May 20, 1952 R. A. SPEARS 2,597,757

MOUNTING ARRANGEMENT FOR PLATED PIEZOELECTRIC CRYSTALS

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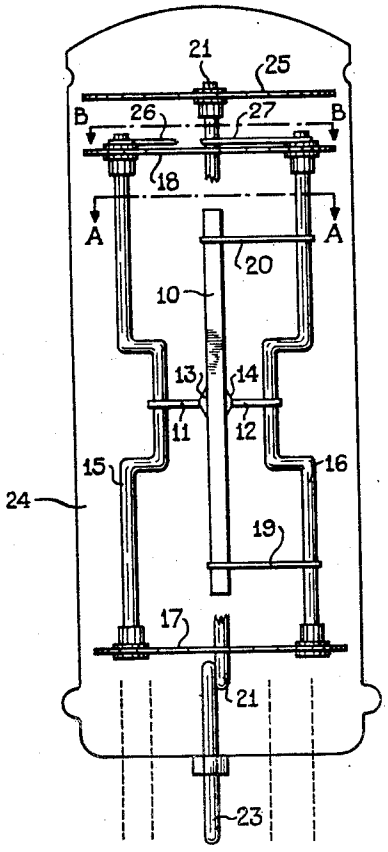


Fig. 1

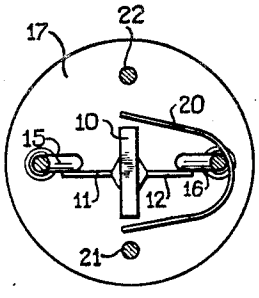


Fig. 2

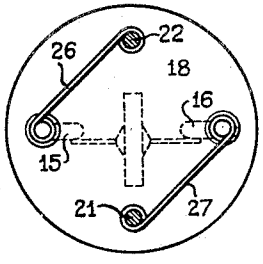


Fig. 3

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MOUNTING ARRANGEMENT FOR PLATED PIEZOELECTRIC CRYSTALS

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2 Claims. (Cl. 171—327)

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The present invention relates to improvements in mounting arrangements for bar and plate type piezoelectric crystals and more particularly to arrangements of the type in which wires attached to each of the major surfaces of the crystal serve both as supports for the crystal and as conductors to the electrodes adhering to said surfaces.

In a known arrangement of this type the crystal has its two major surfaces metallised, with gold for example, to provide electrodes and the midpoint of each major surface is reinforced by a silver spot which serves as a base for a soldered butt joint by means of which a thin resilient conducting suspension wire is attached to each major surface, the other end of each wire being attached to a main support so that the crystal is carried by a two point suspension. The main supports are also electrically conducting and when the unit is mounted in a glass envelope, of the type used for thermionic valves, may conveniently extend to the terminal pins of the envelope.

When a crystal having the above type of two point suspension is subjected to mechanical shock or vibration there is a tendency for it to move arcuately about its suspension wires and this arcuate movement has, in a known case, been limited by setting suitably slotted mica discs towards the ends of the crystal in such a manner that the crystal is normally clear of the discs, but upon a predetermined displacement the crystal strikes one or both of the discs. This arrangement suffers from the disadvantage that since the mica discs are rigid the impact of the crystal on the disc or discs reacts on the suspension wire joints with a shearing action and there is consequently a danger of the joint breaking. The effect of this shearing action is greater when only one end of the crystal engages with a mica disc, in which case the crystal tends to pivot about the point of engagement of the crystal with the disc.

The object of the present invention is to overcome this disadvantage and provide an improved crystal mounting arrangement wherein the possibility of breakage of the wire suspension by shearing forces acting on it due to movement of the crystal about its point of suspension is greatly reduced.

According to the invention there is provided in a mounting arrangement for a piezo crystal of rectangular cross-section the combination with electrode means on each major surface of said crystal and wires attached to said electrode means serving both as supports for the crystal and as conductors to said electrode means, of resilient means to limit without setting up in such a manner that the restricting effect does not set up undue reactive forces in the suspension.

