Aug. 14, 1945. B. B. BAUER 2,381,861

TRANSLATING DEVICE

Original Filed May 21, 1941

Fig. 1.

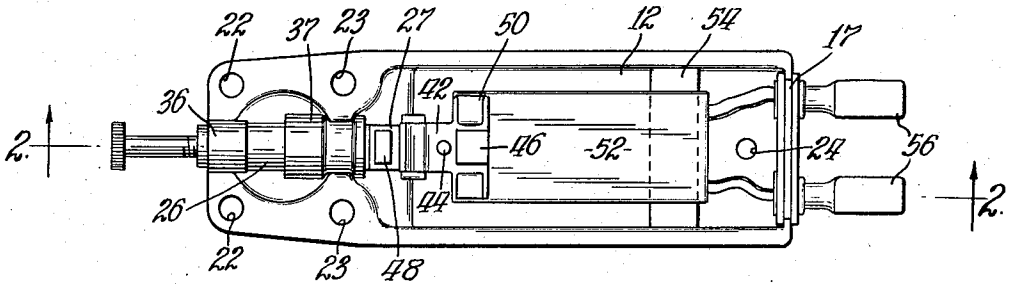


Fig. 2.

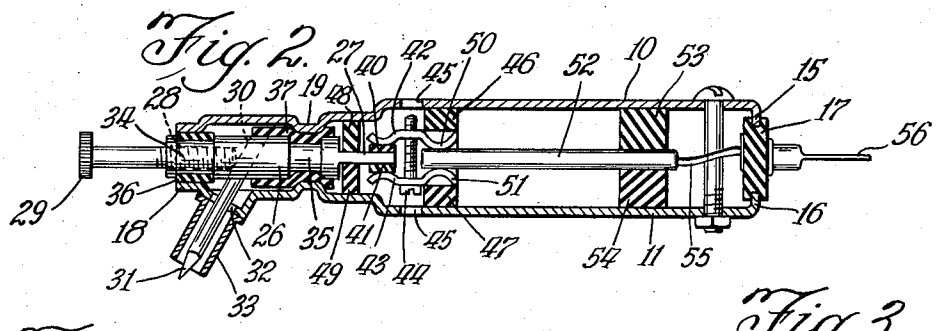


Fig. 6.

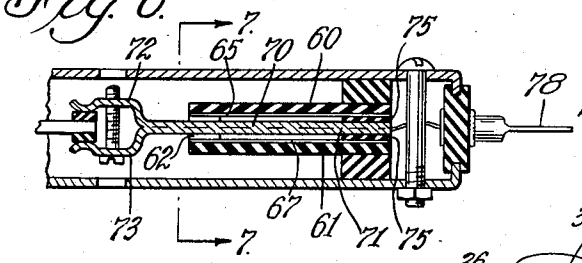


Fig. 3.

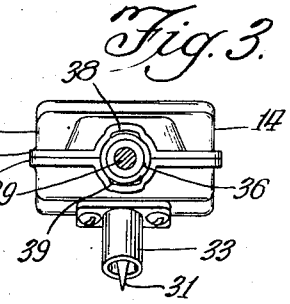
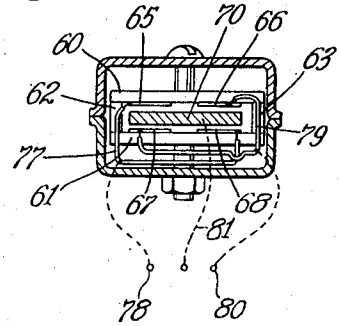


Fig. 7.



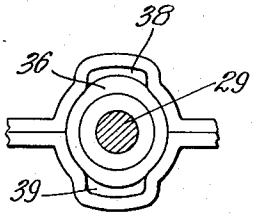


Fig. 4.

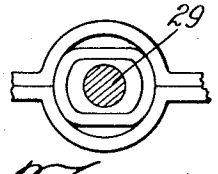


Fig. 5.

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UNITED STATES PATENT OFFICE

2,381,861

TRANSLATING DEVICE

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Original application May 21, 1941, Serial No. 394,564. Divided and this application March 27, 1943, Serial No. 480,773

3 Claims. (Cl. 179—100.41)

This invention relates to phonograph translating devices having a torsional drive rod. The invention is applicable to either a recorder or reproducer and certain features of the invention are of general application to a torsion rod drive. An important feature however concerns itself with the use of a relatively stiff translating means per se in connection with a torsion drive rod.

