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2,392,993

PRESSURE MOUNTED QUARTZ OSCILLATORS

Filed May 6, 1944

Fig. 1

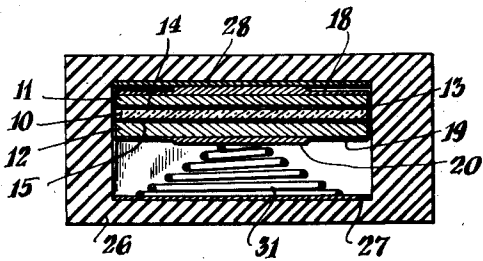


Fig. 3

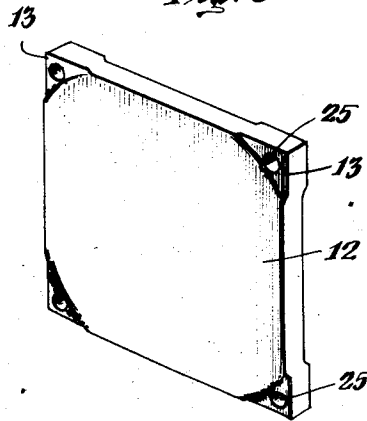


Fig. 2

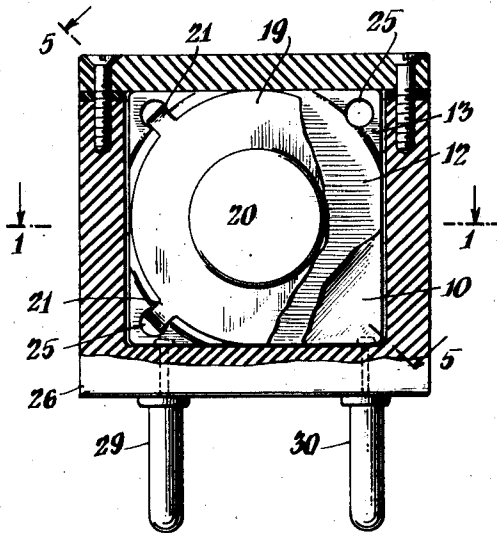


Fig. 4

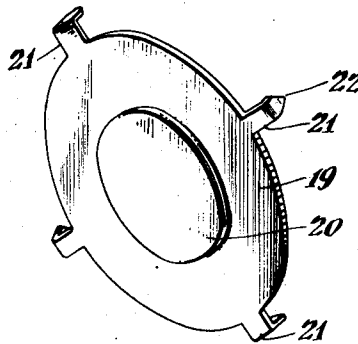
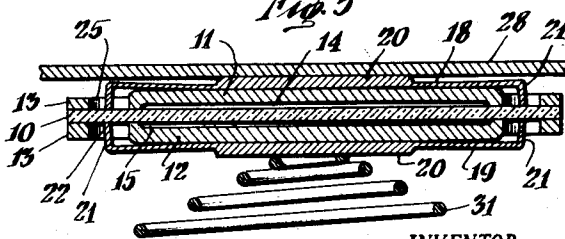


Fig. 5



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PRESSURE MOUNTED QUARTZ OSCILLATOR

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6 Claims. (Cl. 171—327)

The invention relates to piezo-electric oscillator mountings of the pressure air gap type. Proper operational characteristics of an oscillator plate assembly of this general type are dependent upon the maintenance of uniform contact pressure and good electrical contacts. The invention is directed particularly to improvements in mounting constructions affecting these features and adapted to enhance the dependability and faithfulness of performance over extended periods of time and use.

Quartz oscillator plates are seldom absolutely flat and usually have a convex contour, and accordingly the marginal pressure areas lie in different planes. When such a crystal is placed between two electrodes even though they have been lapped to exact flatness, they do not present a perfect contact to the oscillator plate at all of the intended pressure points. Furthermore, even if the original contacts provided on assembly be uniform and adequate, these frequently change during usage due to various factors. For example, the metal electrodes may become distorted by temperature changes or age, with resultant departure from uniform contact pressure and disturbance of the functional characteristics of the oscillator plate. Also, vibration failure in quartz oscillator plates occasionally results from displacement or shifting of the quartz with respect to the electrodes, or displacement of the electrodes and quartz assembly, causing variations in contact pressure and contact resistance. The departures from uniformity in turn result in erratic activity response and disturbance of the functional characteristics of the oscillator plate in general.

A condition which is particularly disturbing to the operational characteristics is the development of increased electrical contact resistance which may result not only from loose contacts but is often augmented by oxidation or corrosion. The quartz plate itself is subject to decomposition and, together with the vibration, may tend to form a microscopic film of quartz powder, increasing the contact resistance to the mother quartz.

In accordance with the principles of the present invention, the difficulties discussed are obviated by a self-adjusting spring pressure electrical contact means adapted to exert a constant pressure at the several marginal supporting points regardless of any normal distortion of the electrode plates or assembly and to provide self-cleaning electrical contacts which continue to penetrate to the solid mass of the quartz plate.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of which invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is a cross-sectional view, taken on the line 1—1 of Fig. 2, of a general assembly of an oscillator plate embodying the invention;

Fig. 2 is an elevational view with parts of the casing broken away;

Fig. 3 is a perspective of one of the electrode plates;

Fig. 4 is a perspective of one of the auxiliary plates; and

Fig. 5 is a cross-sectional view of some of the elements taken on the line 5—5 of Fig. 2.

