Dec. 27, 1949 P. K. CHATTERJEA ET AL 2,492,357

MANUFACTURE OF QUARTZ CRYSTAL ASSEMBLIES

Filed Oct. 6, 1945

FIG. 1.

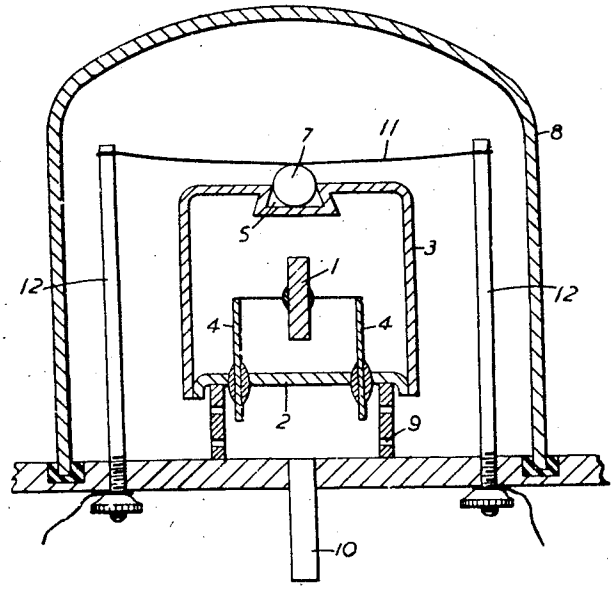
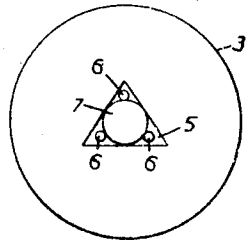


FIG. 2.



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MANUFACTURE OF QUARTZ CRYSTAL ASSEMBLIES

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4 Claims. (Cl. 171—327)

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This invention relates to the mounting of piezo-electric crystals such as quartz crystals used in telecommunication engineering.

It is known that crystals such as those used for controlling the frequency of a radio-frequency oscillation generator should be well shielded against the effects of varying atmospheric condition as well as being protected against foreign bodies such as dust particles; and it is accordingly known to mount the crystal in a vacuum chamber.

The object of the present invention is to improve the process of mounting a crystal in a vacuum chamber so as to result in an assembly that is inexpensive, robust and accurate.

In accordance with one feature of the invention a crystal is mounted within a vessel having an aperture in its top wall which is sealed after evacuation of the vessel within a vacuum chamber.

In accordance with another feature of the invention an aperture in a top wall of a vessel containing a crystal is sealed after evacuation of the vessel within a vacuum chamber by solder melted by contact with an electric heating element within the chamber.

An embodiment of the invention will be described with reference to the accompanying drawings in which Fig. 1 shows a crystal mounted within a vessel during the evacuation process whilst Fig. 2 is a top view of the vessel containing the crystal.

Referring to the drawings the crystal 1 is mounted in any convenient manner upon a copper disc 2, and is then enclosed by an envelope 3 which may be of metal or may be of glass coated with metal. Electrical connections to the crystal 1 are provided by leads 4 passing through insulating and vacuum seals in the copper disc 2, such as glass beads. With the crystal 1 mounted in place upon the disc 2 and its electrical connections completed, the envelope 3 is fitted over and is sealed at its rim to the disc 2 as by soldering, thus providing a vacuum-tight joint.

The next question is that of evacuating the envelope 3 and finally sealing. To this the envelope 3 is preformed with a depression or recess 5 in its top wall, and with one or more small holes 6 in the recess. Conveniently the recess 5 is in the shape of a triangle preferably equilateral, as shown, and there are three holes 6 one at each apex of the triangle. In this recess 5 is placed a ball of solder 7, large enough to project above the top of the envelope 3 to the extent of about half its diameter. The assembly is then put into

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a bell jar 8, conveniently being stood upon a support 9 consisting of a cylinder of porcelain or any other convenient material. If the connection 10 from the bell jar 8 to the exhaust pump is taken through an opening in the centre of the floor of the chamber, as shown, so that the porcelain (or other material) cylinder 9 surrounds this opening 10, then the cylinder 9 must be perforated, as shown, to permit free flow of air. With the assembly in place in the bell jar 8, a heating element is brought into position in proximity to the ball of solder. This heating element consists of a strip of molybdenum 11 carried between two copper terminal posts 12 and bowed downwardly so as to contact the ball of solder 7 with a fair degree of pressure. The procedure then is, of course, simply to operate the exhaust pump until the bell jar 8 is sufficiently evacuated, and finally to pass a heating current through the molybdenum strip 11 via terminal posts 12 so that the solder 7 melts and fills up the recess 5 including the small holes 6 therein.

It may be desirable that the heating strip 11 should not be in contact with the solder 7 when the strip is cold: in that case it may be arranged either by the use of a bimetallic strip or otherwise, that the heating strip 11 is out of contact with the solder 7 when cold and only makes contact when heated.

The copper disc 2 through which the leads 4 pass may be made in the form of a valve base with, any three, five, or seven pins to facilitate mounting the crystal in the equipment.

A wire can be left in the container 3 to help in checking the vacuum now and again during life, i. e. as a Pirani gauge, this wire being connected to two of the terminal pins in the base.

The container 3 can be made to have two spaced walls with a heating coil in between so that the temperature of the crystal may be kept constant.

What is claimed is:

1. A process of mounting a piezoelectric crystal which comprises mounting said crystal within a vessel having an aperture in a recess in the top wall thereof, sealing said vessel with the exception of said aperture, placing a piece of solder in said recess adjacent said aperture, placing said vessel within a vacuum chamber provided with an electric heating element within said chamber in position adjacent said solder, exhausting said chamber to the required degree, and locally heating said solder by connecting an electric current source to said heating element, thus melting the solder and sealing said aperture.

2. A process as claimed in claim 1 in which said

electric heating element is a strip of high resistance material heated by the passage of current therethrough.

3. A process as claimed in claim 1 in which the step of placing the vessel within the vacuum chamber comprises pressing the piece of solder against a bowed strip of high resistance material heated by the passage of current therethrough.

4. A process as claimed in claim 1 in which the step of placing the vessel within the vacuum chamber comprises placing the solder adjacent and spaced from a bimetallic strip, of high resistance materials heated by the passage of current therethrough, the heating of the bimetallic strip causing said strip to bend into contact with said solder.

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