Aug. 10, 1943. M. J. DI TORO 2,326,625

PHONOGRAPH

Filed Jan. 28, 1938 2 Sheets-Sheet 1

Fig.1

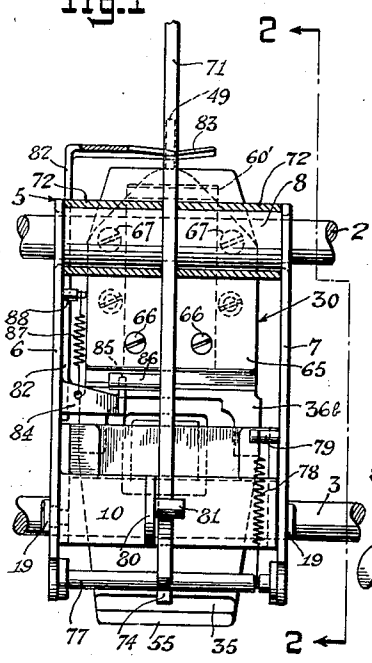



Fig.2

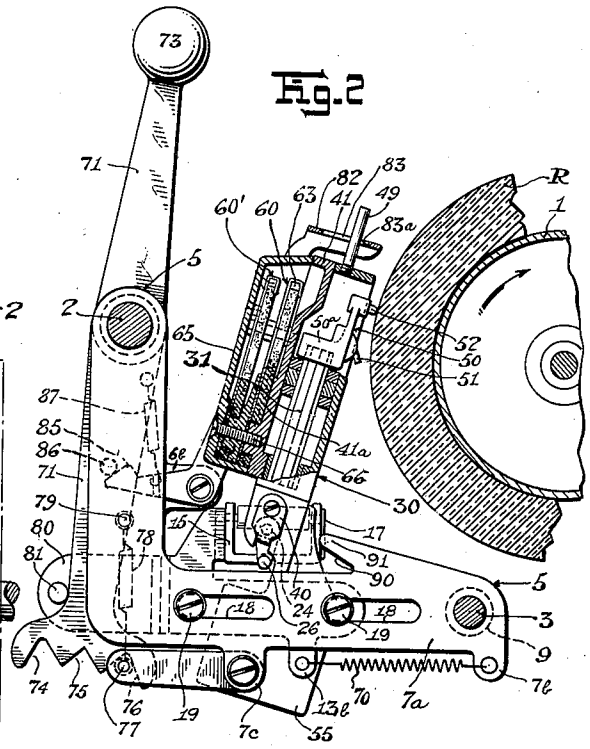



Fig.3

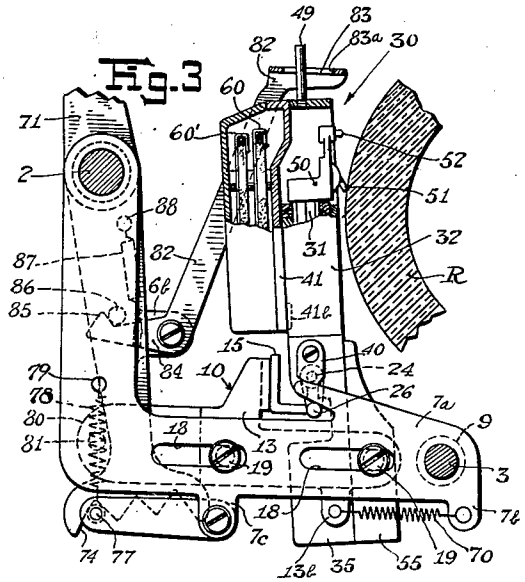
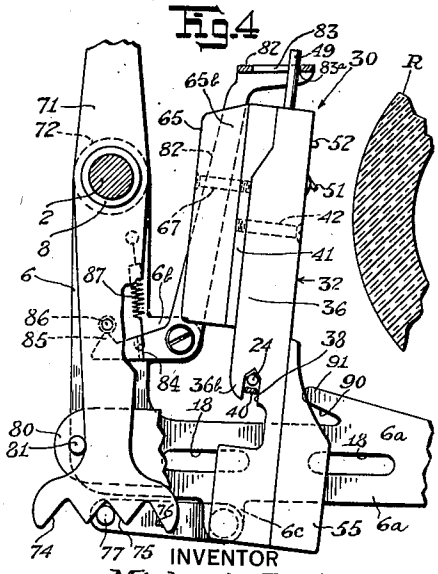



