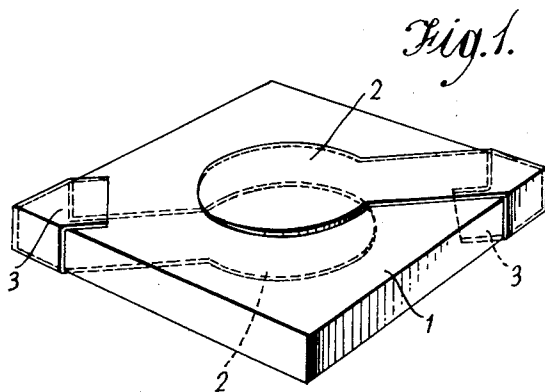
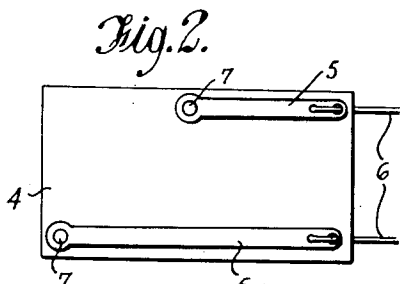
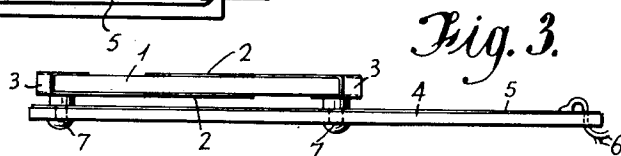
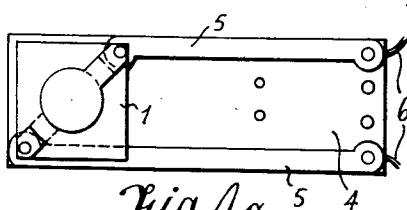
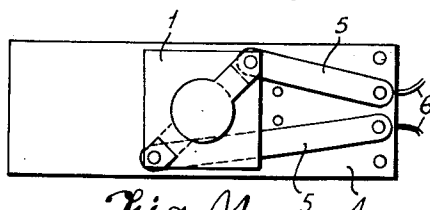
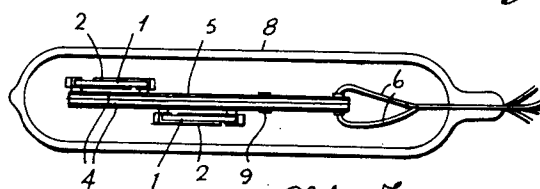


Nov. 20, 1956

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QUARTZ CRYSTAL UNITS
Filed March 17, 1952

2,771,561



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1

2,771,561

QUARTZ CRYSTAL UNITS

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Application March 17, 1952, Serial No. 276,900

4 Claims. (Cl. 310—9.0)

The present invention relates to quartz crystal units, such as are used in crystal-controlled electronic oscillators.

One of the most common forms of quartz crystal units in use at the present time consists of a thin plate of quartz, which may be square, circular or rectangular with electrodes, which may be of gold or some other suitable metal, deposited on the surfaces. Connection is usually made to the electrodes by means of thin wires soft-soldered to silver spots which are fired on to the plate before the electrodes are deposited. The plate is mounted in a metal can or glass envelope by means of these wires. The difficulties encountered in the manufacture of this type of unit are as follows:

(1) The presence of the wire leads is a disadvantage during processing and wastes space in mounting, particularly as present developments make it necessary for the quartz plate to be made thinner, smaller and consequently more fragile (dimensions of the order of 10 mm. x 10 mm. x 0.1 mm. are common).

(2) The methods of sealing the finished unit consists often of either joining a glass bulb to a base or soldering a metal can, both involving the use of temperatures above the melting point of solder, with consequent risk of the crystal plate becoming detached from its wires during the sealing operation.

It is accordingly a main object of the present invention to provide a quartz crystal unit which is more robust and of more compact construction than hitherto, and which overcomes or reduces manufacturing difficulties.

A more specific object of the invention is the provision of a quartz crystal unit wherein a quartz crystal plate having conducting electrodes on the two opposite surfaces thereof is carried by a support member of insulating material having formed thereon or secured thereto two contacts by means of which the unit can be connected to an external circuit, the crystal plate being secured to the support member by two conducting members formed of a conducting paste which has been hardened and extending respectively between said contacts and said electrodes.

Another object of the invention consists in means for directly mounting the crystal on the support member by means of a conducting paste which adheres to the crystal electrodes and serves both as a conductor to the electrodes and a support for the crystal.

Preferably the conducting paste comprises a silver paste containing a reducing agent. After baking, the silver is firmly fixed to the crystal electrodes and to the contacts on the support member. The contacts may be apertured and a firmer fixing between the conducting members and the support member may be obtained by filling the holes with the conducting paste. The support member should be made of a material of a sufficiently refractory nature to withstand the heat treatment of the conducting paste.

A further object of the invention is to provide means whereby the conducting members may connect with the

2

electrodes on the crystal plate at diametrically or diagonally opposed points thereof whereby the crystal plate is supported at both sides and a robust assembly is obtained.

Yet another object of the invention is to provide a method of mounting a quartz crystal plate having conducting electrodes formed on the two opposing surfaces thereof, which consists in forming or securing two contacts on a support member of insulating material and securing the crystal plate thereto by applying a conducting paste between said contacts and the crystal electrodes, and hardening the paste to form conducting supports carrying the crystal from the support member and electrically connecting the electrodes with the contacts.

A further object of the invention is to constitute the contacts of the unit by conducting paths formed on the support member to which lead wires may be connected.

