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(54) A PIEZO-ELECTRIC RESONATOR ASSEMBLY

(71) We, SOCIETE SUISSE POUR L'INDUSTRIE HORLOGERE MANAGEMENT SERVICES SA of 96, Staempflistrasse, CH-2500 Bienne, Switzerland; a Swiss body corporate, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an assembly comprising a piezo-electric resonator made of material such as quartz, a flat support on which conductive mounts for the resonator are fixed, and a cover forming a casing for the resonator. In a known assembly the cover is directly fixed to the support. The mounts for the resonator pass through holes in the support and are hermetically sealed therein.

The terminals of the resonator are connected to the mounts, which are located on the surface of the support opposite to the surface carrying the cover, so that the construction presents a fairly considerable overall height.

The present invention aims to diminish this height, improve the sealing, and reduce the price of the assembly.

According to the present invention there is therefore provided a piezo-electric resonator assembly including a flat support and a cover forming a casing for the resonator, wherein conductive mounts for the resonator are fixed to flat conductors extending between the support and the cover to the outside of the latter.

These flat conductors may form part of a circuit printed on the support, with which other components of a crystal oscillator or a similar apparatus, for example a computer, a transmitter, a receiver, or a quartz crystal watch can be connected. The terminals of the assembly are accessible on an exposed part of the surface of the support which carries the cover. The overall height of the device can thus be reduced. The manufacturing process can be considerably simplified, since it is no longer necessary to provide holes for the resonator mounts which

pass through the support. The metallised parts of the printed circuit and other layers, for example the insulating layers, and a solderable layer for fixing the cover, can be formed on one surface of the support by techniques which are relatively simple and well known. It is also easy to obtain a perfect seal between the cover and the support.

A process for the manufacture of an assembly includes the steps of printing parts of a circuit on the support, attaching conductor resonator mounts to the said parts, fixing a piezo-electric resonator to the mounts and applying a cover to the support over the resonator.

The invention will be explained in detail with reference to the accompanying drawing.

The assembly shown therein comprises a support 1 of insulating material, for example a ceramic material. This support 1 carries a printed circuit comprising flat conductors 2, 3. Conductive mounts 4 of a piezo-electric resonator such as a quartz crystal 5 are soldered on adjacent ends of the conductors 2, 3. The printed circuit is part-covered with an insulating layer 6, on which is formed a solderable layer of annular form 7. A ring 8 is soldered on the layer 7 and a lid 9 affixed thereto. The support 1, the ring 8 and the lid 9 form an air-tight casing for the quartz crystal 5. Using known techniques it is easy to obtain a hermetic seal between the superposed layers 2, 6 and 7, so that the casing can be evacuated if required. The printed circuit can be used inside or outside the casing for mounting other components 10, 11 of a circuit associated with the resonator.

During manufacture of the assembly the printed circuit is first applied to the support 1. Then the insulating layer 6 is applied, for example with the aid of a mask. Next the solderable layer 7 is formed with the aid of another mask. Then the conductive mounts 4 are soldered on the flat conductors 2 and 3, the resonator 5 is introduced between the mounts 4 and these mounts are soldered to metallised parts of the resonator.

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Subsequently the other components 10, 11 are soldered on the printed circuit. The ring 8 can then be soldered on the annular solderable layer 7 and a lid 9 sealed to the ring 8. Finally the casing thus formed may be evacuated if required.

In the embodiment shown, the support is stated to be made of insulating material. However a metallic support covered with an insulating layer, for example by oxidation could be used, the printed circuit being then applied on this insulating layer. Instead of providing a metallic ring 8 this ring could be made of insulating material. Such an insulating ring could be fixed in an airtight manner directly to the printed circuit and on the support 1, so that the layers 6 and 7 could be omitted. Finally, instead of using a cover made in two parts, a one-piece cover could be used.

WHAT WE CLAIM IS:—

1. A piezo-electric resonator assembly including a flat support and a cover forming a casing for the resonator, wherein conductive mounts for the resonator are fixed to flat conductors extending between the support and the cover to the outside of the latter.

2. A process for the manufacture of an assembly as claimed in claim 1, including

the steps of printing parts of a circuit on the support, attaching conductive resonator mounts to the said parts, fixing a piezo-electric resonator to the mounts and applying a cover to the support over the resonator.

3. An assembly in accordance with claim 1, including an insulating layer between the flat conductors and the cover.

4. An assembly in accordance with claim 3, including a solderable layer between the insulating layer and the cover, which latter is soldered to the layer.

5. An assembly in accordance with claim 1, wherein the said flat conductors form part of a circuit printed on the support, and the piezo-electric resonator is made of quartz.

6. An assembly in accordance with claim 5, including components of the circuit fixed to the printed parts inside or outside the cover.

7. An assembly in accordance with claim 1, wherein the cover consists of a metal or insulating ring, and a lid fixed thereto.

8. A process in accordance with claim 2, including the steps of part covering said printed circuit by an insulating layer applying a solderable layer on this insulating layer, and soldering the cover to said solderable layer.

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In the embodiment shown, the support is stated to be made of insulating material. However a metallic support covered with an insulating layer, for example by oxidation could be used, the printed circuit being then applied on this insulating layer. Instead of providing a metallic ring 8 this ring could be made of insulating material. Such an insulating ring could be fixed in an airtight manner directly to the printed circuit and on the support 1, so that the layers 6 and 7 could be omitted. Finally, instead of using a cover made in two parts, a one-piece cover could be used.

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1. A piezo-electric resonator assembly including a flat support and a cover forming a casing for the resonator, wherein conductive mounts for the resonator are fixed to flat conductors extending between the support and the cover to the outside of the latter.

2. A process for the manufacture of an assembly as claimed in claim 1, including

the steps of printing parts of a circuit on the support, attaching conductive resonator mounts to the said parts, fixing a piezo-electric resonator to the mounts and applying a cover to the support over the resonator.

3. An assembly in accordance with claim 1, including an insulating layer between the flat conductors and the cover.

4. An assembly in accordance with claim 3, including a solderable layer between the insulating layer and the cover, which latter is soldered to the layer.

5. An assembly in accordance with claim 1, wherein the said flat conductors form part of a circuit printed on the support, and the piezo-electric resonator is made of quartz.

6. An assembly in accordance with claim 5, including components of the circuit fixed to the printed parts inside or outside the cover.

7. An assembly in accordance with claim 1, wherein the cover consists of a metal or insulating ring, and a lid fixed thereto.

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