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ELECTRICAL TRANSLATION DEVICE

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Fig.1.

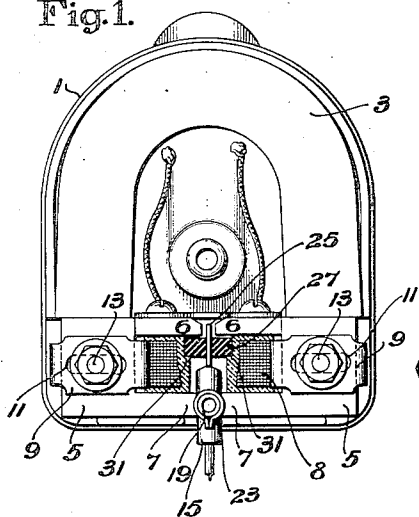


Fig.2.

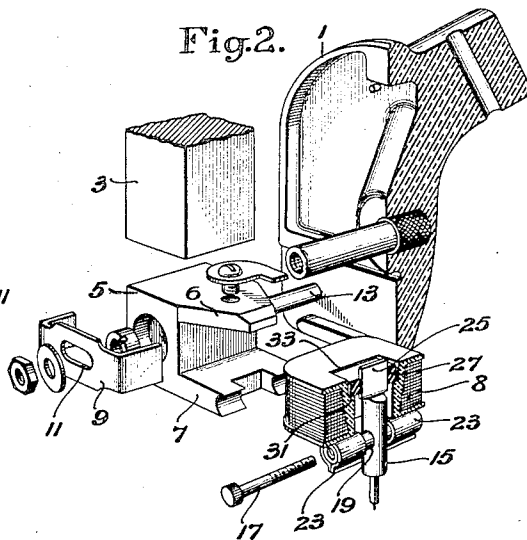


Fig.2a.

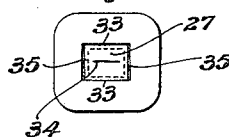
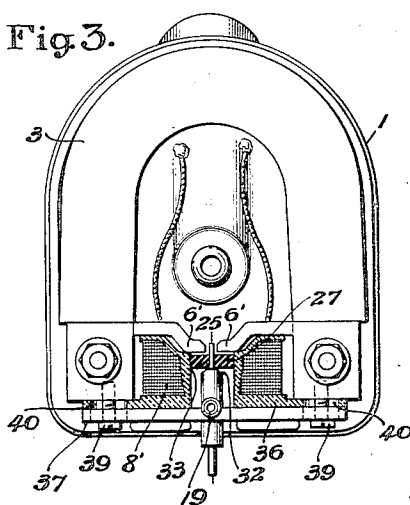


Fig.3.



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UNITED STATES PATENT OFFICE

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ELECTRICAL TRANSLATION DEVICE

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8 Claims. (Cl. 179—100.41)

My invention relates to translating devices, and more particularly to pickup devices for electrical phonographs, for translating mechanical movements into electric impulses and vice versa.

Heretofore in phonograph pickup structures with which I am familiar it has been customary to provide damping and centering means for the armature in several different arrangements. The most common one has been to mount a block of rubber, in a bracket, on the top of the upper pole-tip of the magnetic structure with means for adjusting the bracket to center the armature. In this arrangement it has been necessary to extend the armature, or an attachment thereon, above the level of the poles, into engagement with the rubber block. Such constructions have, however, increased the effective length of the armature and consequently have added to the moment of inertia with a resultant decrease in the effectiveness of response at the higher audio frequencies. In another well known form of pickup device it has been customary to merely insert a small piece of rubber in the air gap between the top of the armature and the pole-tips. This construction has had the effect of seriously limiting the amplitude of vibration of the armature, and in the event of the rubber becoming old and hardened, the pickup has been rendered ineffective for reproducing purposes, and the liability of damage to phonograph records has been considerably increased.

Accordingly, an object of my invention is to provide a translating device having improved quality of reproduction.

