

Oct. 29, 1946.

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2,410,193

CRYSTAL HOLDER

Filed Sept. 2, 1944

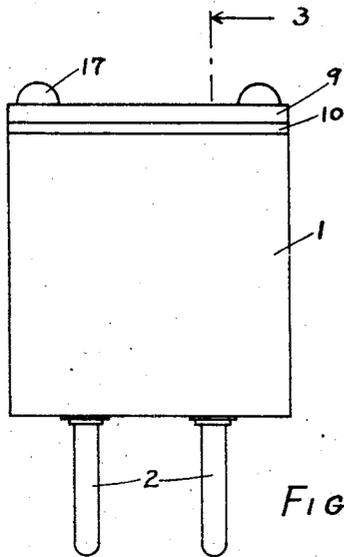


FIG. 1

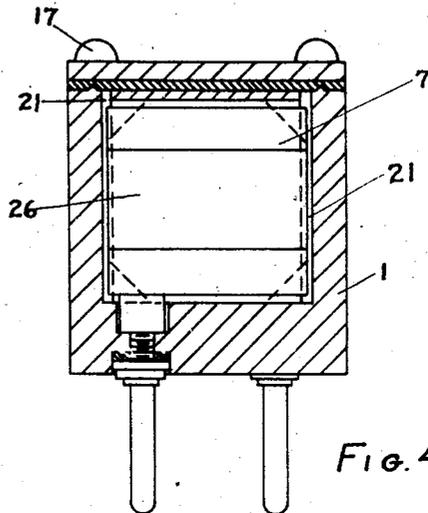


FIG. 4

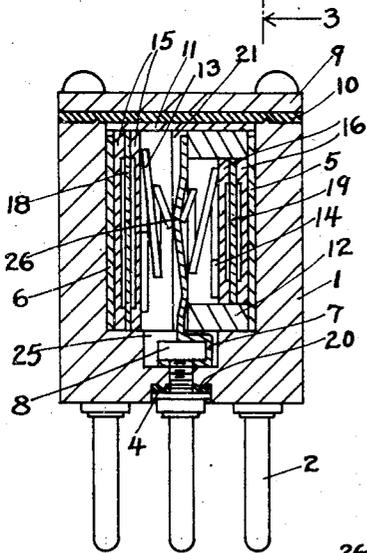


FIG. 3

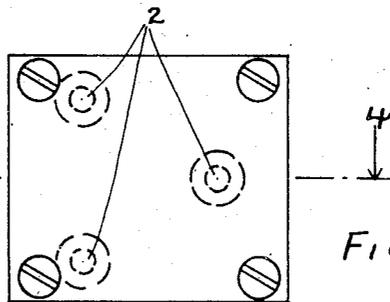


FIG. 2

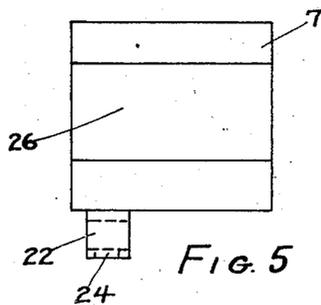


FIG. 5

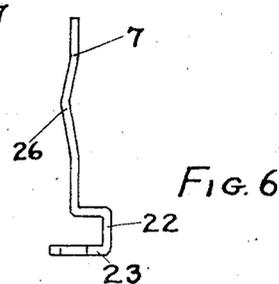


FIG. 6

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# UNITED STATES PATENT OFFICE

2,410,193

## CRYSTAL HOLDER

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Application September 2, 1944, Serial No. 552,436

13 Claims. (Cl. 171—327)

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This invention relates to holders for piezoelectric crystals, and more particularly, to holders wherein a plurality of crystals are contained.

An object of the invention is to provide a crystal holder wherein the assembly of crystals and electrodes will be securely maintained in operative position and wherein the performance characteristics of the unit will be stable under conditions of vibration and shock normally encountered in service.

A further object of this invention is to provide a crystal holder wherein looseness of parts of the assembly of the unit is reduced to a minimum without imposing excessively close tolerances on the fabrication of the components thereof.

