

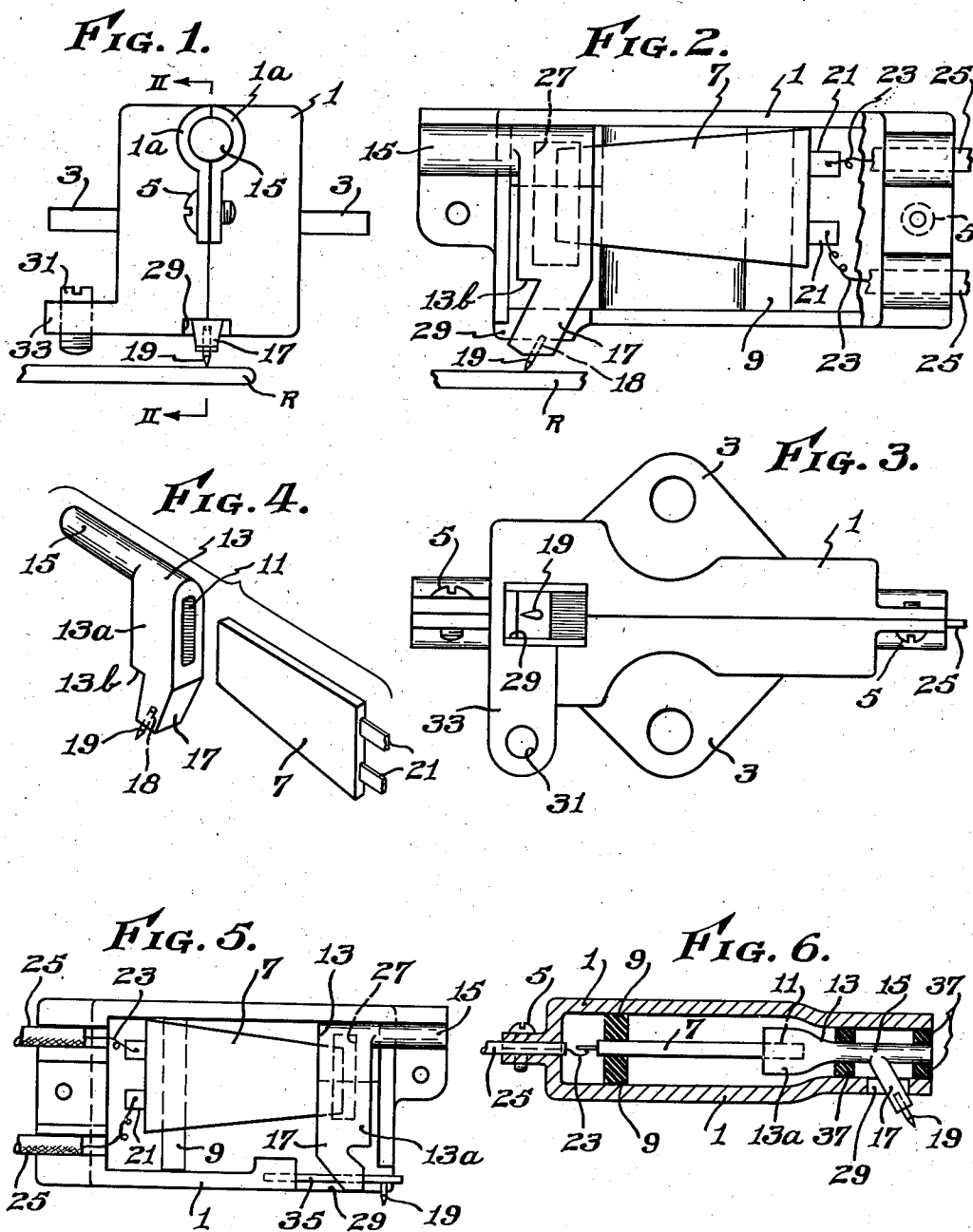
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SIGNAL TRANSLATING APPARATUS

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SIGNAL TRANSLATING APPARATUS

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This invention relates to signal translating apparatus, and more particularly to an electrical pickup device of the type employing a piezoelectric element.