More specifically, it is an object of my invention to provide a pickup device having a relatively small and light armature, with a minimum of inertia, and having improved freedom of movement.

A further object of my invention is to provide an improved centering or restoring means for the vibrating free end of an armature of a pickup device whereby friction is reduced and a minimum of restoring force is thereby required to return the armature to its normal central position in a magnetic air gap during the absence of deflecting forces. In other words, the purpose is to provide an improved pickup whose characteristic mechanical hysteresis loop area is a minimum.

A further object of my invention is to provide a pickup device of such construction that makes possible the employment of a relatively large sized body of resilient damping and centering material, under substantially no stress, for the purpose of increasing the useful life of the material.

A still further object of my invention is to provide in a translating device, simple and improved air gap adjustment means particularly useful in combination with the above mentioned structure.

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 origin and method of operation, together with additional objects and advantages thereof will best be understood from the following description of specific embodiments when read in connection with the accompanying drawing.

In the drawing, Fig. 1 is a front elevation view, partly in section of the pickup device, with cover plate removed to disclose the interior.

Fig. 2 is a perspective view of the pickup device with the parts thereof in an exploded relation for the purpose of illustrating more clearly the interior construction.

Fig. 2a is a fragmentary plan view of the coil form of Fig. 2, showing the relation of certain parts.

Fig. 3 is a front elevational view of a modified form of pickup device embodying my invention, the top cover being removed, and portions of the device being shown in section.

In phonograph pickups, especially those of the balanced armature type, it is necessary to provide resilient restoring means for holding the vibratory armature in a desired central position during the absence of deflecting forces. This resilient means is in practice of such a nature or a material, for example rubber, to provide in addition a damping function for reducing the undesirable effects of resonance of the vibratory element. Both of these functions of the resilient means are commonly considered together under the term "damping means", and hereinafter this term when used is to be so understood. However, in some cases it may be desirable to employ separate means for the above two functions, for example it would be possible to use oil soaked felt as means for purely damping functions and to employ a metallic spring element for the restoring or centering means, and either or both of these means could be mounted within the coil structure or inside the pole pieces within the spirit of my invention.

Referring to the drawing, in which the same reference characters refer to similar parts in the different views, my novel pickup device comprises a casing 1 of non-magnetic material, having mounted therein a magnetic field system such as a "U" shaped permanent magnet 3 having

associated therewith opposed bifurcated pole pieces 5 comprising, respectively, pole-tips 6 and 7. Located between the pole pieces is a translating coil structure, preferably a solenoid 8, whose position longitudinally of the pole pieces is determined by the clamp members 9 having slots 11 respectively adapted to be engaged by the bolts 13, the latter serving also to secure the pole pieces to the casing. An armature bar 15 is supported in vibratory relation between the pole-tips and within the bore of the solenoid.

The vibrating armature is preferably broadly of the type, disclosed e. g. by the Kellogg Patent 1,783,044, having a needle screw 17 co-axially disposed in a rigid shaft 19 that supports the armature. The armature shaft is supported in the air gap formed between the oppositely spaced lower pole-tips 7 of the pole pieces by the interposition of thin pieces of rubber or other desirable resilient material 23 in the usual manner to form a suitable armature bearing substantially free from friction and lost motion. The free end of the armature is preferably flattened at 25 and the portion thereof adjacent the end 25 and just below the air gap formed by the pole tips 6 of the translating structure, is engaged by a body 27 of resilient damping material, such as a block of soft rubber that serves to damp the vibrations as well as to center the free or oscillating end of the armature in the air gap formed by the closely spaced upper pole-tips 6 and to restore the armature to its normal position during the absence of deflecting forces. This gap I shall refer to as the active air gap in view of its important relationship with the oscillating or free end of the armature. The gap formed by the lower pole-tips serves mainly to support the armature by means of the rubber bearings and is magnetically of less importance.

