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CRYSTAL MOUNTING

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Fig. 1.

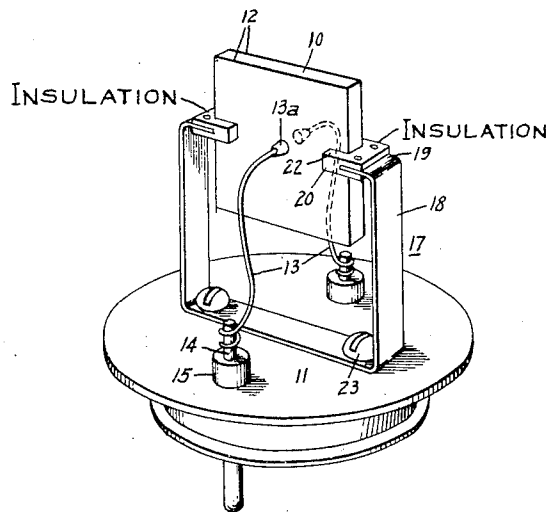
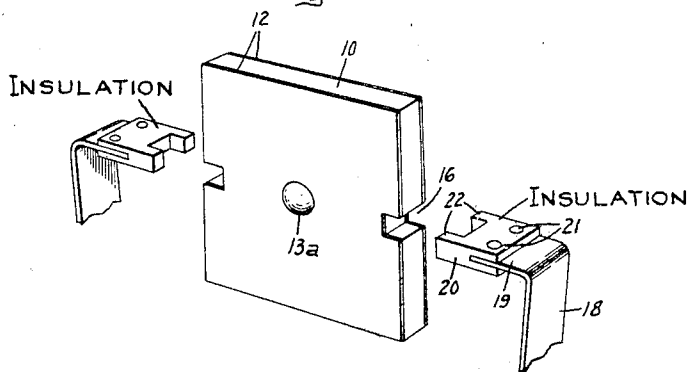


Fig. 2.



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UNITED STATES PATENT OFFICE

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CRYSTAL MOUNTING

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4 Claims. (Cl. 171-327)

This invention relates to piezoelectric translating devices and more particularly to mounting means for such devices.

It is an object of my invention to provide new and improved mounting means for piezoelectric translating devices such as quartz crystals and especially for low frequency crystals, which results in crystal assemblies having greater stability and improved performance.

It is another object of my invention to provide a new and improved crystal mounting in which the crystal is securely supported so that there is substantially no decrease in activity of the crystal by reason of changes in the contact area or pressure between electrodes and the faces of the crystal, substantially no frequency changes due to changes in any air gap between a crystal face and an electrode, and no substantial changes of frequency or activity when the crystal is subjected to vibration or impact, or when tilted.

It is still another object of my invention to provide a new and improved crystal mounting which is particularly adapted for use with crystals having the lead wires attached directly to electrode coatings secured to or integral with the faces of the crystal and which is simple in nature, inexpensive, easily accessible for assembly and adjustment, and practical for general use.

It is a further object of my invention to provide a crystal mounting of such a character that large amplitudes of vibration and severe impacts do not cause frequency changes and loss of activity.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawing in which Fig. 1 is a perspective view of a piezoelectric crystal and its mounting embodying the principles of my invention; and Fig. 2 is an enlarged, perspective, exploded view illustrating details of the supporting means shown in Fig. 1.

In the drawing, there is shown a piezoelectric crystal 10, of quartz for example, supported on a suitable base or header 11. The base may comprise a portion of an evacuated assembly in which case a suitable envelope of glass, for example, (not shown) would be provided to enclose the crystal and its mounting, the envelope being

suitably hermetically sealed to the base or header 11.

The crystal 10 is provided with suitable electrically conductive electrode coatings 12, such as silver or aluminum, on opposing major surfaces or faces of the crystal.

