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H. S. BATES ET AL

2,457,338

CRYSTAL MOUNTING

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FIG. 1.

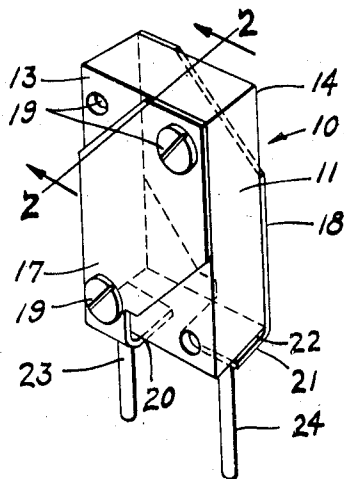


FIG. 2.

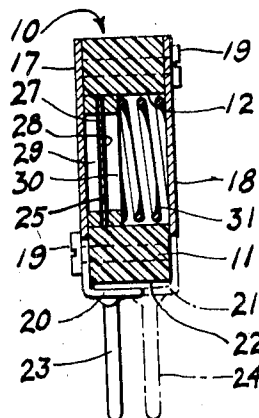


FIG. 3.

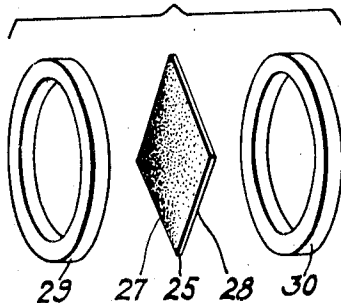


FIG. 4.

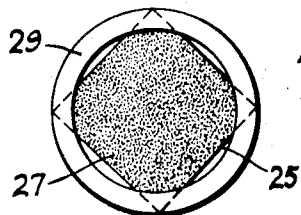
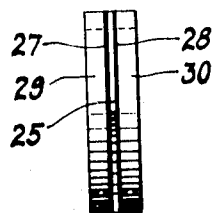


FIG. 5.

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CRYSTAL MOUNTING

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4 Claims. (Cl. 171-327)

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This invention relates broadly to piezo-electric crystal apparatus and has special reference to improved mounting means for such crystals.

The principal object of the invention is the provision of improved holding or mounting means for piezo-electric crystals, particularly of the type provided with plated electrodes.

Another and important object of the invention is to provide a piezo-electric crystal mounting exemplified by its extreme simplicity and maximum economy of manufacture.

The piezo-electric effect of certain crystals is well known in crystallography and a detailed discussion thereof has been omitted herein as being unnecessary to a clear understanding of the present invention. However, it may be well to point out that to utilize this piezo-electric effect it is usually necessary to drive the crystal through the medium of a pair of electrodes, one on each side of the crystal in direct contact with the main faces or surfaces thereof. When the crystal is used in its original cut condition the electrodes are usually provided by the crystal mounting elements, however, the crystal in many cases is provided with so-called plated electrodes, in other words the electrodes are provided by plating the opposite main surfaces, either wholly or in part, with some suitable metallic substance such, for example, as gold or silver. It has been found that the plated type electrode produces more uniform performance in maintaining the rated vibrational frequency of the crystal than do other known types of electrodes, and it is with this plated type of piezo-electric crystal that the present invention is particularly concerned.

There are at least three common well known types of mountings or holders for piezo-electric crystals, namely, the rod or clamp type, wire type and air gap type. A detailed description and discussion of the relative merits of these mountings may be had by reference to "The Bell System Technical Journal," volume XXIII, No. 2, published April, 1944. The present invention provides a new type of holder which, for the sake of distinction, may be designated as a "ring" or "washer" type.

To this end the invention contemplates the use of a pair of ring or washer-like members between which the plated crystal is held in the manner clearly illustrated in the accompanying drawings, in which:

Figure 1 is a perspective view of a crystal unit embodying the invention;

Figure 2 is a vertical sectional view of said unit

taken substantially along the plane of line 2-2, Fig. 1;

Figure 3 is an exploded perspective view of the plated crystal and its ring-like holding or mounting members;

Figure 4 is an end elevational view of the members shown in Figure 3, as in their assembled relation; and

Figure 5 is a side elevational view of the assembled members as illustrated in Figure 4.

Referring more particularly to the details of the drawings, wherein is illustrated one embodiment of the invention, the numeral 10 designates generally an insulating housing member which may conveniently comprise a block 11 of some suitable insulating material, such as polystyrene. The block 11 is provided with a centrally located aperture or bore 12 extending therethrough from one face 13 to the opposite face 14, said bore being closed at both faces by flat conductive members 17 and 18 secured thereto, as by screws 19. Conductive members 17 and 18 are provided at their lower ends with portions 20 and 21 respectively which are turned inwardly beneath the bottom wall 22 of housing 11. These inwardly turned portions are provided with short conductive prongs 23 and 24, respectively, which provide means for connection of the crystal unit with associated apparatus, not shown.