A further object of this invention is to provide a crystal holder for a plurality of crystals wherein the spring pressure acting on the crystals will not vary due to shifting of parts of the holder during service and wherein the performance of the crystals will not be erratic.

A further object of this invention is to reduce the weight and improve the efficiency of certain components of crystal holders.

Other objects of this invention will further appear from the following description and claims, and from the accompanying drawing, wherein:

Figure 1 is an elevational view of a crystal holder of the type embodying this invention.

Figure 2 is a plan view showing the appearance of the top of the holder of Figure 1 and indicating the relative locations of the contact pins.

Figure 3 is a sectional view taken on line 3—3 of Figure 1.

Figure 4 is a sectional view taken on line 4—4 of Figure 2.

Figure 5 is an elevational view of a ground plate according to this invention.

Figure 6 is a side view of a ground plate such as shown in Figure 5.

Crystal holders of the "end loader" type have long been employed in the art. In this type of holder a cover plate is used to close the top of the holder, and usually a gasket is interposed between the cover plate and the top rim of the holder casing to render the holder moisture proof. In holders of the duplex type, that is, containing two crystals, the interior of the holder is divided into two cavities and in many designs the dividing element is a metallic plate which serves as a common, or "ground," conducting element for the two crystals. In such a design the electrical connection between the respective "ground" electrodes of the two crystal assemblies and the ground plate is commonly made by spring mem-

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bers which bear between the electrodes and the ground plate.

The ground plate is ordinarily retained in vertical operative position by a pair of oppositely disposed vertical grooves formed in opposing inner surfaces of the holder cavity and lying in the vertical median plane thereof. The edges of the ground plate are slidably inserted in said grooves during assembly of the holder, means being provided to connect the ground plate to an external contact lug after the ground plate has been slid into position. In order to make it possible to mould the guide grooves for the ground plate, said grooves are slightly tapered, being somewhat wider at the top portion than at the bottom portion of the holder cavity. This is done to provide draft for removing the casing from the mould at the completion of the moulding operation. In the prior art a flat plate of uniform thickness has been used as a ground plate. Due to the taper of the grooves, such a flat plate is normally capable of a certain amount of undesired movement in the grooves. Such movement tends to vary the bearing pressure of the springs on the electrodes in an irregular manner, causing frequency shifts and causing general instability of the unit under normal conditions of vibration and shock.

The present invention does away with instability due to ground plate movement by providing a structure wherein the ground plate is tightly in engagement at all times with the walls of the guide grooves regardless of the taper of said grooves.

As shown in Figures 1 to 6 of the drawing, a duplex crystal holder is provided having a body portion 1, top cover 9, sealing gasket 10 and contact pins 2. Crystal 13 is clamped between electrodes 15 by spring 13, said spring contacting ground plate 7. A contact plate 5 is connected to one of the pins 2 for electrically connecting one of the electrodes 15 thereto and the ground plate 7 is electrically connected to another pin 2 for electrically connecting the other electrode thereto through coil spring 13. Similarly, crystal 19 is clamped between electrodes 16 by coil spring 14 so that one electrode contacts plate 5 which is electrically connected to a pin 2 and the other electrode is conductively connected to ground plate 7 through spring 14. A spacer 12, which may be a rectangular frame member, is used where, as shown in Figure 3, the second crystal and electrode assembly is of substantially smaller size than the cavity of the holder.

The ground plate 7 is formed of relatively light

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resilient sheet metal, such as stainless steel, and is of a width adapted to slidably fit guide grooves 21 formed in the opposing walls of the holder cavity. A depending tab 22 is provided at the lower edge of ground plate 7, said tab being bent to provide a horizontal flange portion 23 provided with an aperture 24. The cavity of the holder is provided with a rectangular recess 25 adapted to receive tab 22 with the aperture 24 in vertical registry with the threaded top portion of a pin 2 when it is inserted through an opening provided therefor in the floor of the body portion 1. Pin 2 may be conductively secured to flange 23 by threaded engagement with a square nut 8 held against rotation relative to the casing body 1 by the walls of recess 25. A countersunk recess is provided under the flange portion of pin 2 to receive a gasket 4, the gasket acting to seal the pin 2 to the holder body 1 by virtue of a peripheral sealing rib 20 formed in the surface of the countersunk portion.