Fig.4




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Fig.5

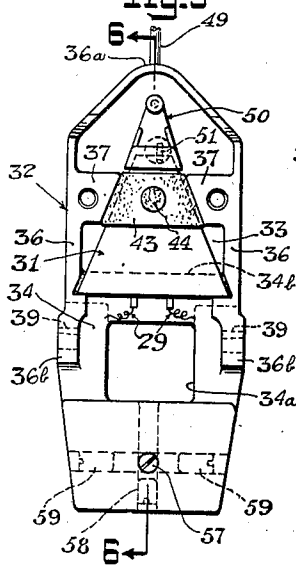



Fig.6

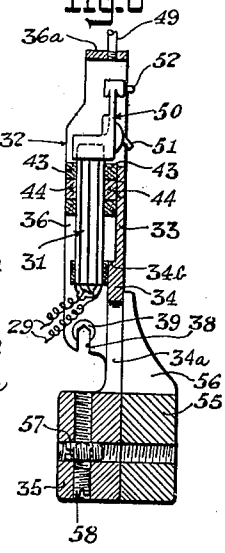



Fig.7

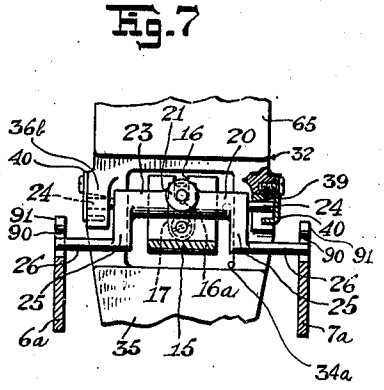



Fig.8

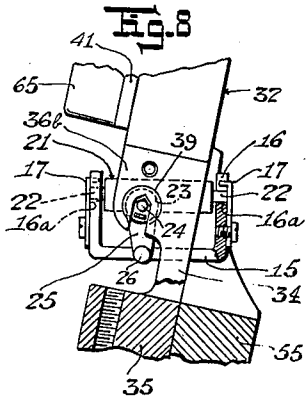



Fig.1a

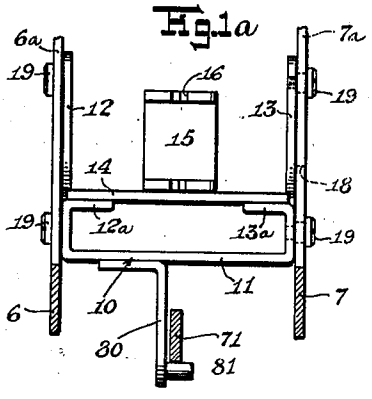
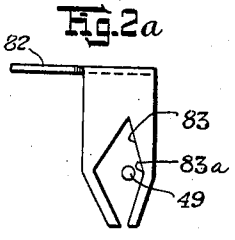



Fig.2a




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Patented Aug. 10, 1943 2,326,625

# UNITED STATES PATENT OFFICE

2,326,625

## PHONOGRAPH

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Application January 28, 1938, Serial No. 187,388

4 Claims. (Cl. 274—30)

This invention relates to phonographs, and in many aspects has especial reference to phonographs of the type adapted for both the recordation and reproduction of sound. The invention has been illustrated, and has especial utility, in connection with phonographs wherein the record is of a form (a wax cylinder, by way of example) adapted to be recorded upon, and reproduced from, by appropriate respective styli in engagement therewith. According to one aspect of the invention, a common translating device for recordation and reproduction, having a common translating unit for actuating the recording stylus and for response to the reproducing stylus, is employed; and while such a translating device and its translating unit proper may be of any form appropriate to an ultimate acoustic-mechanical translation, there has been particularly illustrated an electro-mechanical translating device and unit, for actuation by and production of sound-representing electric oscillations.

It is an object of my invention to provide, in a phonograph, an improved arrangement of the translating device relative to the record.

It is another object to provide an improved and simplified common translating device for both recordation and reproduction.

It is another object to provide an improved selective control of a common translating device for both recordation and reproduction.

It is another object to provide improved and simplified means for effecting and eliminating a certain freedom of movement of a common translating device, as required for its proper respective actions.

It is another object to provide a novel and improved assembly of a common translating device with the carriage therefor.

It is another object to provide an improved and simplified arrangement for imparting the requisite biases to the translating device styli.