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In the preferred form the resilient means comprises bumper members of resilient wire and substantially U-shaped with the legs of the U lying in a plane at right angles to the plane of arcuate movement of the crystal about the wire suspension, said legs being splayed slightly outwards and so positioned that the crystal engages with one leg when rotated slightly in one direction and the other leg when rotated slightly in the other direction. This splaying of the legs ensures a point engagement between the bumper member and the crystal, and avoids the possibility of the crystal electrodes being short circuited.

Alternatively the bumper member may be of resilient non-conducting material for the same purpose of avoiding a short circuit across the crystal electrodes in which case there is no need for the legs of the U to be splayed.

The invention will be better understood from the following description of one embodiment taken in conjunction with the accompanying drawing of which Fig. 1 shows the preferred arrangement with the crystal element of the bar type mounted within a glass envelope.

Fig. 2 is a sectional view in the direction AA in Fig. 1, and Fig. 3 is a sectional view in the direction BB in Fig. 1.

In Fig. 1 a bar type crystal 10 is supported by two Phosphor bronze suspension wires 11 and 12 soldered at points 13 and 14 to the major faces of the crystal and at their other ends to two main supports 15 and 16. The main supports are located by the mica discs 17 and 18 and strapped to two further supports 21 and 22 by bare wire straps 26 and 27 as shown in Fig. 3. The supports 21 and 22 are welded at their lower end to pins such as 23 in the base of the glass envelope 24 and are further located at their upper end by a mica plate 25 positioned above disc 18.

Two substantially U-shaped bumper members 19 and 20 of resilient wire are fixed to the main support 16 one toward either end of the crystal 10 as shown in Fig. 2 so that each leg of the U is located in each case slightly clear of the side edge of the bar crystal 10. The bumper members are not a true U shape as with such a shape there is a possibility of short circuiting the two major surfaces of the crystal, but are of a splayed U shape such that a point engagement

between the crystal and one leg of the bumper member obtains when the crystal tends to pivot about its point of suspension 13, 14 and the possibility of short circuiting the two faces is minimised.

Alternatively the legs of the bumper may be of a resilient non-conducting material in which case they need not be splayed as there will be no risk of short circuiting the major surfaces of the crystal.

Oscillatory movement of the crystal in the horizontal plane and arcuate movement of the crystal about its point of suspension are both limited by the bumper members 19 and 20; and by reason of the resilient nature of these members the limitation is effected without any impact reaction setting up shearing forces which would tend to damage the joints between the suspension wires and the crystal itself.

I claim:

1. In a mounting arrangement for piezo crystals of rectangular cross section, in combination electrode means on each major surface of said crystal, rigid electrically conducting supports disposed vertically on each side of said crystal, horizontal conducting means extending from said vertical supports to a corresponding point on each major surface of said crystal to provide point suspension of and connection to said crystal, and substantially U-shaped resilient bumper means mounted centrally of the curved portion of the U shape on said vertical supports adjacent the upper and lower extremities of said crystal and extending across the path of pivotal movement of said crystal about its point of suspension whereby resiliently to limit such movement without setting up undue reactive forces at said point of suspension.

2. In a mounting arrangement for piezo crystals of rectangular cross section, in combination electrode means on each major surface of said crystal, rigid electrically conducting supports disposed vertically on each side of said crystal, horizontal conducting means extending from said vertical supports to a corresponding point on each major surface of said crystal to provide point suspension of a connection to said crystal, and at least one substantially U-shaped resilient bumper member mounted centrally of the curved portion of the U shape on one of said vertical supports, said bumper member having two legs which extend one on each side of said crystal across the path of pivotal movement of said crystal about its point of suspension whereby resiliently to limit such movement without setting up undue reactive forces at said point of suspension, and which are splayed toward their extremities so as to ensure point engagement of said legs with said crystal in the event of such movement of the crystal.

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