a hermetically sealed piezo-electric crystal holder.

The objects and advantages of the invention will become apparent from a consideration of the following detailed description taken in connection with the accompanying drawings wherein a satisfactory embodiment of the invention is shown. However, it is to be understood that the invention is not limited to the details disclosed but includes all such variations and modifications as fall within the spirit of the invention and the scope of the appended claims.

In the drawings:

Fig. 1 is a perspective view of the complete hermetically sealed holder of the invention;

Fig. 2 is a top plan view of the same on a much larger scale;

Fig. 3 is a sectional view through the complete holder, the view being taken as along the plane of the line 3—3 of Fig. 4;

Fig. 4 is a transverse sectional view through the complete holder, the view being taken as along the line 4—4 of Fig. 3;

Fig. 5 is a perspective view on a smaller scale of parts and an end closure assembly;

Fig. 6 is a side elevational view of a contact pin or prong and eyelet assembly;

Fig. 7 is a plan view of one of the base and cap eyelets employed in effecting a hermetic seal between the base or end closure and the cap of the housing;

Fig. 8 is a side elevational view of the eyelet of Fig. 7; and

Fig. 9 is a greatly enlarged detail sectional view showing an edge portion of an eyelet employed.

Referring in detail to the drawings, the improved holder generally designated 10 includes a base 11 and a cap or housing 12, each comprising a molded body of a low temperature coefficient glass. The cap 12 is a hollow body tapered on its outer surfaces and entirely open at its larger end while completely closed at its smaller end by a wall 13.

The walls of this cap are relatively heavy and the cap is internally tapered whereby a crystal assembly may be mounted in the cap without the use of a chase. Thus, while the inner and outer surfaces of the walls of cap 12 are inclined, such surfaces are nevertheless approximately parallel so that the walls are of substantially uniform thickness. On its inner surface, end wall 13 is provided with a pair of raised portions 14, the purpose of which will appear. Toward the open

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end of the cap, its edge walls 15 and 16 are very substantially flared outwardly as at 17, but all the walls about the open end of the cap are relatively flat and terminate in the same plane.

At its open end the cap is generally rectangular in shape and molded to the cap and covering a portion of its free end wall is a rectangular eyelet 18. This eyelet includes a relatively long inner wall 19, a relatively short outer wall 20, and a connecting wall portion 21. The free edge of its wall 19 is feathered as best shown at 22 in Fig. 9, and in one construction this feathered portion is $\frac{1}{32}$'' long and at its free edge is a maximum of .003 of an inch in thickness. Since the eyelet 18 is molded to the cap its arm 19 is embedded in the latter and the entire eyelet is filled with the material of the cap.

The base 11 comprises a substantially solid body 23 of low temperature coefficient glass. This body is substantially rectangular and of an outside dimension substantially the same as that of the outside dimension of the cap about its open end. Body 23 includes a thickened central portion 23*a* which is partly received in the open end of cap 12 and further includes a lug or extension 23*b* extending into the cap beyond portion 23*a*.

A pair of openings 24 and 25 extend through the body 23 and molded with the body are a pair of metal eyelets 26 and 27 disposed about such openings at the outer side of the base. These eyelets are circular in plan and each includes an outer wall 28, an inner wall 29, and a curved or crown-like connecting portion 30. The eyelets are molded with the base 23 and are completely filled with the material of the latter and the arms 28 of the eyelets are completely embedded in the base. Such arms have their inner or free edges feathered as described in connection with the eyelet 18.

The inner walls 29 of the eyelets 26 and 27 are about portions 31 and 32 respectively of pins or prongs 33 and 34 respectively. Such pins or prongs are brazed to the eyelets through the use of silver solder at 35 and pass entirely through the openings 24 and 25 and are exposed at the inner side of the body 23. The solder connection between the pins and the eyelets is continuous extending entirely about the pins and thus provides a hermetic seal between these parts. The pins 33 and 34 are of the self-aligning type including outer sleeves 33*a* and 34*a* respectively. This construction is more fully described in my co-pending application.

A rectangular eyelet generally designated 36 is molded with the base 11 and is disposed about the

inner surface of the edge portion of the latter. This eyelet 36 is of the construction of the eyelet 18 above described, and is molded with the base 11 in the same manner that the eyelet 18 is molded with the cap 12.

