July 18, 1950 F. F. SYLVESTER 2,515,673

ELECTRICAL COMPONENT

Filed Feb. 27, 1946

Fig. 1.

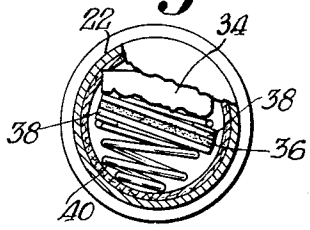


Fig. 2.

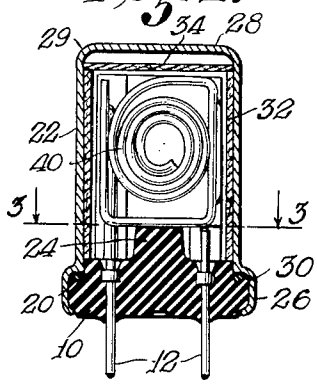
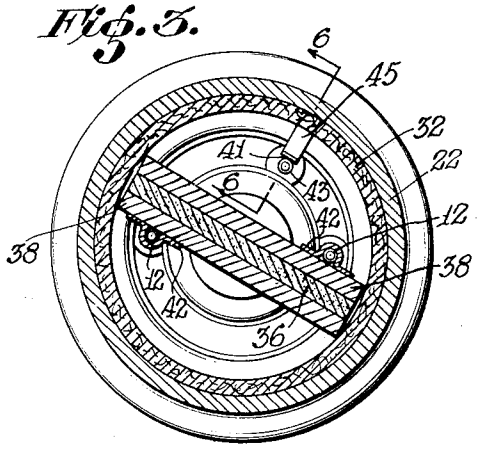


Fig. 3.



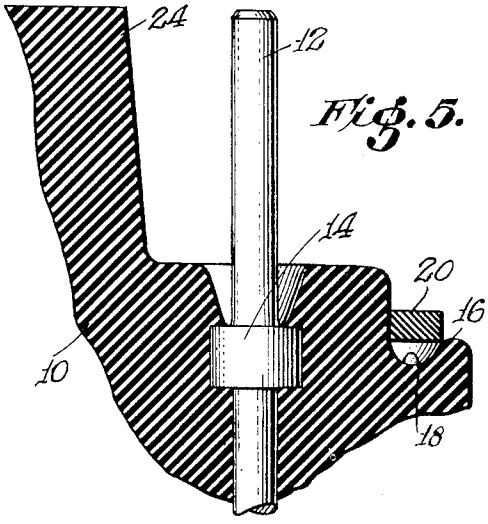


Fig. 5.

Fig. 6.

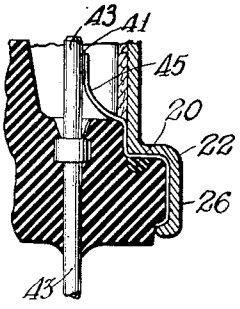
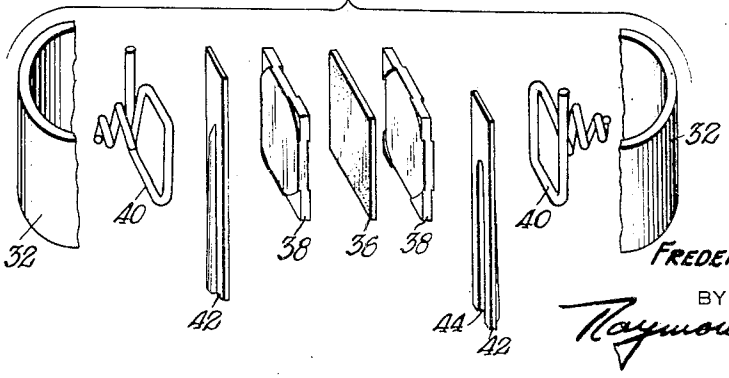


Fig. 4.



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ELECTRICAL COMPONENT

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Application February 27, 1946, Serial No. 650,631

20 Claims. (Cl. 171—327)

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The highly developed art relating to holders for piezoelectric crystals has been primarily directed thus far to applications calling for utmost precision, very close tolerances, and accordingly expensive installations. Now with manufacture about to emerge again on a commercial and consequently highly competitive basis, it becomes important to the expanded use of such crystals that they be produced in accordance with assembly line principles requiring a minimum of precision consistent with proper performance and simple operations permitting the employment of semi-skilled or unskilled labor.

