Dec. 15, 1942. F. W. LUTZENS 2,304,835

ART OF MOUNTING PIEZOELECTRIC CRYSTALS

Filed Nov. 29, 1941

FIG. 1.

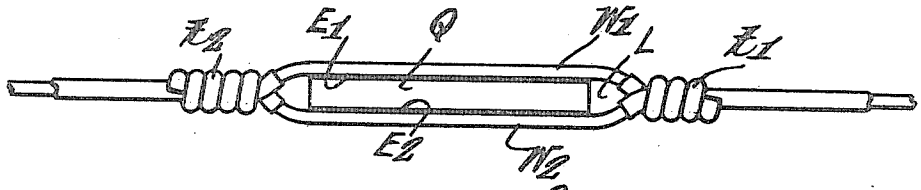


FIG. 2.

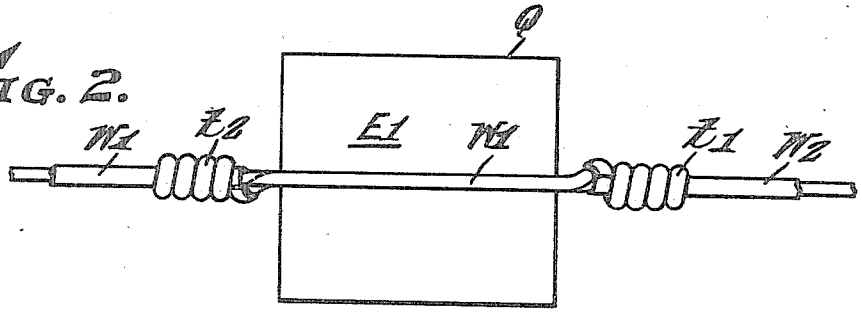


FIG. 3.

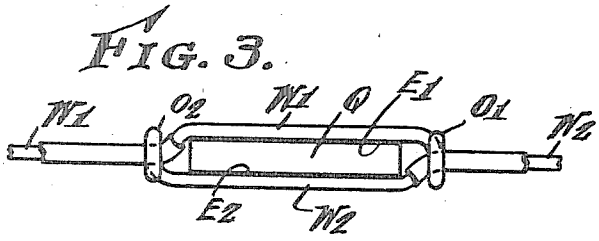


FIG. 4.

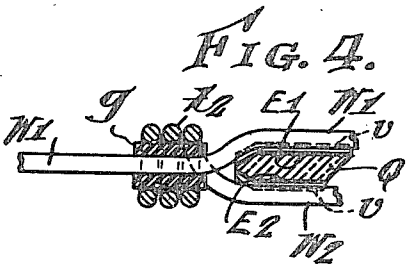


FIG. 5.

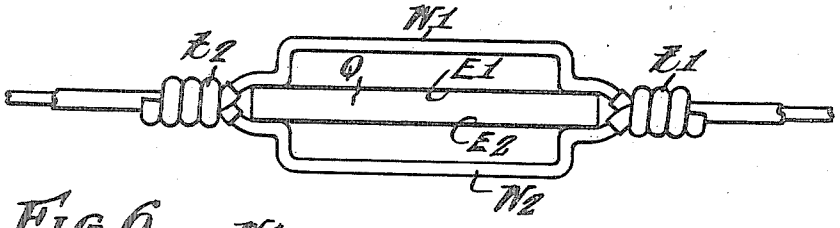
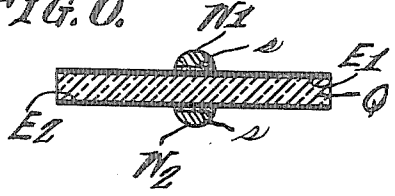


FIG. 6.



Inventor
Fredrich W. Lutzens

By J. J. Luff

Attorney

Patented Dec. 15, 1942

2,304,835

UNITED STATES PATENT OFFICE

2,304,835

ART OF MOUNTING PIEZOELECTRIC CRYSTALS

Fredrich W. Lutsens, Audubon, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application November 29, 1941, Serial No. 420,947

7 Claims. (Cl. 171—327)

This invention relates to the art of mounting piezoelectric crystal elements and has special reference to the provision of improvements in nodal mounting arrangements of the type wherein the electrodes for the crystal are in the form of separate adherent conductive coatings or metalized films.

The principal object of the invention is to provide a reliable yet inexpensive mount for plated crystals and one which may be made from readily obtainable materials without the use of dies or other special tools.

A related object of the invention is to provide a novel and compact support for a plated crystal, and one which dispenses with the necessity of soldered or other auxiliary electrical connectors for the film-like metal electrodes.

Still another object of the present invention is to provide an improved crystal-mount capable of accommodating crystals of different sizes, and one adapted with but minor changes to the mounting of either a thickness-mode or a contour-mode crystal.

