

June 16, 1936.

J. G. BEARD

2,044,145

CRYSTAL HOLDER

Filed Sept. 18, 1934

Fig. 1.

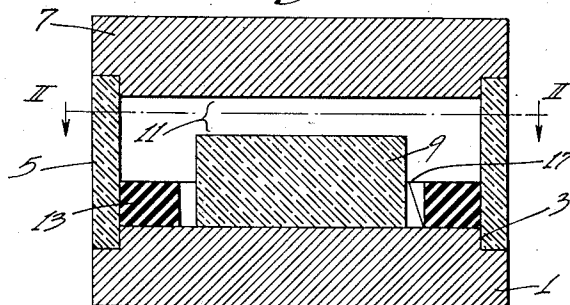


Fig. 2.

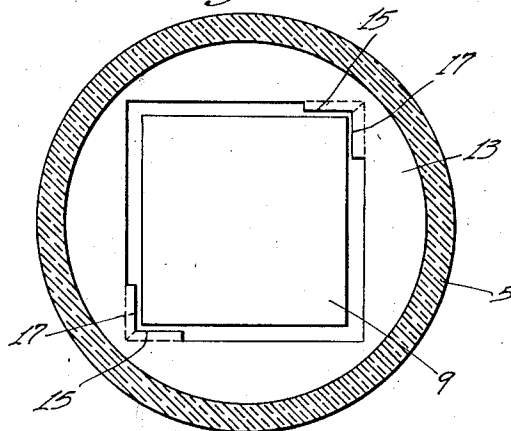
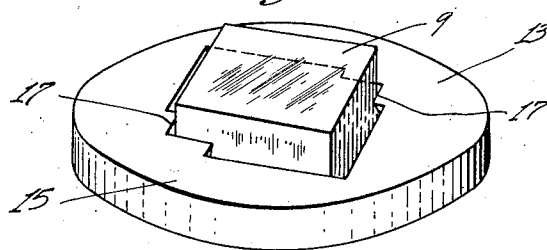


Fig. 3.



WITNESSES:

E. C. Leiding
E. Broder

INVENTOR

Joseph G. Beard.

BY

F. W. Lyle.
ATTORNEY

UNITED STATES PATENT OFFICE

2,044,145

CRYSTAL HOLDER

Joseph G. Beard, Springfield, Mass., assignor to
Westinghouse Electric & Manufacturing Com-
pany, East Pittsburgh, Pa., a corporation of
Pennsylvania

Application September 18, 1934, Serial No. 744,527

6 Claims. (Cl. 171—327)

My invention relates to crystal apparatus for use in frequency control apparatus to stabilize the frequency thereof, and it has particular relation to a crystal positioning means.

5 A crystal utilized in the stabilizing of the frequency of a piezo-oscillator is normally cut from a quartz crystal, and has the properties of vibrating mechanically in response to voltage pressures applied to the faces thereof and vice versa, voltage pressures may be developed by producing mechanical vibration of the crystal. While the energy involved in these transformations is sufficient to energize an electron discharge device and control its operation, it is, nevertheless, of
10 such small magnitude that the least mechanical interference with the vibration of the crystal will damp its movement considerably, thereby altering its frequency of vibration, and will often impede the operation of the crystal entirely, rendering it impossible to stimulate the crystal into vibration. Therefore, it becomes of importance to so position and mount a crystal that it will have the maximum amount of freedom of movement.

25 Another factor of importance to be considered is to maintain practically constant, whatever slight amount of damping might exist due to contact with the walls of a crystal holder, regardless of shifting of the crystal in its holder. Since frequency is a function of the damping of the crystal, the frequency will be maintained constant if the damping is constant, all other conditions being the same.

It is accordingly an object of my invention to provide a crystal positioning means which shall permit freedom of movement in the operation of the crystal.

Another object of my invention is to provide a positioning means for a crystal which shall positively position a crystal and at the same time offer a negligible amount of resistance to vibrational movement thereof.

Another object of my invention is to provide a crystal positioning means which shall have very little contact with the crystal itself.

Another object of my invention is to restrict the lateral movement of the crystal so that, should the electrodes in an air gap type holder be not parallel, a frequency change will be prevented which might ordinarily occur, should lateral shifting of the crystal be permitted.

Another object of my invention is to provide a crystal holder having a minimum but constant damping characteristic.

55 Another object of my invention resides in a

crystal holder wherein the frictional contact between the crystal and the adjacent walls of the housing will be substantially independent of shift of the crystal.

Additional objects of my invention will be disclosed in the following description of the same, when taken in connection with the accompanying drawing, in which:

Figure 1 is a view in cross-section of my improved positioning element in a crystal housing.

Fig. 2 is a view taken along line II—II of Fig. 1 illustrating the application of the crystal positioning element in a crystal housing.

Fig. 3 is a view in perspective of my invention.

The details of the crystal housing are of no particular importance in connection with the present invention, but I have illustrated one form of crystal housing in connection with which my invention may find application. This housing comprises a base 1, preferably of metal, which constitutes one electrode, this base element being provided with a peripheral groove or shoulder 3 at its upper edge on which may be mounted a spacing collar 5 of some material having a low coefficient of expansion, such as quartz. Another electrode 7 to be mounted above the crystal 9 in spaced relationship therefrom may be constructed of the same material and configuration as the base electrode, and will be mounted on the upper edge of the spacing collar, the height of the spacing collar being such as to provide the desired air gap 11 between the crystal and the upper electrode. The crystal is placed within the housing thus formed, and rests on the bottom electrode in intimate contact therewith.