Various mounts of the so-called pressure type have been proposed and used prior to this time, but they have not adapted themselves to sub-assembly techniques nor have they embodied self adjusting features of the type which are inherent to the structure herein proposed.

In accordance with this invention a tubular body, which may be of dielectric material and of substantially uniform cross-section, receives a piezoelectric crystal having predetermined characteristics sandwiched between a pair of opposed electrodes and a pair of resilient elements which bear upon the inner wall of the tubular body and the respective electrodes, serving as a resilient transverse support for the crystal and its electrodes.

This sub-assembly may then be combined with a base sub-assembly which may comprise a plurality of terminal pins molded in the base body in pressure tight relationship, the inner ends of which may be provided with contact elements intended for interposition between the crystal electrodes and the springs or other resilient supporting elements provided in the tubular body. The inner surface of the base may be provided with a projection designed to extend into the tubular body, when assembled, to serve as a locating means for the longitudinal position of the crystal and electrodes. A grooved shoulder near the edge of the base may provide a gasket seat for cooperation with a shouldered envelope.

The crystal assembly and base assembly may be combined by forcing the contact elements into position between the respective electrodes and resilient elements until the base projection encounters one or more of the components within the tubular body. The assembly formed thus far may then be inserted into the larger end of an envelope the walls of which may be either tapered or cylindrical terminated by an arcuate closed end, preferably of conducting metal, together with a somewhat resilient cover for the tubular body, which cover will preferably have a dimension in excess of that encountered towards the reduced portion of the envelope, so that when the shoulder of the envelope engages the gasket provided on the base shoulder, the

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cover will buckle to provide a resilient support for the end of the tubular body and its contents. A skirt at the enlarged end of the envelope may then be crimped, rolled or otherwise deformed into clamping relationship with the base.

A more complete understanding of the invention will follow from a description of the accompanying drawings wherein:

Fig. 1 is a plan, partially broken away, of the assembled holder;

Fig. 2 is an elevation in section of the assembled holder;

Fig. 3 is a section along line 3—3 of Fig. 2;

Fig. 4 is an exploded view of the crystal sub-assembly;

Fig. 5 is an enlarged fragmentary elevation of the base; and

Fig. 6 is a fragmentary section along line 6—6 of Fig. 3.

The assembled crystal holder, best illustrated in Figs. 1 and 2 comprises a base 10, preferably of molded plastic composition, having a desired number of terminal pins 12 anchored therein in pressure tight relationship. These pins are formed with intermediate flanges 14 which assure their location and retention in the molded composition. The base is formed with a stepped marginal shoulder 16 containing an annular groove or depression 18 into which a volumetric gasket 20 is pressed to perfect a seal when the envelope 22 is crimped into position on the base. A central projection 24 on the upper surface of the base serves as a locating element for the crystal assembly as will be described.

The envelope 22 is depicted as a drawn or stamped metallic member of generally cylindrical form, having a larger open base terminating in a skirt 26, and a smaller closed base 28. The side walls of the envelope 22 may be sufficiently tapered to produce a generally frusto-conical form of larger diameter at the open end and/or may be provided with a developed peripheral spherical radius 29 at the closed end 28. This arrangement serves to reduce the inside diameter of the envelope 22 in the region of its closed end for a purpose which will become apparent. As shown in Fig. 2, the portion of the envelope from which the skirt depends is formed with a shoulder 30 for cooperation with the shoulder 16 on the base to bear upon the gasket interposed between them.

A tubular body 32, fabricated of one or more dielectric materials or compositely of dielectric material and metal, serves as a housing for the crystal assembly. This body is received within the envelope 22 and supported longitudinally therein against a resilient cover 34, which may be formed of dielectric impregnated fish-paper or the like, and which may have spaced projections, defining a preferably polygonal plan, for engagement with the reduced and/or arcuate portion of

the envelope internal wall so that a wedging-buckling action will be produced as the cover is advanced towards the closed end of the envelope. The lower end of the tubular body is seated upon the upper surface of the base so that when the parts are assembled, the cover 34 exerts a resilient action at the upper end of the body in its supporting capacity.

Within the tubular body, a piezo-electric crystal 36 is arranged between opposed electrodes 38 and a pair of opposed springs 40 which bear upon the inner wall of the tubular body and the electrodes.

Electrode terminals 42 containing grooves 44, complementary with the upper ends of the terminal pins 12, are soldered or otherwise secured to their respective terminal pins, the upper ends of the terminals extending between the springs and electrodes to effect good electrical contact with the latter.