Another object is to produce a quartz crystal unit in which the crystal and its support member may be assembled in a glass envelope or metal container in conventional manner.

Other objects and advantages of the invention may be seen from the following description, as exemplified in the accompanying drawings to which reference will now be made, and in which

Fig. 1 shows a view of a quartz crystal plate before mounting.

Fig. 2 shows a plan view of a support member for the quartz plate shown in Fig. 1.

Fig. 3 shows a side view of a quartz plate mounted on the support member.

Figs. 4a and 4b show respectively two crystal units adapted to be assembled together in a common envelope.

Fig. 5 shows a side view of the units in Figs. 4a and 4b assembled in a sub-miniature glass envelope.

Fig. 1 shows a quartz crystal plate before mounting, in which the crystal plate 1 has metal electrodes 2 deposited on each face in conventional manner but omitting the silver spots to which the conductors are usually soldered. Preferably these deposited electrodes (or at least one of them) extend over opposite corners of the plate, as shown at 3, so that connection may be made to both electrodes from one side of the plate.

The support member shown in Fig. 2 comprises a thin plate 4 of mica, ceramic or some other refractory material having two thin wire leads 6 attached thereto by welding to eyelets or in some other convenient manner. From these leads, two silver conducting tracks 5 are painted or sprayed on to the surface of the plate 4, these tracks leading to two holes 7 spaced apart by a distance slightly less than the diagonal dimension of the quartz crystal. A suitable material for the tracks is silver paste containing a reducing agent. The support plate is now baked, leaving two reliable conducting tracks well bonded to the wire leads 6.

The quartz crystal is fixed to the supporting member by placing two portions of a similar paste on to the conducting track at the holes 7, so that the paste fills the holes and may be moulded out on the reverse side of the plate, the quartz crystal being placed against these portions of silver paste in such a way that the portions of the electrodes at diagonally opposed corners thereof adhere to the paste and are supported thereby as shown in Fig. 3. The assembly is now baked again, preferably with a temporary spacer between the crystal and the supporting plate, whereby the silver is keyed into the holes and on to the electrodes, thus producing a mounted crystal without leads or soldered joints which can be finally processed and mounted in the usual way.

It will be seen that the mounting arrangement according to the present invention provides a compact assembly which enables two or more crystals to be readily mounted in one envelope by securing two supporting plates

3

back to back as shown in Figs. 4a, 4b, and 5. Figs. 4a and 4b show respectively the two units before they are mounted together and it will be seen that the conducting tracks on the support member shown in Fig. 4b are arranged so that they allow the wire leads joined to these tracks to be spaced from the wire leads joined to the tracks of the unit shown in Fig. 4a when the two units are secured together by rivets 9 or by clips or in any other convenient manner. As the conducting tracks are on the outer surfaces of each mica plate when they are secured together, adequate insulation is obtained between the two units.

The present invention thus provides a simple, cheap and extremely compact crystal mounting arrangement which forms a relatively robust unit for handling. It avoids the necessity for applying silver spots to the crystal and soldering wires on to very small quartz crystals, which soldered joints might become disconnected under the temperatures involved in sealing the unit into a glass bulb or metal can.

Whilst particular embodiments have been described it will be understood that various modifications may be made without departing from the scope of the invention. Thus, for example, if the crystal electrodes do not extend to lie on the same surface of the crystal paste, the silver plate can be led around the corner or edge of the crystal plate to connect with the upper electrode. Further, the conducting tracks on the support member need not be formed by depositing a conductor thereon but could be constituted by conductors made of metal foil or other suitable material.

What I claim is:

1. A quartz crystal unit comprising a support plate of insulating material, two elongated electrical contact tracks of a conducting metal paste arranged side-by-side, but spaced apart, in contact with said plate throughout the length of the track, a quartz crystal plate parallel to said plate of insulating material, conducting electrodes on the two opposite faces of said quartz crystal plate, each of said electrodes having a part of its surface on the same side of said quartz crystal plate, and electrical connections between said contact tracks and said electrode parts on said same side of said quartz crystal plate.

2. A quartz crystal unit comprising a support plate of insulating material, two elongated electrical contact tracks of a conducting metal paste arranged side-by-side, but spaced apart, in contact with said plate throughout the length of the track, a quartz crystal plate parallel to

4

said plate of insulating material, conducting electrodes on the two opposite faces of said quartz crystal plate, each of said electrodes having a part of its surface on the same side of said quartz crystal plate, and connections of said conducting metal paste between said contact tracks and said electrode parts on said same side of said quartz crystal plate.

3. A quartz crystal unit comprising a support plate of insulating material, two elongated electrical contact tracks of a conducting metal paste arranged side-by-side, but spaced apart, in contact with said plate throughout the length of the track, a quartz crystal plate parallel to said plate of insulating material, conducting electrodes on the two opposite faces of said quartz crystal plate, each of said electrodes having a part of its surface on the same side of said quartz crystal plate, connections of said conducting metal paste between said contact tracks and said electrode parts on said same side of said quartz crystal plate, a glass envelope surrounding said unit, and electrical leads secured to said tracks and passing through said glass envelope to the outside.

4. A quartz crystal unit comprising a pair of crystal supports, each comprising a support plate of insulating material, two strip-form electrical contacts on one face of said support, a quartz crystal plate, conducting electrodes on the two opposite faces of said quartz crystal plate, and two conducting members extending respectively between said contacts and said electrodes thereby securing them together, means for securing said pair of supports together back to back with the quartz crystal plates outermost, electrical leads connected to said strip-form electrical contacts and insulated from each other, and a glass envelope surrounding said unit, said electrical leads passing through said envelope to the outside.

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