It is another object to provide an improved arrangement of a translating device for freedom of movement of its reproducing stylus along the record.

It is another object to provide an improved and simplified arrangement for biasing such a reproducing stylus to a mean position within its free-movement range.

It is another object to an improved arrangement for biasing the reproducing stylus at once to a mean position in such range and against the record.

It is another object to provide especially simple means for holding both the recording and the reproducing styli in a translating device, while providing the proper respective couplings of each to the active translating unit.

It is another object to provide improved means for holding a reproducing stylus in a translating device.

It is another object to provide an electro-mechanical translating device and unit of improved efficiency for phonographic reproduction, and for joint recordation and reproduction.

It is another object to provide a piezo-electric phonographic translating unit, for either reproduction or recordation, of improved efficiency.

It is another object to provide especially effective damping means for a translating unit having rigidly supported portions.

It is another object to provide a common translating device for both recordation and reproduction wherein excessive responses at certain frequencies in each of said actions are effectively suppressed.

A general object is the provision of an improved phonograph for both the recordation and reproduction of sound.

Other and allied objects will more fully appear from the following description and the appended claims.

In the detailed description of a preferred embodiment of my invention, hereinafter set forth, reference is had to the accompanying drawings, of which:

Figure 1 is a partial front elevational view of a phonograph wherein my invention has been embodied;

Figure 1*a* is a plan view of the cradle **10** hereinafter described, together with the portions of the carriage which support it;

Figure 2 is a vertical cross-sectional view taken principally along the line **2—2** of Figure 1, but taken centrally of the translating device in the upper portion of that device, and illustrating a reproducing adjustment;

Figure 3 is a view essentially similar to Figure 2 but illustrating a recording adjustment;

Figure 4 is a view essentially similar to Figure 2 but illustrating a neutral adjustment;

Figure 5 is a front elevational view of the translating device with the vibration dampers, front casing, and clamping plate, hereinafter mentioned, removed;

Figure 6 is a vertical cross-sectional view taken along the line **6—6** of Figure 5;

Figure 7 is an enlarged front elevational view of the rocker system **20**, showing portions immedi-

ately adjacent thereto partly in section and partly in elevation;

Figure 8 is an enlarged side elevational view of the same apparatus as shown in Figure 7; and

Figure 2*a* is a top plan view of the upper portion of the arm 82 hereinafter mentioned.

Reference being had to Figures 1 and 2, there will be seen a mandrel 1 serving as a support for a cylindrical record R, which may be removably mounted thereon; the mandrel may be rotated, for example in the direction of the arrow in Figure 2, by any suitable means. In front of and below the mandrel 1 will be seen the respective upper and lower carriage rods 2 and 3, parallel with the mandrel axis; along these rods a carriage 5 is adapted to be slowly driven simultaneously with rotation of the mandrel, for example in a rightward direction as shown in Figure 1, as by a feeding arrangement conventional for cylindrical phonographs and not herein necessary to show. The carriage 5 has been shown for example as comprising mutually parallel L-shaped lefthand and righthand side frames 6 and 7, respectively; a cylindrical cross-member 8 terminally secured between the front top ends of the two side frames and surrounding the upper carriage rod 2; and a cylindrical cross-member 9 terminally secured between the rear bottom ends of the two side frames and surrounding the lower carriage rod 3. The upper or vertically disposed portions of the L-shaped side frames 6 and 7 extend downwardly from the upper carriage rod 2, with the respective lower side frame portions 6*a* and 7*a* extending rearwardly therefrom to the lower carriage rod 3.

Between the side frame portions 6*a* and 7*a* there is slidably held, for forward and rearward movement, a cradle 10; a plan view of this cradle with only parts of the carriage side frame portions 6*a* and 7*a* appears as Figure 1*a*. The principal portion of the cradle may conveniently be formed from flat stock, folded into a U-shaped member whose base or forwardly disposed cross-portion is indicated as 11, and whose side portions 12 and 13 respectively lie against the inner surfaces of the carriage side frame portions 6*a* and 7*a*. Each of these carriage portions may be provided with horizontally elongated holes or slots 18; inwardly through these slots and into threaded engagement with the cradle side portions 12 and 13 may be passed shouldered screws 19, the screws and slots forming the support of the cradle to the carriage for forward and rearward sliding therein.