The invention is capable of incorporation in various conventional types of quartz oscillator plate assemblies, the one shown in Fig. 1 being illustrative. The crystal employed may likewise be of various conventional shapes, but as shown in Fig. 1, comprises a thin flat plate 10 having a shape which in plan is square or rectangular with accordingly four right-angled corners. The crystal is sandwiched between two metal electrode plates 11 and 12, the face of each electrode adjacent the crystals having lands or elevated corner areas 13 as shown particularly in Fig. 3. Accordingly, the crystal is provided with air gaps 14 and 15 at its opposite sides throughout the central area thereof. The dimensions are somewhat exaggerated in Fig. 1, and it will be understood that although the air gap thickness may vary under different circumstances, it normally would be within a range of a few thousandths of an inch.

Located adjacent to the surface of each electrode plate opposite to the crystal is an auxiliary plate 18, 19 details of one of these being shown in Fig. 4. These plates may conveniently be formed by stamping from thin flexible electrical conducting material, such as sheet metal. The specific construction of each of these auxiliary plates includes a central area 20 relatively thicker than the surrounding annular area. Spaced around the periphery of the body portion is a series of fingers 21 each having an outer end bent

at right angles to the main portion provided with relatively sharp extremities 22. These fingers are spaced similarly to, and correspond in number with, the supporting lands 13 of the metal electrode plates 11 and 12. The extremities 22 are adapted to engage directly the crystal 10. To this end, the lands 13 may be provided with openings 25 through which project the respective fingers 21.

The main casing or support 26 of electrically insulating material also has therein suitable electrical contacts such as the plates 27 and 28 in electrical connection respectively with the terminals 29 and 30. The oscillator plate assembly is adapted to be mounted in compressed relation between the plates 27 and 28, and for this purpose there is shown the spring 31 adapted to urge the plates into pressure contact against plate 28. The fingers of the auxiliary plates 18 and 19 are longer than the thickness of the plates 11 and 12 at the lands 13, so that under the pressure of the spring 31 the central areas 20 are pressed into firm engagement with the respective electrode plates 11 and 12 and the fingers 21 are each resiliently pressed into engagement directly with the crystal 10 forming a direct electrical contact therewith. Since the ends of the fingers 21 in contact with the oscillator plates 10 are of limited area and under constant resilient pressure, they are, so to speak, self-cleaning and penetrate to the solid quartz plate and continue to do so under extended usage regardless of any amount of distortion of the metal electrodes 11 and 12 or relative displacement of the plate elements which may occur over a period of time. The operating characteristics of the assembly as a whole accordingly remain constant and uniform.

The auxiliary spring contact plates 18 and 19 are readily insertable or removable, and are relatively thin, and, therefore, may be omitted for preliminary tests in the lapping of the oscillator plate and other finishing or adjusting operations, and the spring plates thereafter inserted in the final assembly.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a piezo-electric oscillator assembly having a crystal and plate electrode arranged in contacting relation therein, an auxiliary plate of electrically conducting material arranged adjacent said electrode on the side opposite to said crystal, and spring means for urging said auxiliary plate, electrode and crystal into contact, said auxiliary plate having spaced fingers at the outer edge adapted resiliently to engage respectively marginal portions of said crystal and to maintain direct electrical contact therewith.

2. In a piezo-electric oscillator assembly hav-

ing a support and a crystal sandwiched between a pair of electrodes therein, an auxiliary plate of electrically conducting material arranged adjacent the surface of each electrode on the side respectively opposite to the crystal, and spring means for compressing into contact said auxiliary plates, electrodes and crystal, said auxiliary plates each having spaced fingers at the outer edge adapted resiliently to engage respectively marginal portions of said crystal and to maintain direct electrical contact therewith.

3. A piezo-electric oscillator assembly comprising a casing, a plate crystal and a plate electrode therein arranged to contact at marginal portions with an air gap at their central portions, an auxiliary plate of resilient electrically conducting material arranged adjacent said electrode opposite to the crystal, and spring pressure means for compressing said auxiliary plate, electrode and crystal, said auxiliary plate having spaced bent finger portions adapted resiliently to engage directly said crystal at marginal points.

4. In a piezo-electric oscillator assembly having a crystal and a flat electrode arranged to contact at a plurality of marginal portions with an air gap at the central areas, an auxiliary plate of electrically conducting material arranged adjacent said electrode opposite to said crystal, and spring pressure means for urging said auxiliary plate, electrode and crystal into contact, a plurality of said marginal portions having openings therethrough and said auxiliary plate being provided with relatively sharp finger portions extending through said openings and adapted resiliently to engage said crystal and maintain direct electrical contact therewith.

5. In a piezo-electric oscillator assembly having a casing and a crystal sandwiched between a pair of plate electrodes therein and arranged to be contacted at marginal portions by the electrodes with an air gap at each side of the crystal over its central area, a relatively thin resilient auxiliary plate of electrically conducting material arranged adjacent the surface of each electrode on the side respectively opposite to the crystal, and spring means for compressing said auxiliary plates, electrode plates and crystal, each of said auxiliary plates being urged into contact at its central area with its respective electrode and having at the outer edge spaced bent fingers adapted to extend through openings in the respective said marginal portions and presenting a relatively sharp extremity resiliently engaging said crystal to maintain direct electrical contact therewith.

6. In a piezo-electric oscillator assembly having a crystal and a plate electrode arranged in contacting relation therein, an auxiliary member of electrically conducting material arranged adjacent said electrode on the side opposite said crystal, and spring means for electrically compressing together said auxiliary member, electrode and crystal, said member having a part adapted resiliently to engage a marginal portion of said crystal and to maintain direct electrical contact therewith.

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