A torsion drive rod for lateral record grooves utilizes a needle or stylus extending generally transversely to the rod axis. In such a construction, it is desirable from a theoretical angle to endow the drive rod with only one degree of movement; i. e. torsional about its longitudinal axis. Longitudinal and lateral rod movement are ordinarily to be avoided.

As is well known, the width of lateral cut grooves is constantly varying. Where the groove width decreases, a vertical component of force is created tending to raise the needle, assuming the needle is above a horizontal record. This is known as the "pinch" effect and should be considered as a substantial factor. In practice therefore, it is highly desirable to provide for some transverse rod travel in a direction perpendicular to the record under normal operating conditions.

It follows that there should be a controlled elasticity for needle movements tending to vibrate the drive rod perpendicularly to the record. Since the rotational elasticity of the drive rod is highly important in regard to characteristic control, it is clear that these two elasticities should preferably be independent. This has not heretofore been true of prior devices. In general the mechanical construction interlinked these two elasticities so that independent control of each was impossible. As a rule, the final characteristics were a compromise between conflicting tendencies.

In a torsion drive device, there must be some physical means for connecting the drive rod with the translator per se; i. e. with the element where energy conversion takes place. If a translator has a greater stiffness than is desirable to project to the needle point, a coupling must be used so that the needle may be deflected more easily.

As is well known, the moment of inertia of a rotary part is a function of the square of the radius. By keeping down the radius to a minimum value the moment of inertia is reduced. However, mechanical coupling details require relatively larger and smaller parts, particularly if manual adjustments are to be provided. In such case, I dispose the smaller parts in the drive rod part of the system and have the larger parts in the translator portion of the system. Thus advantage of reduced vibration amplitude in the translator is taken to keep the inertia of the entire device at a minimum value. Between the two, a flexible coupling may be provided which functions to change large vibrations of a flexible element to smaller vibrations of a stiffer element.

Referring now to the drawing:

Fig. 1 is a top plan view of a translating device, with the top casing member removed;

Fig. 2 is a section on 2—2 of Fig. 1 but with the top casing member in place;

Fig. 3 is a front elevation of a translating device;

Fig. 4 is an enlarged view of the torsion rod bearing shown in Fig. 3;

Fig. 5 is an enlarged view of a modified torsion rod bearing;

Fig. 6 is a sectional elevation of a modified translator and clamp combined; and

Fig. 7 is a section on 7—7 of Fig. 6.

The translating device as a whole includes a pair of complementary case members 10 and 11. Both members are generally similar and may be of stamped aluminum, sheet iron, die cast or may even be of a suitable plastic material. Both case members are generally dished to provide a comparatively large compartment 12 formed by wall portions 13 and 14. Rear edges 15 and 16 of the case may be inturned and fitted against an insulating terminal block 17.

The front portion of the case is shaped to provide a pair of journals 18 and 19, the metal being pushed inwardly to form the journals. The free edges 20 and 21 of the two casing shells meet along the case sides and front. The two shells may be maintained tightly in position by bolts passing through apertures 22, 23 and 24.

Journal 18 and preferably also journal 19 are not circular, as might be expected but have an elongated shape with the long dimension being perpendicular to the general casing plane. As seen in Figs. 3 and 4, the vertical dimension is somewhat longer than the horizontal one. The difference need not be great and in practice need only amount to about a hundredth of an inch or so. The drawing obviously shows the elongation exaggerated.

Disposed within the forepart of the casing is a torsion drive rod 26 having a generally circular section and a male coupling element as a flat tail piece 27. Drive rod 26 may have an axial threaded channel 28 into which a thumb screw 29 may be disposed. A generally transverse needle receiving

slot 30 is provided at an intermediate part of the rod and into this may be disposed a needle 31. This needle may be either a conventional reproducing needle or a jewel or may be a cutting stylus for recording. The needle is clamped by screw 29 and preferably extends forward of the device, as shown in Fig. 2. A suitable aperture 32 in casing member 11 is provided for clearing the needle. A tubular guard 33 is carried by casing member 11 and extends around needle 31 for a distance so that only the tip of the needle clears. Thus guard 33 will take up any shock above that necessary to push the needle tip in.