It will be noted that the springs 40, or other suitable resilient means, will not only provide transverse resilient supports for the crystal and electrodes, but will tend to rotate the elements with respect to the relatively fixed terminals until proper contact is assured.

The components are preferably assembled as a combination of three separate subassemblies: the crystal subassembly, the base subassembly and the envelope. The preformed base formed as a unit with its anchored terminal pins will have the gasket 20 properly seated on the stepped shoulder 30 and the terminals 42 will have their lower grooved ends soldered or otherwise secured to the upper ends of the terminal pins.

An electrical connection to the outer shell or envelope 22 through one of the base pins when required, may be provided by soldering, welding or otherwise affixing to one or more of the desired terminal pins 12 at the point 41 where the electrode terminals 42 are affixed to terminal pins 12 or by affixing to a separate terminal pin 43, as depicted in Fig. 6, provided for shell connection only, a strip 45 of conducting material which may assume the form of metallic thin strip silver, nickel, nickel silver, or other suitable material. This conducting strip may be extended over the sealing gasket 20 and base shoulder 16 to a position between the base 10 and the shell skirt 26 whereby pressure contact is effected between the conducting strip 45 and the shell skirt 26 upon crimping or sealing of the shell skirt over the base. This relationship provides a permanent electrical connection between the conducting strip and shell without adversely affecting the pressure tight seal between the base body and the envelope.

The envelope will receive the cover 34 so that its spaced projections or corners will become slightly bent or buckled after it is driven home towards the reduced end of the envelope inner wall and thereby provide a resilient support longitudinally of the crystal subassembly.

The tubular body will preferably have one of its open ends supported on a plane surface for reception through the other open end of the crystal, electrodes and springs.

Then holding the tubular body so as to prevent ejection of the crystal, electrodes and springs, the terminals 42 will be forced between the respective springs and electrodes until the lower end of the tubular body becomes seated on the upper surface of the base. The envelope containing the cover will then be applied over the tubular body and its contents until the lower skirt of the envelope surrounds the base, the shoulder of the envelope coming to rest upon the gasket carried by the

shoulder on the base. Then, with the envelope and base forced together so as to distort the gasket into sealing position, the lower end of the envelope skirt will be crimped or otherwise deformed near the lower surface of the base to maintain the seal and retain the parts in assembled mechanical and electrical relationship. As the envelope and base are drawn together, the projection 24 on the upper surface of the base will engage the components within the tubular body and force them against the cover 34 until the predetermined positioning is completed. It will be noted that the cover 34 comes to rest in the assembled holder at a position near the closed end of the envelope where the convergence is greatest, thus effecting the buckling of the cover corners so as to provide the resilient longitudinal support.

The foregoing description of the embodiment selected for illustration of the present invention has treated an example of the manner in which the invention can be applied. This example should not be construed as restrictive beyond the scope of the appended claims.

I claim:

1. A holder for a piezo electric element comprising a conductive envelope having an open end; a piezo electric element, electrodes and mounting means received within said envelope; a non-conductive base forming a closure for the open end of said envelope, said envelope being deformed into clamping relationship with said base, deformable gasket means providing a volumetric seal between an intermediate portion of said envelope and base, and electrode terminal means projecting through said base in pressure tight relationship.

2. A holder for a piezo electric element comprising a unitary metallic envelope having an open end; a piezo electric element, electrodes and resilient mounting means received within said envelope; a non-conductive base and a deformable gasket forming a pressure tight closure with an intermediate portion of said envelope, element locating means formed on said base, said envelope being deformed into clamping relationship with said base, and electrode terminal means projecting from said base.

3. A holder for a piezo electric element comprising a unitary envelope having an open end; a tubular body housing a piezo electric element, electrodes and mounting means received within said envelope; a base forming a closure for the open end of said envelope, said envelope being deformed into clamping relationship with said base, gasket means providing a seal between said envelope and base, and electrode terminal means projecting from said base.

4. A holder for a piezo electric element comprising a unitary envelope having an open end; a tubular body housing a piezo electric element, electrodes and mounting means, and a cover for said body received within said envelope; a base forming a closure for the open end of said envelope and providing locating means for said element, said envelope being deformed into clamping relationship with said base, gasket means providing a seal between said envelope and base, and electrode terminal means projecting from said base.