In order to connect the crystal in an electrical circuit there are provided suitable conductors 13 preferably of small diameter, relatively flexible, wires. One end of each of the conductors is attached to one of the coatings while the other ends are suitably attached to relatively rigid lead-in wires 14 extending through the base. If the crystal is disposed in a hermetically sealed container the lead-in wires 14 may pass through suitable sealing bushings as indicated by the numeral 15.

A low frequency crystal usually has a nodal line across the face of the crystal. This nodal line is the inactive portion of the crystal and any pressure or weight along this line has little effect upon the activity of the crystal. Nodal lines occur at different angles and planes depending upon the cut or orientation of the crystal.

In the method of making the crystal employed in my invention, a nodal line is first determined by any desired method such as by the use of powder patterns. Then a metallic, electrically conductive paste dot, as a silver paste, for example, may be applied to both faces of the crystal at a point on the nodal line. The dot is then baked to drive out any volatile substances and after baking, the electrode coatings may be deposited on the crystal faces by any desired method, such as evaporation. Electrical connection is then made to the electrodes or coatings as by soldering the wires 13 to the silver dots 13a. While I have applied the coatings to the crystal after the formation of the dots, the coatings may be applied first, if desired.

After the conductors have been attached to the coatings, another determination of the nodal line may be necessary, since the silver plating and wires tend to load the crystal which may shift the ends of the nodal line. After the nodal line is accurately determined, inwardly directed slots 16 are cut into opposite edges of the crystal along the nodal line as best seen in Fig. 2. The slots may be cut in by a small diamond saw, for example.

The supporting means for the crystal are indicated at 17. In the illustrative form of my invention, the supporting means comprises a generally U-shaped member of suitable resilient spring material as, for example, phosphor bronze. The free ends 18 of the support have

inwardly directed portions 19 for engagement with the slots 16. In order to prevent short circuiting the crystal when an electrically conductive material is used for the support, the ends of the support may terminate in engaging portions 20 of suitable insulating material suitably attached to the portions 19 as by means of rivets 21. The insulating engaging portions 20 may be provided with prongs 22 for engagement with the major faces of the crystal on the outside of the coatings and thereby prevent the crystal from sliding sidewise out of the suspension. The complete suspension may be secured in position on the base or header 11 in any suitable manner as by means of threaded fastening members 23 engaging suitably tapped openings in the base.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that changes and modifications may be made without departing from my invention in its broader aspects, and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination with a piezoelectric crystal having metallic coatings formed integrally with each of two opposite faces and having a pair of slots inwardly directed from opposite edges of said crystal along a nodal line across said crystal, a pair of conductors having one end of each attached to one of said coatings on said nodal line, and resilient means for supporting said crystal solely by interlocking engagement with said slots.

2. In combination with a piezoelectric crystal

having metallic coatings formed integrally with each of two opposing faces and having a pair of slots inwardly directed from opposite edges of said crystal along a nodal line across said crystal, a pair of conductors having one end of each attached to one of said coatings on said nodal line, a base, and means for mounting said crystal upon said base comprising a pair of resilient arms extending from said base in parallel spaced relation and having their free ends biased toward each other and into interlocking engagement with said slots.

3. In combination with a piezoelectric crystal having metallic electrode coatings formed integrally with each of two opposite faces and having a pair of slots inwardly directed from opposite edges of said crystal along a nodal line across said crystal, a pair of conductors having one end of each attached to one of said coatings on said nodal line, a base, a pair of cantilever spring arms extending from said base in parallel spaced relation and having their free ends biased toward each other, and a pair of U-shaped insulating members mounted upon said free ends of said spring arms and interlockingly engaging said slots thereby to support said crystal and to prevent short-circuiting of said electrode coatings.

4. In combination, a piezoelectric crystal having metallic coatings formed integrally with each of two opposite major faces of said crystal and having a nodal line across at least one of said major faces, an electric conductor connected to each of said coatings, and interlocking supporting means resiliently engaging said crystal solely at opposite ends of said nodal line.

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