In recent years, pickup devices of this type have come into rather extensive use. In operation, mechanical forces derived from the record by coaction of the needle therewith are transmitted through suitable coupling means to the piezoelectric element to set up stresses therein, the latter, in turn, generating voltages corresponding to the stress variations. In the case of Rochelle salt crystals, which are advantageously used in piezoelectric pickup devices because of their very high piezoelectric effect, care must be taken not to apply too great stress thereto, or the crystals are apt to break. For this purpose, various constructions have been proposed heretofore, but all of them, so far as I am aware, are relatively complicated and expensive.

The primary object of my present invention is to provide an improved piezoelectric pickup device which is exceedingly simple in construction and inexpensive in cost.

More particularly, it is an object of my present invention to provide an improved piezoelectric pickup device which is light in weight and will have minimum inertia effects in operation.

Another object of my present invention is to provide an improved piezoelectric pickup device wherein the motion-transmitting element has sufficient compliance to prevent injury to the piezoelectric element upon application of forces thereto derived from a phonograph record.

Still another object of my present invention is to provide an improved piezoelectric pickup device as aforesaid the mass inertia of the moving system of which is low, as a result of which the needle chatter is very greatly decreased.

A further object of my present invention is to provide an improved piezoelectric pickup device adapted to rapid and accurate assembly, and the production costs of which are a minimum.

It is also an object of my present invention to provide an improved piezoelectric crystal pickup device which is extremely compact, which is light in weight and, therefore, will apply a relatively small needle pressure to the record, which is highly efficient in use, and which will have a long life.

In accordance with my invention, I provide a casing within which a piezoelectric element, such as a Rochelle salt crystal, is clamped at one end, the other end thereof being received in a socket formed in a resilient holding member preferably

made of rubber. The holding member has a forwardly extending integral torsion shaft which may be suitably clamped within the casing to support the same in place, and an integral extension which protrudes from the casing a short distance and receives a needle adapted to cooperate with the record, the needle being preferably of the permanent or semi-permanent type. It will be seen, therefore, that the crystal holder, the torsion shaft, and the needle holder comprise one, single, integral unit which can be very easily applied to the crystal and set in place within the casing, thereby eliminating many separate parts, such as are employed in conventional piezoelectric pickup devices, and reducing assembly costs considerably. The rubber crystal holder is made of a quality of rubber having such inherent compliance that the holder, in transmitting to the crystal motion imparted to the holder by the needle, will attenuate a portion of said motion, the rubber being, however, sufficiently stiff to transmit considerable of that motion to the crystal to set up stresses therein, whereby the latter can generate the required voltages. Preferably, although not necessarily, the needle holding portion is so arranged on the crystal holder that it is quite flexible toward the torsion shaft, so that, if the pickup is accidentally dropped on the record, the needle holder will yield readily to prevent injury to the unit. If desired, an additional stop member may be provided on the casing to limit the extent to which the needle holder may be made to yield.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of assembly and operation, as well as additional objects and advantages thereof, will best be understood from the following description, when read in conjunction with the accompanying drawing, in which

Figure 1 is a front elevation of one form of piezoelectric pickup device constructed in accordance with my invention,

Figure 2 is a sectional view taken on the line II—II of Figure 1,

Figure 3 is a bottom plan view thereof,

Figure 4 is an exploded perspective view of the crystal and its holder,

Figure 5 is a view similar to Figure 2 but showing a slight modification of my invention, and

Figure 6 is a central sectional view of still another form of my invention.

Referring more particularly to the drawing,

wherein similar reference characters designate corresponding parts throughout, there is shown a pickup device comprising a casing 1 formed in two parts, each having a wing 3 by means of which the device may be mounted on a suitable supporting arm (not shown) and held together by a plurality of screws or the like 5. Within the casing 1 a piezoelectric element 7, such as a Rochelle salt crystal unit, is clamped at one end between a pair of damping blocks 9, which may be made of viscoloid or the like, the opposite end of the crystal 7 being snugly and frictionally received in the socket 11 of a crystal holder 13 made of rubber and having a forwardly extending torsion bar or shaft 15 and a downwardly extending needle holding portion 17, the latter having an opening 18 therein for frictionally receiving a needle 19 adapted to cooperate with a phonograph record R.