Rod 26 has reduced circular bearing portions 34 and 35 on opposite sides of the needle clamping region and these reduced portions register with journals 18 and 19 respectively. Around reduced portions 34 and 35 are flexible sleeves 36 and 37 of rubber, felt or the like. It will be noted that the casing flares outwardly on both sides of journal 19. Preferably, reduced portion 35 has about the same length as bearing journal 19 while sleeve 37 is longer than reduced portion 35. Thus the sleeve material stretches out on both ends of the bearing portion and effectively forms a thrust bearing for axially directed forces. The ends of the sleeves are thus firmly retained against longitudinal force. A somewhat similar thrust bearing action may be obtained by sleeve 36 on reduced portion 34.

Both sleeves 36 and 37 are just thick enough so that a resilient bearing is provided. Each sleeve is originally uniform in thickness so that an increase in resiliency along a vertical axis, as seen in Figs. 3 and 4, results. The elongation of one or both bearing jounals may be sufficient to provide open regions 38 and 39 above and below the sleeves. It is understood that substantially the same result may be obtained by varying the sleeve thickness and having round bearings or by having uniform sleeves in round journals and flattening the drive rod at the top and bottom as shown in Fig. 5 for example. The thickest part of the variable sleeve would be at the horizontal axis and this would be most compressed.

Since the compression of the sleeves 36 and 37 controls the torsional flexibility of the drive rod, it is clear that this characteristic is independent of the vertical elasticity of the drive rod mounting. The angular extent and depth of free bearing regions 38 and 39 will determine the elasticity of the rod mounting to vertical transverse forces. Hence the elastic properties of the drive rod mounting to torsional movement and vertical translation may be independently controlled.

Tail piece 27 may have disposed on opposite sides thereof flat rubber or other flexible pads 40 and 41. If desired one pad may be omitted. It is preferred however to have one pad of different compressibility and resistance than the other. Flexible materials like rubber, leather, cork or the like have a non-linear characteristic of stress and strain, the compressibility and resistance depending upon the initial compression. It is clear that by having pads 40 and 41 different, it is possible to control the vibratory characteristics of the entire coupling. Thus particularly desirable results have been secured by having one pad of a material whose predominant characteristic is elasticity, such as live rubber, and by having the other pad of viscous material whose predominant characteristic is resistance, such as "Viscoloid."

A pair of clamping members 42 and 43 engage the padded tail piece and the pressure of engagement may be controlled by bolt 44 loosely passing through one piece, here 42, and threadedly engaging the other piece. In effect, the coupling consists generally of a male member on the drive rod and a female member cooperating therewith.

As shown in Fig. 1, clamping members 42 and 43 are generally T-shaped with the bottom of the T preferably engaging the tail piece 27. Other shapes of clamping members are possible. Members 42 and 43 may be springy if desired.

Pads 40 and 41 and clamping members 42 and 43 with bolt 44 really form a transmission coupling with adjustable characteristics. Suitable apertures 45 in the casing give access to bolt 44 and permit adjustment after assembly. Flexible pads 46 and 47 at the center of the T may be provided to engage the casing wall. Flexible pads 48 and 49 on opposite sides of the tail piece 27 may be also provided.

Clamping members 42 and 43 are adapted to clamp any vibratable element of an energy translator between the head ends 50 and 51. The means clamped may be an armature of an electromagnetic device, a piezo crystal, a condenser assembly or any other suitable means. Thus as shown in Figs. 1 and 2, a flat torsionally responsive crystal 52, suitably wrapped, may be gripped between clamping ends 50 and 51. The crystal may be braced at the faces and sides thereof by flexible pads 53 and 54. Wires 55 may be brought out to soldering terminals 56 carried by terminal block 17.

The female clamp parts are more or less tightly coupled to the translator and both vibrate at an amplitude small in comparison to that of the drive rod. Thus the effective inertia at the drive rod of the relatively massive female part of the coupling and the manual adjustment is small.