To maintain this crystal in its proper position on the bottom electrode, I provide my improved crystal positioning means which comprises a positioning wafer 13 of a thickness less than that of the crystal. This positioning element has an outside configuration corresponding to the area defined by the spacing collar. An opening is provided through the positioning element having a contour corresponding in general to that of the crystal which it is adapted to position, the opening, however, being of an area which is substantially greater than the area of the crystal.

In the specific embodiment disclosed by me, the crystal is of rectangular shape and the opening through the positioning element is also of a rectangular shape to correspond with the shape of the crystal. At alternate or at diagonally opposite corners of the opening through the positioning element, I provide a pair of ledges 15 and 17, which are beveled, to provide sharp or

knife edges thereon. The ledges preferably join or merge at the corners, presenting an angular appearance as viewed from above; and extend inwardly toward the center of the opening so as to provide just sufficient room for the positioning of the crystal in the opening through the positioning element, whereby only the lightest of contact between the crystal and the positioning element will be obtained. By reason of the fact that the ledges are provided with beveled edges, surface contact between the positioning contact and the crystal is reduced to a minimum, practically a line contact, and at widely spaced locations around the crystal. Thus, the thickness of the centering element may vary without altering the line contact area with the crystal, whereby uniformity will be maintained.

Thus, while the crystal will be restrained against material shifting movement in its holder by my improved positioning means, it is apparent from the nature of my construction that the maximum amount of freedom will be permitted in the operation of the crystal. The damping of the crystal will, accordingly, be reduced to a negligible quantity, and the maximum performance may be obtained from the crystal.

Moreover, the above described construction provides for a minimum, but substantially constant damping. Particularly in connection with radio apparatus of a portable type is this important. A tendency of the crystal to "creep" or shift in position, will in the customary holder of the prior art, vary the surface contact between the crystal and its holder, causing a change in damping of the crystal with a corresponding alteration in its frequency.

In the device as disclosed by me, the crystal will invariably contact only two of the knife edges. Should the crystal tend to shift into a corner having the inwardly projecting ledges, the crystal will contact the two ledges in that corner only and will be free of frictional contact with the ledges in the other corner. If the tendency to shift be toward a corner which is free of ledges, the crystal will then frictionally contact one of the ledges in each corner. In either case, the crystal contacts only two ledges and the amount of frictional contact, therefore, will be the same in each case.

My invention provides, therefore, a very simple and highly efficient element for positioning a crystal in its holder, and while I have disclosed only the one embodiment thereof, it is apparent that the general idea of providing sharp knife-edge contact with the crystal at alternate corners or at widely spaced points around the positioning element as well as any crystal holder which provides for a minimum but substantially constant damping will fall within the principle of my invention. Accordingly, I do not desire that I be limited in my protection to the specific details disclosed except as may be necessitated by the prior art and by the appended claims.

I claim as my invention:

1. A positioning means for use in positioning a quartz crystal or the like comprising a pair of

electrodes and a spacer therebetween comprising an element of insulating material having an opening therethrough larger than and of the general contour of the quartz crystal to be used therein and beveled ledges extending substantially parallel to a median plane of the space between said electrodes inwardly from the periphery of said opening at spaced positions thereof to lightly accommodate said crystal and maintain the same spaced from the periphery of said opening.

2. A positioning means for use in positioning a crystal having the form of a polyhedron comprising a pair of electrode plates and a spacer therebetween comprising an element of insulating material having an opening therethrough larger than and of the general contour of the crystal to be used therein and beveled ledges extending substantially parallel to said plates inwardly from the periphery of said opening at spaced positions thereof to lightly accommodate said crystal and maintain the same spaced from the periphery of said opening.

3. A positioning means for use in positioning a crystal of polygonal shape comprising an element of insulating material having an opening therethrough larger than and of the general contour of the crystal to be used therein and beveled ledges extending inwardly from the periphery of said opening at certain of the corners thereof to lightly accommodate said crystal and maintain the same spaced from the periphery of said opening.

4. A positioning means for use in positioning a crystal of polygonal shape comprising an element of insulating material having an opening therethrough larger than and of the general contour of the crystal to be used therein and beveled ledges extending inwardly from the periphery of said opening at alternate corners thereof to lightly accommodate said crystal and maintain the same spaced from the periphery of said opening.

5. A positioning means for use in positioning a crystal of rectangular shape comprising an element of insulating material having an opening therethrough larger than and of the general contour of the crystal to be used therein and beveled ledges extending inwardly from the periphery of said opening at diagonally opposite corners thereof to lightly accommodate said crystal and maintain the same spaced from the periphery of said opening.

6. A positioning means for use in positioning a crystal, said means comprising a pair of electrodes and a spacer therebetween comprising an element of insulating material having an opening therethrough for the reception of a crystal, said opening being of an area substantially greater than the area of said crystal, spacing means disposed around the periphery of said opening at widely separated locations, said points being so located as to provide contact of linear nature with said crystal during operation, the direction line of said contacts lying substantially in planes which are normal to the line connecting the centers of said electrodes.

J. G. BEARD.