The body portion 13a of the crystal holder 13, in which the socket 11 is formed, is integral with the torsion bar or shaft 15 and the needle holding portion 17. The torsion shaft 15 is clamped between a pair of cooperating semi-cylindrical sleeve portions 1a on the casing 1 and permits the needle holder 17 and the body portion 13a of the crystal holder to rock thereon in response to transverse movement of the needle 19 in a phonograph record groove of the lateral cut type. This transverse motion is, of course, transmitted to the crystal 7 by the needle holder 17 and the body portion 13a, thus setting up stresses in the crystal 7 which are transformed thereby into voltages which may be transferred to suitable amplifying apparatus by the terminal foils 21 on the crystal 7, in turn connected by flexible leads 23 to terminal strips 25 on the casing 1. If the crystal holder 13 were made of rigid material, the motion imparted thereto by the needle 19 and transmitted thereby to the crystal 7 might, in many cases, be sufficient to injure the crystal 7. To prevent this, I make the crystal holder 13 of rubber of such hardness that its inherent compliance will attenuate a portion of the aforesaid motion. Enough motion is, however, transmitted thereby to the crystal to actuate the crystal. If desired, the body portion 13a may be clamped between a pair of damping blocks 27 of viscoloid or the like mounted within the casing 1.

It will be noted from Figures 1 and 2 that the needle holder 17 protrudes slightly from the casing 1 through an opening 29 therein, the needle holder 17 extending laterally with respect to the crystal 7 and the torsion shaft 15. Occasionally, the pickup device may be dropped on the record R through carelessness or by accident. To prevent injury to the unit, I preferably arrange the needle holder to one side of a shoulder 13b on the body 13a of the crystal holder and incline the needle holder 17 and the opening 18 therein in a direction such that the axis of the needle 19 is angularly related to the axis of the torsion shaft 15, both axes being, however, in the same plane. Arranging the needle holder in this manner permits it to flex or yield readily adjacent the shoulder 13b when the unit is dropped accidentally onto the record. If desired, an adjustable stop, such as a set screw 31, may be provided on a lateral extension 33 on the casing 1 for the purpose of limiting the degree of flexure required of the needle holder 17.

The modification of my invention shown in Figure 5 is quite similar to that shown in Figures 1 to 4 and heretofore described. In this form of

my invention, however, instead of mounting the needle directly in the holder 17, I mount the needle 19 on the forward end of a short length of wire 35 secured to the casing 1 and received in a slot formed in the lower portion of the needle holder 17, the wire being preferably compliant in all directions.

In both forms of my invention thus far described, the crystal is arranged within the casing in a vertical plane. My invention is, however, equally applicable to a crystal mounted in a horizontal plane, and such a unit is shown in Figure 6. In this modification, the crystal 7 is again received in the socket 11 formed in the body portion 13a of the crystal holder 13, and the torsion shaft 15 is preferably held in place between two pairs of cooperating rubber blocks 37 of somewhat softer rubber than the crystal holder 13. The torsion shaft 15, in this modification, is arranged with its axis in alignment with the axis of the crystal 7, and the needle holder 17 extends laterally from the torsion shaft 15 instead of from the body portion 13a, as in the case of the previously described modification.

From the foregoing description, it will be apparent that I have provided an improved piezoelectric pickup device which is simple in construction, is comprised of a minimum number of parts, and can be assembled with great ease and rapidity. The construction lends itself particularly well to a pickup device of light weight and, since the moving parts thereof are reduced to a minimum, they will have very low mass inertia, thus reducing tendency of the needle to chatter. To those skilled in the art, it will undoubtedly be obvious that many other modifications, as well as changes in those herein described, are possible. For example, instead of applying my improved crystal holder to a crystal of the torsional or twisting type, as herein described, it may be applied to a crystal of the bending type equally well. Also, by properly orienting the parts, the device may be made to operate on a hill and dale record instead of on a record of the lateral cut type. Furthermore, instead of fitting the needle 19 into the opening 18 and retaining it therein by friction the needle may be secured in place within the opening 18 by means of a suitable adhesive. Other similar changes will, no doubt, readily suggest themselves to those skilled in the art. I therefore desire that my invention shall not be limited except insofar as is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In an electric sound-translating device, the combination of a piezoelectric element, and resilient means movably supporting one end of said element, said means including an integral torsion shaft on which it can rock to move said element and an integral needle holding portion.

2. In an electric sound-translating device, the combination of a piezoelectric element, and a rubber holding member movably supporting one end of said element, said holding member including an integral torsion shaft on which it can rock to move said element and an integral needle holding portion.

3. In an electric sound-translating device, the combination of a piezoelectric element, and a rubber holding member therefor, said member having a socket therein snugly receiving one end of said element and including an integral torsion shaft on which it can rock to move said element,

and said member also including an integral needle holding portion.