Positioned within bore 12 of housing 11, as shown more clearly in Figure 2, is a piezo-electric crystal 25 provided at its two opposite major surfaces, as indicated by the numerals 27 and 28, with a pair of adherent metallic coatings or films which comprise the electrodes for the crystal. These coatings or films may be plated on the crystal by any known method. It is well known in crystallography that the piezo-electric effect may be obtained from many different crystals and it is the intent of the present invention to include within its scope all those crystals with which the novel ring-type mounting may be used.

In particular accordance with the present invention the crystal is clamped between a pair of ring or washer-like members 29 and 30 to thus form a three-element unit as more clearly depicted in Figures 3, 4 and 5, said unit being positioned within the left end of bore 12, as seen in Figure 2, with ring 29 in direct contact with conductive plate 17. The clamping pressure is provided by a resilient member 31, such as the coil spring shown, positioned within bore 12 between ring 30 and conductive plate 18. In the event that the frequency of the crystal is suffi-

ciently high to create an objectionable inductive effect in the coil spring, other resilient means, such as a spring leaf, may be employed. It may be seen by reference to Figure 5 that the ring members 29 and 30 clamp the crystal at the corners only, thus leaving the central portion thereof free to vibrate. One of the advantages of this type of mounting means is the restriction or damping of unwanted modes of vibration to an extent preventing serious dips in activity characteristic, over a wide temperature range. It will be noted, by reference again to Figure 2, that rings 29 and 30, in conjunction with the conductive plates 17 and 18 and prongs 23 and 24, provide means for connecting the plated crystal to the associated apparatus, spring 29 being conductively interposed between ring 30 and plate 18.

With particular reference to Figure 5 it may be seen that the diagonal dimension of the crystal 25 is preferably equal to the outside diameter of the ring members 29 and 30. Now, with reference to Figure 2, it will be noted that the diameter of bore 12 is equal substantially to that of the outside diameters of said rings, thereby preventing accidental changes in the position of said crystal with relation to the rings, should the unit be subjected to shocks. Thus it will be evident that the central area, i. e. that area of the crystal free to vibrate, will remain fixed and hence without variation in its activity. With the above arrangement it is necessary for the spring to exert only sufficient clamping pressure to hold the crystal securely between the ring members to prevent axial displacement of the rings relative to the crystal while at the same time permitting the free area of said crystal to vibrate with the desired activity and at its rated frequency.

It should be particularly understood that the rings 29 and 30 may be made by a simple inexpensive stamping method, sufficient care being taken to provide the side of the ring contacting the crystal electrode with a continuous plane surface, whereby each of said corners may be clamped by at least a portion of this surface regardless of the angular orientation of the crystal in the plane of the rings.

This plane surface may, if desired, encompass the whole side area of the ring-like members, however, it will be evident that it is not essential that the corners of the crystal be clamped by the full overlying ring surface, as illustrated in Figure 5, as a lesser portion thereof may be sufficient. It is necessary only that one side surface of each ring be provided with a continuous plane surface. It is to be understood however that both sides of said ring-like members may be provided with such a plane surface if such is desired, thereby facilitating the assembly of the unit by eliminating the necessity of first determining which side thereof has been so provided.

It is further evident that the exterior configuration of housing 11 is merely illustrative and may assume other convenient forms without departing from the spirit of the invention. Similarly, the mounting rings or washers need not necessarily

be circular, and the use of the words "annular" or "ring-like" in the appended claims, should be understood with this in mind.

From the foregoing description it is now clearly evident that there has been provided by the above described invention, a novel improved mounting means for piezo-electric crystals and one which is exemplified by its extreme simplicity and economy of manufacture.

We claim:

1. In combination, a rectangular piezo-electric crystal having opposite substantially parallel major surfaces, said surfaces being metalized and forming electrodes, and mounting means comprising a pair of substantially circular metallic members each having a continuous annular plane surface between which surfaces the crystal is clamped, said annular plane surfaces contacting corner portions of adjacent metalized major surfaces of said crystal.

2. A piezo-electric crystal unit comprising a rectangular piezo-electric crystal of the type having plated electrodes on its opposite major surfaces, a pair of metallic ring-like members each having a continuous annular plane surface, a housing and means within said housing clamping said crystal between said members with at least a portion of each corner of said plated major surfaces in intimate contact with a portion of the adjacent annular plane surface.

3. A construction in accordance with claim 2 in which the major dimension of said crystal is substantially equal to the major dimension of said members, and in which said housing is so constructed and arranged as to closely encompass said members and said crystal in a manner preventing displacement of the crystal with relation to said members.

4. In combination, a rectangular piezo-electric crystal having opposite major surfaces, mounting means comprising a pair of substantially circular members each having a continuous annular plane surface between which surfaces the crystal is clamped, said annular plane surfaces contacting corner portions of the adjacent major surface of said crystal, each of said members further being substantially co-extensive in major dimension with the major dimension of said crystal, and a cylindrical housing closely encompassing said members and being in close adjacency to the corners of said crystal, whereby to prevent displacement of said crystal with relation to said members.

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