The cradle may be completed by a cross-member 14 disposed somewhat behind and above the cross-portion 11 and secured between the cradle side portions 12 and 13 (for example, to upwardly and inwardly extending ears 12*a* and 13*a* formed from 12 and 13), and by a vertically disposed U-shaped bracket 15 extending rearwardly from the central portion of the cross-member 14; if desired, this bracket may be integral with that cross-member, which latter will then form the front upright of the U-shape.

Pivotally supported to the carriage, and more particularly to the bracket 15 of cradle 10, is a rocker system 20; the pivoting is for rotation of the rocker system in a plane parallel to the path of the carriage 5, and more particularly involves substantially horizontally aligned pivots, for rotation of the system in a substantially vertical side-to-side plane. This rocker system appears in enlarged detail in Figures 7 and 8; its immediately pivoted portion may be a front-and-back extending cylinder 21, from the ends of which extend pivoting rods 22. These rods may rest in central slots 16 extending downwardly from the top edges of the front and back upright portions of the bracket 15, the slots being wider than the diameter of the rods 22 but having bottoms 16*a* which are V-shaped (see Figure 7) and chamfered (see Figure 8) to provide a linear V-bearing for the pivoting rods 22. The cylinder 21 may be loosely retained against accidental upward dislodgment from the bearings just mentioned, and against more than minute longitudinal play in the bearings, by inverted L-shaped caps 17 screwed to the outer surfaces of the bracket uprights and spacedly overhanging the rods 22.

The rocker system further includes, secure with respect to the cylinder 21, a side-to-side extending cylinder 23, intersecting the cylinder 21 with its axis at right angles to and slightly lower than that of 21 and slightly forward of the longitudinal center of 21; pivoting rods 24, hereinafter further referred to, extending axially from the ends of the cylinder 23; crank-like webs 25 extending downwardly a short distance from the ends of the cylinder 23; and locking rods 26, hereinafter further referred to, extending outwardly from the lower extremities of the webs 25, parallel with the axis of cylinder 23. The entire rocker system is conveniently cast from a suitable metal, the pivoting rods 22 and 24 and locking rods 26 being thereafter machined.

The translating device, described in detail hereinbelow, is pivoted to the rocker system—i. e., to the pivoting rods 24—for stylus movement toward, and preferably also bias against, the record. The action of the translating device may include reproduction from the record; and in connection with reproducing action there is well understood as desirable a material freedom of movement of the reproducing stylus in the direction of carriage travel (one function of which freedom is the proper "tracking" of the record grooves, helically formed for example in the surface of a recorded record). Such freedom of movement is provided by the pivoting of the rocker system (at 22); and it may be particularly pointed out that according to my invention this freedom is provided not merely for the reproducing stylus or for a limited portion of the translating device including the stylus, but for the entire device—all the pivoting being effected externally to the device. The action of the translating device may include recordation upon the record; and in connection with recording action it is well understood that there may be undesirable that freedom of stylus movement which is so desirable in connection with reproduction. That freedom of movement is accordingly eliminated during recordation; and it may be particularly pointed out that with the pivoting effected wholly externally to the translating device, this elimination may be effected in a highly simple and trouble-free manner.

According to the preferred embodiment of my invention the translating device is substantially vertically arranged, preferably in front of the record, rather than horizontally above the record. This has considerable advantage in respect of compactness; of inherently greater safeguarding of the record from unintended and damaging contacts by various instrumentalities in the hands of the operator of the machine, since the carriage rods and carriage are more squarely interposed between him and the record; of ease of counterbalancing, since the maximum horizontal

extent of the translating device tends to be considerably less; and the like. In connection with the provision of the reproducing freedom of movement above discussed, the vertical translating device arrangement has the especial advantage of causing the simple action of gravity on the entire translating device to bias the reproducing stylus to a mean or normal position in its free-movement range—as well as permitting that force to perform its conventional function of providing stylus bias against the record for both recordation and reproduction. The vertical arrangement further facilitates the selective engagement with the record of two styli, both fixedly carried by the translating device, by a simple horizontal movement of the translating device pivots—such movement being the function of the sliding for which the cradle 10 has been described above as arranged. Other advantages of the vertical arrangement will be apparent as the description of the translating device proceeds in detail.