The ground plate 7 is provided with a number of corrugations extending horizontally from edge to edge and forming a bowed portion 26, as shown in Figures 3, 4, 5 and 6. The corrugations have a twofold purpose. They stiffen the plate so that deflection thereof due to differential pressure of springs 13 and 14 is minimized, and they insure a tight fit in guide grooves 21. The normal amplitude of the bowed portion formed by the corrugations is somewhat larger than the maximum width of grooves 21 so that the plate must flatten out slightly when it is forced into the grooves during assembly of the holder. Due to the resiliency of the material of the plate, the plate remains in tight contact with the walls of the grooves at all times after assembly. Thus all looseness of the ground plate 7 in the holder body is eliminated.

The corrugations may be of any desired shape and the number thereof may be modified within the spirit of this invention. It has been found satisfactory in one design to employ a single arcuate bowed portion, such as 26, with flat upper and lower bearing portions. Other modifications will occur to those skilled in the art. This invention may, furthermore, be applied to other elements of crystal holders besides ground plates, that is, wherever the problem of undesired movement of a plate member contained in the holder in retaining grooves is present.

Although only one specific embodiment of this invention has been described it is apparent that numerous applications thereof are possible. This invention therefore is not to be limited except insofar as is necessitated by the scope of the appended claims.

What is claimed is:

1. A holder for a piezo-electric crystal comprising a body member formed with a cavity for receiving a crystal and electrode assembly, spring means maintaining the crystal and electrode assembly in operative compressed relation, said spring means bearing between an electrode and a contact plate, said contact plate being provided with corrugations, and means for supporting said contact plate at edge portions thereof to resist the pressure of the spring means.

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2. A holder for a piezo-electric crystal comprising a body member formed with a cavity for receiving a crystal and electrode assembly, a contact plate, guide means provided in the walls of said holder cavity for receiving the contact plate, resilient means under compression positioned between said assembly and said contact plate to exert pressure on the assembly, said contact plate being provided with corrugations.

3. A holder for a piezo-electric crystal comprising a body member formed with a cavity for receiving a crystal and electrode assembly and a resilient contact plate, grooves being provided in the walls of the holder cavity for receiving said contact plate, said contact plate being provided with corrugations extending to the edge portions thereof whose depth is slightly greater than the width of said grooves whereby said contact plate may be resiliently fitted into said grooves during the assembly of the holder, and means electrically connecting said assembly to said contact plate.

4. The invention as claimed in claim 3 and wherein the corrugations extend transversely with respect to the vertical edges of the contact plate.

5. The invention as claimed in claim 3 and wherein the means electrically connecting said assembly to said contact plate comprises resilient means under compression positioned between said assembly and said contact plate.

6. In a crystal holder provided with a cavity for receiving elements of the holder, guide means provided in the walls of said cavity, plate means inserted in said guide means, said plate means being formed with corrugations extending to said guide means and cooperating therewith to provide a tight fit of said plate means in said guide means.

7. The invention of claim 6 and wherein said corrugations extend transversely of the plate means.

8. The invention of claim 6 and wherein the guide means comprise grooves formed in the opposite side walls of the holder cavity.

9. The invention of claim 6 and wherein the guide means comprise grooves formed in the opposite side walls of the holder cavity, the width of said grooves being slightly greater than the depth of the corrugations formed in the plate means.

10. A contact plate for a crystal holder comprising a body portion and a depending tab portion, said body portion being provided with corrugations extending transversely to the side edge portions thereof.

11. A contact plate for a crystal holder comprising a body portion and a depending tab portion, said body portion being provided with flat top and bottom portions and an arcuate transverse corrugation in the intermediate portion thereof.

12. The invention of claim 10 and wherein the contact plate is of resilient material.

13. The invention of claim 11 and wherein the contact plate is of resilient material.

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