5. A holder for a piezo electric element comprising a unitary conductive envelope having an intermediate step and an open end; a piezo electric element, electrodes and mounting means received within said envelope; a non-conductive

base forming a closure for the open end of said envelope, element locating means provided by said envelope and base, said envelope being deformed into clamping relationship with said base, gasket means providing a seal between said step and base, and electrode terminal means projecting from said base.

6. A holder for a piezo electric element comprising a unitary conductive envelope having an open end; a piezo electric element, electrodes and mounting means received within said envelope; a non-conductive base forming a closure for the open end of said envelope, said envelope being deformed into clamping relationship with said base, opposed shoulders provided on said envelope and base, gasket means providing a seal between said shoulders, and electrode terminal means projecting from said base.

7. A holder for a piezo electric element comprising a unitary conductive envelope having an intermediate step and an open end; a piezo electric element, electrodes and mounting means received within said envelope; a non-conductive base forming a closure for the open end of said envelope, said envelope being deformed into clamping relationship with said base, gasket means providing a seal between said step and base, and electrode terminal means projecting from said base.

8. A holder for a piezo electric element comprising a tubular insulating body, a piezo electric element having opposed electrodes resiliently supported within said body, a conducting envelope receiving said body and means providing terminals for said electrodes.

9. A holder for a piezo electric element comprising a tubular insulating body, a piezo electric element having opposed electrodes resiliently supported within said body, a conducting envelope receiving and resiliently supporting said body and means providing terminals for said electrodes.

10. A holder for a piezo electric element comprising a tubular insulating body of substantially uniform cross section, a piezo electric element having opposed electrodes resiliently supported within said body, a conducting envelope of varying cross section receiving said body and means providing terminals for said electrodes.

11. A holder for a piezo electric element comprising a tubular insulating body having a circular bore, a piezo electric element having opposed electrodes supported within said body, opposed self positioning springs received in said bore resiliently supporting said element and electrodes with respect to said body, a conducting envelope receiving said body and means providing terminals for said electrodes.

12. A holder for a piezo-electric element comprising a tubular insulating body, a piezo electric element having opposed electrodes resiliently supported within said body, a conducting envelope receiving said body and means providing terminals biased to contact with said electrodes.

13. A holder for a piezo electric element comprising a tubular body, a piezo electric element having opposed electrodes resiliently supported within said body, a cover for one end of said body, a conducting envelope receiving said body and cover, said cover resiliently supporting said body with respect to said envelope, and means providing terminals for said electrodes.

14. A holder for a piezo electric element comprising a tubular body, a piezo electric element having opposed electrodes resiliently supported within said body, an envelope receiving said body, a base for said envelope, a locating projection on said base extending into said body, and means providing terminals for said electrodes.

15. A holder for a piezo electric element comprising a tubular body, a piezo electric element having opposed electrodes resiliently supported within said body, an envelope receiving said body, means locating said element and electrodes longitudinally with respect to said body, and means providing terminals for said electrodes.

16. A holder for a piezo electric element comprising a tubular body, a piezo electric element having opposed electrodes resiliently supported within said body, a tapered envelope closed at its smaller end receiving said body and means providing terminals for said electrodes.

17. A holder for a piezo electric element comprising a tubular body, a piezo electric element having opposed electrodes resiliently supported within said body, a tapered envelope receiving said body and locating said electrodes, and means providing terminals for said electrodes.

18. A holder for a piezo electric element comprising a tubular body, a piezo electric element having opposed electrodes, opposed springs bearing upon said electrodes and the internal wall of said body, and terminals interposed between said electrodes and said springs.

19. A holder for a piezo electric element comprising a tubular body, a piezo electric element having opposed electrodes resiliently supported longitudinally and transversely within said body, and means providing terminals in resilient contact with said electrodes.

20. In a unit of the character described, a base comprising an insulating body and a plurality of terminal pins carried by said body and extending at each of the inner and outer sides thereof, a central insulating projection on the inner side of said body, an oscillator plate having its lower edge on said projection, an electrode at each side of said oscillator plate, said electrodes having their lower edges on said projection, a coil spring against the outer side of each of said electrodes, a metal shell enclosing said springs, electrodes and oscillator plate and mounted on said insulating body, an insulating lining in said shell against which the outer portions of said springs bear, an insulating retaining plate extending transversely of said shell at the inner end of said lining and disposed against the inner edges of said electrodes and oscillator plate, and conducting means directly contacting the respective electrodes and establishing electrical connections between the respective electrodes and a pair of said terminal pins.

FREDERICK F. SYLVESTER.

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