In Figs. 6 and 7, a modification is shown where a condenser having movable plates is used as a translating device. In this form, an insulating frame consisting of flat plates 60 and 61 with spacers 62 and 63 is provided. Carried by plate 60 is a pair of metal electrodes 65 and 66, these being long and narrow and preferably symmetrical with respect to the longitudinal axis of plate 60. Plate 61 also carries similar plates 67 and 68. Spaced between these opposing electrodes is a vibratable electrode plate 70 rigidly clamped at 71 and having formed integral therewith clamps 72 and 73. Suitable insulating means such as hard rubber pads 75 may be provided at 72. Obviously plates 65 and 68 as one pair and 66 and 67 as the other pair cooperate with movable plate 70 for translating action. A cross connected pair of three plate condensers is thus provided. Thus wire 77 connects plates 65 and 68 and is brought out to a terminal 78. Similarly wire 79 connects plates 66 and 67 and is brought out to a terminal 80. Wire 81 is connected to movable plate 70. Thus push-pull circuit action is obtained. It is understood that wire 81 and one of the remaining two terminals may be utilized in a conventional two wire system.

By virtue of the construction disclosed herein highly desirable characteristics are obtained. Thus the non-circular journals at 18 and 19 provide increased elasticity to shock in the drive mounting perpendicular to the record. This would occur in case the entire device were set down too hard on the needle. Guard 32 of course protects the entire device against excessive shock. Also, the resilient mounting permits the needle to adjust itself in the record groove. By having substantial resiliency, groove wear in reproduction may be greatly reduced.

The drive rod bearings also provide an end thrust protection and tend to hold the rod with some elasticity against longitudinal movement. This end thrust provision does not impair the rotational flexibility of the mounting as is the case when the rubber supports are cemented to prevent longitudinal movement. The actual elastic structure is simplicity itself—merely some rubber tubing.

The provision of a simple flat tail piece 27 and the clamp construction also has highly desirable features. Thus the drive rod is made simple and light and has low rotational inertia. The clamp with its adjusting screw is separated from the drive rod by flexible means here shown as pads 40 and 41. Thus transmission characteristics between the drive rod and clamp may be controlled by pressure on the pads. The clamp and translating device are relatively tightly coupled. Because the clamp and bolt increase the rotational inertia of the vibratory system, it is desirable to couple it closely to the translator. By controlling the clamp tension, the vibratory characteristics of the entire device may be controlled within wide limits.

One highly desirable advantage of the construction is the ready removability of the translating unit and replacement thereof. Thus any translating unit, crystal, electro-magnetic or condenser, may be replaced with another for any reason at all with a minimum of trouble.

It is clear that the assembly of the entire device may be accomplished with a minimum of equipment and skill. It is difficult to put anything together incorrectly and after assembly, the adjustment on the clamp is simple.

This application is a division of my copending application Serial No. 394,564, filed May 21, 1941.

What is claimed is:

1. In a phonograph translating device having a torsional drive rod having its axis disposed generally parallel to the record surface under normal operating conditions, a mounting for said rod comprising a substantially hard journal encircling a portion of said rod, a compliant elastic member between said journal and said rod and supporting said rod within said journal, said journal, rod and elastic member being so constructed and arranged that the compliance of said elastic member to lateral motion of said rod varies around the periphery of said rod in such manner that greater compliance is present in a line passing through said rod axis and generally prependicular to the record surface than in a line passing through the rod axis and generally parallel to the record surface.

2. In a phonograph translating device having a torsional drive rod having its axis disposed generally parallel to the record surface under normal operating conditions, a resilient mounting for said rod comprising a substantially hard journal encircling a portion of said rod, and a resilient sleeve between said journal and said rod, said journal, rod and sleeve being so constructed and arranged that the degree of compression upon said sleeve varies around the periphery of said rod in such manner that less sleeve compression occurs in a line passing through the rod axis and generally perpendicular to the record surface than in a line passing through the rod axis and generally parallel to the record surface.

3. In a phonograph translating device having a torsional drive rod having its axis disposed generally parallel to the record surface under normal operating conditions, a resilient mounting for said rod comprising a substantially hard journal encircling a portion of said rod, a resilient sleeve between said journal and said rod, the distance between opposing journal and rod surfaces varying around the periphery of said rod in the normal position of said rod, said distance being greater in a line passing through the rod axis generally perpendicularly to the record surface than in a line passing through the rod axis generally parallel to the record surface, whereby the compliance of said sleeve is greater in said perpendicular line than in said parallel line.

BENJAMIN B. BAUER.