The translating device 30 with which I have illustrated my invention is of electro-mechanical nature, for the translation of electric oscillations (representing sound, for example) into mechanical vibrations and/or vice versa. Its active portion is a translating unit 31, which is preferably in the form of a piezo-electric bending unit of the so-called "bi-morph" type, such for example as in general disclosed in U. S. Patent No. 1,802,782 to Sawyer. In such a unit two or more thin piezo-electric crystals are secured together face-to-face, with suitable intermediate and outside metal foil electrodes electrically interconnected, in an arrangement such that upon the application of voltage to the electrodes one or more of the crystals will contract longitudinally and another one or more will expand longitudinally, to result in a transverse bending of the unit—and, conversely, upon transverse bending of the unit there will be developed on the several electrodes potentials which are caused by the electrode interconnection to aid each other. The unit 31 which I have particularly illustrated is of trapezoidal plan shape and comprises four crystals secured together.

The full assembly of the translating device 30 appears in vertical, principally cross-sectional view in Figure 2, while Figures 5 and 6 are respectively front and cross-sectional views of the device with the vibration dampers, front casing, and clamping plate, all hereinafter mentioned, omitted; Figures 7 and 8 show in enlarged form the portion of the translating device immediately associated with the pivot rods 24. The main frame of the translating device is indicated as 32; this may be a casting of suitable metal. It may comprise an upper plate portion 33; a lower plate portion 34 continuing downwardly from 33 but slightly thicker (i. e., extending more forwardly), centrally apertured as at 34*a*; a heel portion 35 extending downwardly from 34 but still thicker; a forwardly extending rim or flange 36 beginning at an intermediate point on one side of the lower plate portion 34, running upwardly along that side of 34 and of 33, extending above the upper end of 33, curving in a "nose" 36*a*, and returning along the other side of 33 and 34 to terminate horizontally opposite its point of beginning; and and partial inward extensions 37 of the rim 36 across the top part of the front face of 33. The downwardly directed ends 36*b* of the rim 36 are provided with upwardly extending slots 38 which fit freely over the pivot rods 24 above described; these slots terminate in bearings 39 of relatively hard metal inset into the rim 36, in which bearings the top surface of the slot is V-shaped (see Figure 8) and chamfered (see Figure 7) to provide a linear V-bearing for the translating device on the pivoting rods 24. The translating device may be loosely retained against accidental upward dislodgement from the pivot rods 24, and against more than minute play longitudinally of those rods, by L-shaped caps 40 screwed to the outer surfaces of the terminal rim portions and spacedly hooking below the rods 24.

Against the front surface of the rim 33 and of its inward extensions 37 there is held a clamping plate 41, as by screws 42 passing through clearance holes in the upper plate portion 33 and the extensions 37 into threaded engagement with the clamping plate. This plate may extend from the nose 36*a* of the rim 36 to a little below the top of the lower plate portion 34; along the bottom part of its inner or rearward surface this plate may be slightly thickened in an inward direction to form a jaw 41*b*. Between this jaw and the top part 34*b* of the front surface of the lower plate portion 34, acting as a cooperating jaw, there is cemented the base or wide-end portion of the bending unit 31; thin electrical insulating pieces, such as of "fish-paper," are interposed between the jaws and the unit to insulate the latter. The unit 31 extends upwardly between the clamping plate 41 and the upper plate portion 33 to have its upper or narrow-end extremity slightly above the top of 33.

This unit end is of course intended to vibrate relative to the rest of the translating device; it is desirable, however, that its vibration be somewhat damped, in order to suppress an exaggeration of response in the frequency region of resonance of the effective compliance of the unit 31 with the effective mass of the unit and of components carried thereby. This damping may be readily provided, the unit made better proof against breakage, and the unit further hermetically sealed, by placing in front of and behind the unit, between the rim extensions 37, damping pieces 43; these, with the unit between them, are clamped between the clamping plate 41 and the upper plate portion 33. In areal configuration these damping pieces may be trapezoidal, to fit between the extensions 37 whose inner surfaces may be angled for parallelism with the sides of the unit 31; in thickness these pieces may be dimensioned to result in a desired degree of compression thereof upon assembly of the device. Effective pieces 43 may be made of the resilient damping material currently available under the trade name of "Neoprene"; for still more effective damping action, when desired, they may be provided with transverse holes and these holes filled with inserts 44 of highly viscous and little resilient material, such as that currently available under the trade name of "Viscoloid."