Although there are a few other well known materials which may be used for the resilient body 27, I prefer to use rubber, preferably in a form known as long life rubber, because of its combined damping and restoring functions. The rubber damping block 27, in accordance with my invention, is supported within the space between the upper and lower pole-tips of the pole pieces and preferably, as shown, by the interior walls of the pickup coil. Although I have shown the block as unitary, having a slit 34 in the center thereof to grip the flat portion 25 of the armature, it may obviously be composed of separate portions if so desired. I have shown the block of rubber as being retained in proper position by means of shoulders 31 on the inside wall portions of the coil form. However, for manufacturing purposes it is ordinarily sufficient to rely merely upon the frictional or adhesive contact relation between the rubber and the surface of a straight-sided coil bore.

It is preferred for the purpose of greater freedom of movement of the armature, that only the opposite ends 33 of the block of damping material engage opposed inner wall portions of the coil form. This I have shown more clearly in Fig. 2a where the sides or edges of the block are preferably spaced from the other vertical wall portions of the coil form as shown at 35 in the last named figure. Additionally the slit 34 in the block is adapted to grip the flattened portion of the armature, tending to prevent displacement of the block. Furthermore, as may be seen in Figs. 1 and 2, the top of the block is preferably similarly spaced from the adjacent upper pole-tips 6. This spaced arrangement permits

the resilient damping body to expand or bulge during vibratory movement of the armature without being limited by confinement at the top, bottom, and sides respectively.

Referring to the modification shown in Fig. 3 I have illustrated what is known as a high impedance pickup having a construction adapted to employ an armature with a low moment of inertia. In this form of my device the separation of the bifurcations of each of the pole pieces is made greater in order to receive a large sized coil 8', and the upper pole-tips 6' are formed downwardly into operative relation with the end 25 of the vibrating armature, thereby making possible the use of a relatively short, low inertia armature. In keeping with the foregoing construction the rubber damping and centering block 27 is preferably supported within the pole pieces, in order to make possible the use of a still shorter armature. I have shown in this modification, as above suggested, a coil form with a straight bore therein, the edges of the rubber block being in firm frictional or adhesive engagement with the walls at its opposite ends 33. I have also shown the shoulder 32 on the armature as an abutment to insure against extensive downward displacement of the rubber block, or to prevent sagging thereof.

While in Fig. 3 the position of the free end of the armature in the air gap between the upper pole-tips may be adjusted by means of the clamps, as shown in Fig. 1, that determine the position of the coil, I have preferred to employ another form of adjusting means in Fig. 3. This particular form of adjusting means per se constitutes no part of my present invention but is shown principally as a convenient means for permitting assembly of parts in combination with the inwardly directed pole-tip construction. Specifically the lower end of the coil form of insulating material is provided with a lateral extension 36 adapted to engage the lower end surface of the pole pieces in lateral slidable relation. A metallic plate 37 preferably of magnetic material is positioned against the lower end of the coil and serves to clamp, by means of screws 39, the coil form to said pole pieces, elongated slots 40 being provided in the plate and the coil form extension for lateral adjustment. Cooperating recesses are formed in adjacent faces of the coil form and the plate 37 for securing the armature shaft 19 and the resilient bearing material therebetween.

The foregoing construction provides for the assembly and removal, as the case may be, of the coil form despite the upper pole-tip construction. Otherwise, if the lower pole-tip were integral with the pole-piece as in Fig. 1, removal or assembly of the coil form would be difficult, if not impossible. This construction has the additional advantage of permitting the removal of the coil form, armature, and lower pole-tips without disturbing the upper air gap construction.

By reason of the above novel features of construction I have provided a pickup that not only gives an improved quality of reproduction and that has a longer useful life, but which is considerably more adaptable to manufacture in large quantities and at a lower cost. The assembly of the parts and the air gap adjustment is a relatively simple matter with the above improved construction as will be readily obvious to one skilled in the art.

