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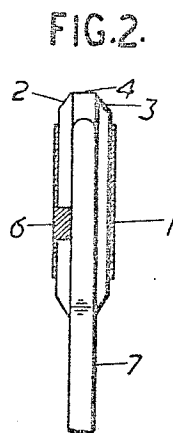
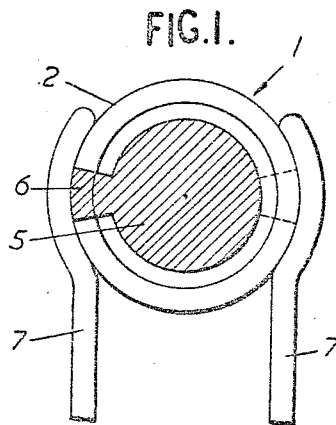
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METHOD OF MOUNTING PIEZO-ELECTRIC CRYSTALS

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METHOD OF MOUNTING PIEZO-ELECTRIC CRYSTALS

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1 Claim. (Cl. 310—9.6)

This invention relates to piezo-electric crystal elements in which the crystals are intended to vibrate in the thickness shear mode, and in particular to methods of mounting the crystals in such manner that minimum damping is produced by the mounting means, so that the low loss which is characteristic of this vibration mode is retained.

The actual mode in which a crystal will vibrate is determined by the relationship between the planes along which the crystal element is cut and the crystallographic axes of the piezoelectric material, the method of mounting, and the electrode disposition.

The alternating E. M. F. which maintains the vibration of the crystal is applied to the two selected faces of the crystal element, which are provided with thin conductive coatings, commonly by volatilisation or cathodic sputtering. The natural frequency of vibration is primarily determined by the dimensions of the crystal, and when high vibration frequencies are required, the crystal elements are normally in the form of thin plates.

When such a plate is cut to vibrate in the fundamental thickness shear mode, there is a neutral or nodal plane midway between the two major surfaces of the plate, and during oscillation this plane remains stationary. It is therefore desirable, when possible, that the mounting means should be attached to the crystal at points along the nodal line, that is, the line along which the nodal plane cuts the edge of the crystal. It has hitherto been customary to attach the conductive supports to points on the electrode surfaces as near as possible to the edges of the plate, but we have found it possible to attach them to the edges of the crystal so that they effectively lie along this nodal line.

The invention therefore provides a piezo-electric crystal element constructed so that the natural vibration of the crystal is in the thickness shear mode, comprising a piezo-electric crystal shaped as a disc with bevelled edges, a pair of conductive supports so shaped as to embrace opposing arcs of the perimeter of the crystal disc, each support making contact one with each of the respective conductive coatings on the two major surfaces of said disc shaped crystal.

An embodiment of the invention will be described with reference to the accompanying drawing, in which: Figs. 1 and 2 represent to an enlarged scale a plan view and a side elevation respectively, of a crystal mounted according to the invention.

In the figures there is shown a disc shaped crystal plate 1, which has bevelled edges 2, 3, separated by an unbevelled portion 4, which is at right angles to the planes of the major surfaces. Each of the major surfaces is provided with a conductive coating 5, preferably of the familiar key-hole shape, the projecting tail 6 of which

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is carried over the edge of the crystal as shown in Fig. 2. Support wires 7 are shaped as shown so as to embrace the edge of the crystal, and are attached to the unbevelled portion 4 by means of a suitable adhesive to ensure contact between the support wires and the electrodes, the tails 6 of the key-hole coatings being continued across the adhesive and the support wires 7.

The support wires 7 are normally attached to stiff metal supports mounted in a suitable base, and the whole assembly is then commonly mounted in a vessel which is subsequently evacuated. This is not, however, an essential feature.

It is to be appreciated that the crystal plate shown in the figures is drawn on an enlarged scale; the wires 7 are in practice usually of small diameter and somewhat flexible. The wires must embrace sufficiently large arcs of the circumference 4 of the crystal disc to minimise the risk of their becoming detached by mechanical shock; at the same time the greater the arc, the greater the damping, so that the actual dimensions have to be determined for any individual construction.

The following examples give dimensions of constructions which have been found satisfactory.

	Diameter of disc, mm.	Length of arc of contact of support wire, mm.
Example 1.....	14.00	7
Example 2.....	12.62	5

Diameter of supporting wires approximately 1 mm.

It is to be appreciated that although the crystals in the embodiments described are of circular disc form, other shapes might in some circumstances be preferred, including for example, crystal plates of rectangular outline or of elliptical outline.

While the principles of the invention have been described above in connection with specific embodiments, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What is claimed is:

A piezo-electric crystal mounting assembly comprising a circular disc-shaped piezo-electric crystal of uniform thickness and having parallel, major surfaces and adapted to vibrate in the fundamental thickness shear mode, said disc having spaced arcuate, bevelled circumferential edges separated by an unbevelled perimeter, conductive coatings on the opposite major flat surfaces of said crystal, each coating having keyhole extensions with tail portions extending over and contacting said bevelled edges, a pair of flexible wire supports having arcuate arms embracing the crystal along a nodal line and over opposing large arcs of the perimeter and making contact with said tail portions.

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