The various eyelets described are all of Kovar or other alloy having the same or substantially the same coefficient of expansion as the parts to which they are molded. Therefore, under varying conditions of ambient temperature there will be no separation of the metal eyelets from the glass bodies to which they have been molded. Prior to the various molding operations the eyelets are prepared by oxidation of their surfaces. Then in the molding operation this oxide is dissolved by the molten glass and a hermetic seal established between the eyelets and the glass parts to which they are molded.

As shown in Figs. 3 and 4, there is a slight clearance between the pins and the body or base 23. Thus, it will be understood that it would be only under conditions far beyond atmospheric conditions that sufficient heat would be encountered to cause expansion of the pin portions 37 to any such degree as to cause breakage of the base. In fact, with a slight clearance, as in the nature of .001 of an inch, and with the pins made of nickel-silver there has been no difficulty encountered along the lines suggested, even when the parts are subjected to a temperature of 900° F. The solder 35 physically attaches the pins to the eyelets 26 and 27 and thus to the body 23. As the eyelets are hermetically tight with the body 23, the solder 35 completes a hermetic seal between the pins and said body by effecting such a seal between the pins and the eyelets.

In making this base assembly the pin portions 31 and 32 are located within the eyelets 26 and 27 and then the silver solder 35 is applied. These sub-assemblies are then located in the mold and the eyelet 36 is positioned in the mold. Thereafter, the glass is introduced and flows about and is molded to the parts. During this operation the glass engaged portions of the pins are heated from the poured glass and expand. However, the pins of nickel-silver, or alloys of that type, being in contact with the molten glass, a powdery oxide is produced on the pins which the molten glass will not wet. On cooling of the molded assembly, the pins have a greater coefficient of expansion than the glass and therefore, the portions of the pins 37 contract away from the glass, providing the openings 24 and 25 above described and which openings are of greater dimensions than the pin portions passing through them, whereby any later expansion of the pins will not cause breakage of the glass body.

Certain parts are located within the housing and these parts will later be briefly described. For the present, assuming that the parts are in place, the base and cap are arranged in such relationship that the connecting wall portions 21 of the respective eyelets 36 and 18 are in abutting relation and then they are physically secured together and a hermetic seal is accomplished through the use of soft solder as at 38.

With the described construction, it will be understood that I have provided an all glass crystal or oscillator holder and one which is hermetically sealed. The cap 12 and base 11 each comprise a single molded piece of glass and are, therefore, impervious to moisture. While the pins or prongs 33 and 34 have a loose fit through the base, yet the eyelets 26 and 27 are hermetically sealed to the latter and a hermetic seal is obtained between the

eyelets and the prongs by a solder connection at 35. Also, with eyelets 18 and 36 and the solder 38, the base and cap are physically secured together through the soldering together of the last named eyelets and a hermetic seal is established at this point.

For the purpose of disclosing a complete holder including the oscillator and associated parts, certain construction now to be described has been illustrated.

Within the cap 12 is any or a conventional piezoelectric crystal or oscillator 39 against the opposite sides of which are disposed any or the usual electrodes 40 and 41 respectively. Somewhat similar contact elements generally designated 42 and 43 are disposed on the outer sides of the electrodes 40 and 41. As shown, the contact element 42 includes a flat body 44 having lugs 45 on certain of its edges. These lugs are bent to extend laterally and engage and embrace respective edges of the electrodes 40. In addition, contact 42 includes a pair of outwardly pressed or raised portions 46, the purpose of which will appear, and a U-shape extension or portion 47 receiving the inner end of the pin 34 and spot-welded to opposite sides of the same as at 48.

Contact element 43 is of the construction of the element 42 with the exception that element 43 is plane on its outer surface. Element 43 includes body 49 provided with lugs 50 embracing the edges of electrode 41, and further, includes the generally U-shape extension 51, receiving the inner end of the pin or prong 33 and spot-welded to opposite sides of the same. A spring, as the coil spring 52, is welded at its end of smaller diameter to the outer side of contact element 43.

With the crystal between the electrodes and the latter held by the lugs of the contact elements and the contact elements spot-welded to the inner ends of the contact pins or prongs 33 and 34, a base assembly is provided and the spring 52 comprises part of this assembly since it is welded to the outer side of contact element 43. With the spring 52 manually compressed the crystal, electrodes and contact elements are inserted into the cap 12 and the base 11 is disposed with its eyelet 36 against the eyelet 18 of the cap, and the solder 38 is to be applied.