Other objects and advantages, together with certain preferred details of construction, will be apparent and the invention itself will be best understood by reference to the following specification and to the accompanying drawing, wherein

Fig. 1 is a side elevational view and Fig. 2 a top plan view of a plated contour-mode crystal mounted in accordance with the invention,

Fig. 3 is a side elevational view of an alternative embodiment of the invention,

Fig. 4 is a fragmentary side elevational view of another embodiment of the invention,

Fig. 5 is a side elevational view of a mount within the invention adapted for use with a so-called V-cut thickness-mode crystal, and

Fig. 6 is a cross-sectional view taken on the line 6—6 of Fig. 2.

In the drawing, wherein like reference characters designate the same or corresponding parts in all figures, Q designates a quartz or other crystal element having piezoelectric properties. Contiguous the opposite major faces of the crystal Q are electrodes E_1 and E_2, respectively, which preferably comprise integral or adherent coatings formed of evaporated metal, or metal foil.

In accordance with the invention, the crystal Q is supported by two wires W_1 and W_2, respectively, which are so bent, spliced, insulated and tensioned, as to comprise a loop L within which the crystal is clamped.

Wires W_1 and W_2 also serve as conductive leads for applying the appropriate potentials to the crystal through its electrodes E_1 and E_2. In order to prevent short-circuiting between the opposite electrodes, the free ends of the leads W_1 and W_2 are provided with insulating terminals t_1 and t_2. As shown in Figures 1, 2 and 5, these terminals t may comprise simply an insulated section of the wire wound tightly about that insulated or noninsulated part of the other wire which lies adjacent the opposite edge of the crystal. Alternatively, the free ends of each wire W may have a slidable fit with respect to the other. Thus, as shown in Figure 3, the free end of each lead wire W may terminate in a small loop O_1, O_2 respectively, or, referring to Figure 4, each wire may be secured to insulating grommet g which is slidably fitted about the other wire of the pair.

Where, as in the embodiments of the invention shown in Figures 1 to 4 inclusive the crystal Q is of the low frequency type and has a nodal axis which extends thereacross, the conductive leads or wires W_1 and W_2 are arranged to contact the opposite plated surfaces E_1 and E_2 in register with the said nodal axis, in order to minimize damping effects. On the other hand, where, as shown in Figure 5, the crystal comprises a so-called "thickness-mode," high frequency crystal, the wires W_1 and W_2 are preferably bent or bowed outwardly away from, and out of contact with, the central areas of the electrodes E_1 and E_2 so that the clamping force is confined to the end zones of the crystal. As shown more clearly in Figure 6, the surface portions of the wires which contact the electrode faces E_1 and E_2 are preferably flattened as indicated at f and may be affixed to the said faces by an application of a silver cement or other electrically conductive adhesive. Alternatively, as indicated in Figure 4, the wires W_1 and W_2 may be maintained in position by seating them within grooves v provided for the purpose adjacent its opposite edges or on the major surfaces of the crystal.

Various other embodiments of the invention will suggest themselves to those skilled in the art. It is to be understood, therefore, that the foregoing is to be interpreted as illustrative and not in a limiting sense except as required by the spirit of the appended claims.

What is claimed is:

1. In combination, a piezoelectric crystal element having a pair of oppositely located metallized electrode faces and a loop in which said crystal is mounted, said loop comprising a pair

of conductive leads insulatingly connected at opposite sides of said crystal and each electrically connected intermediate its ends with one of said metallized electrode faces.

2. In combination, a piezoelectric crystal element having a pair of adherent electrodes on its opposite major faces, a conductive lead extending across said crystal in contact with one of said electrodes, a second conductive lead extending across said crystal in contact with the other of said electrodes, and insulating means on said leads adjacent opposite sides of said crystal for applying a mounting force to said crystal through said conductive leads.

3. The invention as set forth in claim 2 wherein said piezoelectric crystal comprises a quartz element of the type having a nodal axis which extends thereacross and wherein said conductive leads are arranged in register with said nodal axis.

4. The invention as set forth in claim 2 wherein said piezoelectric crystal comprises a quartz element of the type having opposite end zones of minimum piezoelectric activity and wherein the mounting force exerted through said conductive leads is applied to said element adjacent said end zones.

5. The invention as set forth in claim 2 and wherein said insulating means comprises a ring-like element mounted on the free end of each lead and through which the other of said leads extends.

6. The invention as set forth in claim 2 and wherein those parts of said leads which lie contiguous said electrodes comprise plane surfaces.

7. The invention as set forth in claim 2 and wherein a surface of said crystal is provided with a groove in which said lead is seated.

FREDRICH W. LUTZENS.