While I have disclosed my invention in con-

nection with a pickup device for record reproduction, it is obvious to one skilled in the art that the invention is equally useful for record recording or cutting. Furthermore, it is equally
 5 obvious that an electromagnetic field may be employed in place of the permanent field magnet shown and any other suitable arrangement of pole pieces, pole-tips, and coil structure for the purposes hereinbefore described may be used in
 10 combination with my invention above disclosed.

While I have shown in the above forms of my invention, the body of damping material as being supported entirely within the bore or passage of the translating coil it is within the scope of
 15 my invention to mount the block of damping material only partially within the coil structure, or to mount a block above the coil structure between the latter and the upper pole pieces. The invention therefore is not limited to the specific
 20 embodiments shown in the present example, but may be applied to other forms of electrical translating devices in order to obtain the above disclosed features and advantages.

I claim as my invention:

25 1. In a record reproducing device, a translating coil structure having a passage therethrough, a vibratory armature supported for oscillatory movement in said passage, means at one end of said coil structure for pivotally supporting said
 30 armature and resilient centering means for said armature comprising a body of damping material engaging said armature and disposed within said passage in engagement on two of its opposite sides only with the walls of the passage.

35 2. In a translating device, a vibratory armature, magnetic pole structure defining an air gap in which one end of said armature vibrates, a translating coil disposed about said armature and having a central opening substantially in axial
 40 alignment with said air gap, and means for damping and centering said armature comprising a body of resilient material disposed around said armature within said opening, one dimension of said material in a plane normal to the axis of
 45 the opening being less than the corresponding dimension of said opening and another dimension of said material normal to the first named dimension and lying in the same plane being substantially the same as the dimension of the opening parallel thereto, whereby the material is restricted against movement along a line parallel
 50 to the last-named dimension.

3. The invention set forth in claim 2 characterized in that the last-named dimension of the resilient material lies in a plane that is substantially normal to the axis about which the armature vibrates.
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4. In a phonograph pickup device, a short low

inertia vibratory armature, a magnetic pole structure comprising a pair of air gaps, a bearing for said armature in one of said air gaps, said armature having a free end that is adapted to vibrate in the other of said air gaps, said
 5 free end terminating substantially in said last named gap, a coil structure disposed axially about said armature and having a bore substantially in alinement with said air gaps, and a body of damping material disposed about said
 10 armature in a region between said air gaps, said body being in the form of a relatively thin block having edges engaging the bore of the coil on two opposite sides only.

5. In an electric pick-up device, an armature
 15 mounted for vibratory movement about a pivot, magnetic field structure having a plurality of pole tips providing an air gap spaced apart from the pivot into which gap an end of said armature extends, a coil support surrounding said
 20 armature between the pivot and the air gap, damping means interposed between the coil support and said armature, and means for moving said coil support and damping means relative to the pivot whereby the end of the armature
 25 may be centered in the air gap.

6. The invention set forth in claim 5 additionally characterized in that the damping means is spaced away from the pole tips to obviate friction therebetween when the device is in
 30 operation.

7. In an electric pick-up device, an armature mounted for vibratory movement about a pivot, magnetic field structure having a plurality of pole-tips providing an air-gap spaced apart from
 35 the pivot, the armature having a rigid extension of reduced cross section that extends into the air-gap, a coil support surrounding the armature between the pivot and the air-gap, centering means for the armature including a body of
 40 damping material embracing the rigid extension of the armature and contacting opposite inner walls of the coil-support, the said body being spaced away from the pole-tips whereby it may freely be deformed when the armature is caused
 45 to vibrate, and means for moving the coil support relative to the pivot to center the extension in the air-gap.

8. Phonograph pick-up mechanism having a pair of magnetized pole pieces each having an
 50 upper and a lower portion, a pick-up coil spool mounted between the upper and lower portions of said pole pieces, and an armature mounted in the center of said spool, characterized by said spool being slidably mounted for adjustment on
 55 said pole pieces.

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