In the complete assembly the raised portions 46 engage the inclined inner surface of the cap at one side thereof in spaced relation to the wall 13 and therefore, the contact element engages the wall adjacent its inner end and at a point spaced from its inner end, so that the element remains straight and true with relation to the center line of the entire device.

The spring 52 bears against the opposite inner wall of the cap, and so the described assembly is held against casual movement with all parts in engagement. Raised portions 14 on the inner surface of cap wall 13 are butted by the electrodes and associated parts but a recess 53 between such raised portions serves to accommodate the innermost of the lugs 45 and 50 of the respective contact elements. Additionally, the lug or extension 23b on the base engages the upper edges of the electrodes and the oscillator and retains such assembly against the lugs 14.

Having thus set forth the nature of my invention, what I claim is:

1. In a piezoelectric crystal holder, a hollow relatively thick-walled molded glass cap open at one end and having a circumferentially continuous end wall, a circumferentially continuous metal eyelet having an exposed portion and a

portion molded into said end wall of said glass cap forming a glass-to-metal seal extending entirely about the end of the latter at said open end, a glass base for closing the said open end of the cap, a circumferentially continuous metal eyelet having an exposed portion and a portion molded into said glass base forming a glass-to-metal seal extending entirely about the same at one side thereof, said metal eyelets adapted to have circumferentially continuous engagement of their exposed portions with each other on the base being disposed on the open end of the cap, said eyelets of a metal having a coefficient of expansion substantially the same as that of the glass of said cap and base assembly to remain molded to the latter in hermetically sealed relation under changes in ambient temperature, and a filler of soft solder sealing and securing said eyelets to one another in hermetically sealed relation.

2. In a device of the character described, a two-part housing of molded glass, an electro-mechanical vibrator in said housing, two pins carried by one of said housing parts, one of said pins being electrically connected with one side of the vibrator and the other pin being electrically connected with the other side of the vibrator, said pins adapted to be inserted in sockets, and metallic means hermetically sealed to each of said housing parts and hermetically sealed to each other and hermetically sealing said housing parts together in enclosing relation with said electro-mechanical vibrator.

3. In the device of the character described, a housing comprising a base and hollow cap having an open end, metallic means hermetically sealing said base over the open end of said cap, a piezoelectric crystal in said cap, a pair of pins each including a portion extending through said base, means electrically connecting the respective pins with the opposite sides of said piezoelectric crystal, and metallic means forming a hermetic seal between said pins and said base.

4. In a piezoelectric crystal holder a two-part housing of molded glass, one of said parts comprising a hollow cap member open at one end and having a circumferentially continuous end wall, a piezoelectric crystal in said cap member, an electrode at each side of said crystal, the other part of said housing comprising a base member, a pair of contact pins carried by said base member, said pins electrically connected with the respective electrodes, a circumferentially continuous metal band molded to said base, a circumferentially continuous metal band molded to said end wall of said cap member, said metal bands hermetically sealed to the base and cap respectively in a glass-to-metal seal, and means securing said bands to one another and thereby connecting said base and cap member in assembled relation.

5. In a device of the character described, a two part housing of molded glass comprising a body and a base, an electro-mechanical vibrator in said body, two pins carried by said base, one of said pins being electrically connected with one side of the vibrator and the other pin being electrically connected with the other side of the vibrator, said pins extending from said base and adapted to be inserted in sockets, means hermetically sealing said housing parts together in enclosing relation with said electro-mechanical vibrator, a pair of annular eyelets molded into said base forming a glass-to-metal hermetic seal and disposed in spaced relation to one another, said eyelets of a metal having substantially the same coefficient of expansion as the glass of said base, whereby the parts are not separated by changes in ambient temperature and the hermetic seal effected between the parts is not broken by changes in ambient temperature, said base having openings therethrough in alignment with the openings through said eyelets, said pins of metal and having portions passing through the respective holes through the base and having a slight clearance in such holes, and solder rings securing said pins to said metal eyelets and hermetically sealing said parts together.

6. In a device of the character described, a two part housing of molded glass comprising a body and a base, an electro-mechanical vibrator in said body, two pins carried by said base, one of said pins being electrically connected with one side of the vibrator and the other pin being electrically connected with the other side of the vibrator, said pins extending from said base and adapted to be inserted in sockets, means hermetically sealing said housing parts together in enclosing relation with said electro-mechanical vibrator, each of said pins including a portion passing entirely through said base but in slightly spaced relation to adjacent portions of the latter, and metallic means mechanically securing another portion of each of said pins to said body and establishing a hermetic seal between such parts.

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