4. In an electric sound-translating device, the combination of a piezoelectric element, and a rubber holding member therefor, said member including a body portion provided with a socket for snugly receiving and clamping one end of said element therein, an integral torsion shaft extending from said body portion on which said body portion can rock to move said element, and an integral needle holding portion also extending from said body portion laterally with respect to said torsion shaft.

5. In an electric sound-translating device, the combination of a piezoelectric element, and a rubber holding member therefor, said member including a body portion provided with a socket for snugly receiving and clamping one end of said element therein, an integral torsion shaft extending from said body portion on which said body portion can rock to move said element, and an integral needle holding portion extending from said torsion shaft laterally therefrom.

6. In an electric sound-translating device, the combination of a piezoelectric element, and a rubber holding member therefor, said member including a body portion provided with a socket for snugly receiving and clamping one end of said element therein, an integral torsion shaft extending from said body portion oppositely to said element and on which said body portion can rock to move said element, and an integral needle holding portion extending from said member laterally with respect to said element and said shaft.

7. In an electric sound-translating device, the combination of a piezoelectric element, and a rubber holding member therefor, said member including a body portion provided with a socket for snugly receiving and clamping one end of said element therein, an integral torsion shaft extending from said body portion oppositely to said element and on which said body portion can rock to move said element, and an integral needle holding portion extending from said member laterally with respect to said element and said shaft, said needle holding portion having an opening therein for snugly receiving a needle.

8. In an electric sound-translating device, the combination of a piezoelectric element, and a rubber holding member therefor, said member including a body portion provided with a socket for snugly receiving and clamping one end of said element therein, an integral torsion shaft extending from said body portion oppositely to said element and on which said body portion can rock to move said element, and an integral needle holding portion extending from said member laterally with respect to said element and said shaft, said needle holding portion having an opening therein for snugly receiving a needle, and said opening being so disposed that the axis of the needle therein is angularly related to the axis of said shaft.

9. In an electric sound-translating device, the combination of a piezoelectric element, and a rubber holding member therefor, said member including a body portion provided with a socket for snugly receiving and clamping one end of said element therein, an integral torsion shaft extending from said body portion oppositely to

said element and on which said body portion can rock to move said element, and an integral needle holding portion extending from said member laterally with respect to said element and said shaft, said needle holding portion having an opening therein for snugly receiving a needle, and said opening being so disposed that the axis of the needle therein is angularly related to the axis of said shaft and is in the same plane therewith.

10. In an electric sound-translating device, the combination of a casing, a piezoelectric element within said casing, a rubber holding member carried by said casing and including a body portion provided with a socket for snugly receiving one end of the said element, said body portion having an integral extension thereon constituting a torsion shaft on which said body portion can rock to set up stresses in said element, means for clamping said torsion shaft in place within said casing, said holding member having a second integral extension thereon extending laterally therefrom with respect to said torsion shaft and through said casing, and a recording-engaging needle carried by said second-named extension externally of said casing.

11. The invention set forth in claim 10 characterized in that said rubber member is made of a quality of rubber having such inherent compliance that said member, in transmitting to said element motion imparted thereto by said needle, will attenuate a portion of said motion.

12. The invention set forth in claim 10, characterized in that said rubber member is made of a quality of rubber having such inherent compliance that said member, in transmitting to said element motion imparted thereto by said needle, will attenuate a portion of said motion, and characterized further in that said second-named extension is so constructed and arranged that it is free to flex toward said torsion shaft with relatively little resistance.

13. An actuating device for actuating the crystal element of a piezoelectric translating device adapted to cooperate with a phonograph record, said actuating device comprising a flexible rubber member having a body portion provided with a socket for snugly receiving one end of the crystal element, a torsion shaft extending from said body portion and providing means for supporting said actuating device for movement relative to said crystal element, and a needle holding portion extending from said member laterally with respect to said shaft.

14. The invention set forth in claim 13 characterized in that said needle holding portion extends from said body portion.

15. The invention set forth in claim 13 characterized in that said torsion shaft extends from one side of said body portion, and characterized further in that said needle holding portion extends from the bottom of said body portion.

16. The invention set forth in claim 13 characterized in that said body portion is provided with a shoulder adjacent said needle holding portion, and characterized further in that said needle holding portion is inclined with respect to said shoulder and is free to flex toward said shoulder with relatively little resistance.

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