To the upper end of the unit 31 is secured a stylus holder 50 in which may be held both a recording stylus 51 and a reproducing stylus 52, adapted to be selectively engaged with the record in a manner hereinafter detailedly described. The requirements for the couplings of these two styli to the unit 31 are quite dissimilar; the recording stylus 51 should be substantially rigidly coupled to the unit; whereas the reproducing stylus 52 should be coupled to the unit through a compliance which is large relative to the compliance of the recorded record, in order that record wear may be properly minimized, and which

also is desirably provided with some damping in order that resonance effects involving that compliance shall not attain to undue amplitudes. I preferably provide in an integral, one-piece stylus holder **50** the most desirable coupling for each stylus. This I do by forming the holder of compliant material, preferably characterized by some considerable internal damping; by holding the recording stylus **51** in the holder close to the region of contact of the holder with the unit **31**; and by holding the reproducing stylus **52** in the holder relatively remote from that region—preferably near the end of a relatively thin extending portion of the holder, wherein the compliant nature of the holder material has an opportunity to manifest itself.

The stylus holder so described has been disclosed in detail and claimed in an application filed as a division of this application, and now constituting Patent No. 2,267,693, issued December 23, 1941.

The construction of the stylus holder so described results in the reproducing stylus **52** being displaced appreciably above the recording stylus **51**, the recording stylus preferably extending very slightly, and the reproducing stylus still a little more, rearwardly of the rear face of the translating device frame **32**. If the parts are arranged, as shown, so that when the translating device **30** is very approximately in a vertical plane the recording stylus is very approximately at the elevation of the record axis, then with the translating device **30** extending downwardly from the styli in a vertical plane, or in the slightly counterclockwise-from vertical plane illustrated in Figure 3, the engagement of a stylus with the record will be of the recording stylus **51**. Engagement of a stylus being caused by a rearward bias of the entire upper part of the translating device, the conditions for recordation are established by a position of the forwardly-and-rearwardly slidable cradle **10** which brings the pivot rods **24** substantially vertically underneath the styli, and the translating device into such a position as illustrated in Figure 3. To establish the conditions for reproduction the cradle **10** may be moved to displace the rods **24** appreciably forwardly; the translating device, being biased to maintain stylus engagement, will rotate about the pivot rods **24** rearwardly in its upper part, or clockwise as shown in Figures 2 and 3—and, with a degree of movement which yet leaves the styli principally vertically disposed above the pivot rods **24** and the translating device in the only slightly clockwise-from-vertical position shown in Figure 2, the record-engaging stylus will become the reproducing stylus. A means for controlling the cradle position, and hence for selecting between recording and reproducing conditions of the apparatus, is described hereinbelow.

The rearward bias of the upper part of the translating device **30** and hence of the styli is provided by the arrangement of the center of gravity of the device, this center being accordingly fixed within the device at a small distance behind the pivot rods **24**—the distance depending on the stylus-biasing forces desired. Vertically the center of gravity is fixed at such a mean position that its elevation will never depart much from the elevation of those pivot rods—in order that neither the recording biasing force nor the somewhat lower reproducing biasing force shall be appreciably varied by expectable variations in the diameter of the record R. The center of gravity will of course be highest when recording on a large-diameter (e. g., a new) record, and lowest when reproducing from a small-diameter (e. g., a many-times shaved) record; it is at a mean value, and is then caused to lie substantially at the elevation of the rods **24**, when recording on a small-diameter record and when reproducing from a large-diameter record. To fix the center of gravity as so outlined there may be appropriately included in the translating device **30**—for example, secured to the rear surface of the heel **35** and connected if desired through webs **56** with the rear surface of the lower plate portion **34**—a weight **55** of heavy metal such as brass. The weight **55** and/or the heel **35**, as needed, may be provided with set screws, the screws being adjustable in respectively different directions. I have illustrated two such screws in a front-and-back vertical plane through the center of the translating device: a horizontally arranged screw **57**, primarily for fine adjustment of the displacement of the center of gravity rearwardly from the pivot rods **24**; and a vertically arranged screw **58**, primarily for fine adjustment of the vertical position of the center of gravity.

Before the determination of the requirements for a weight such as **55** the translating device **30** must of course be otherwise complete. The illustrated translating device includes, in addition to components already described, a pair of fine coiled conductors **29** connecting the translating unit **31** with electrical work circuits for supplying oscillations to and/or receiving them from that unit; a pin **49** projecting upwardly from the nose **36***a* of the rim **36**; a pair of damped vibration absorbers **60** and **60'**; and a front casing **65** enclosing the absorbers. One of the absorbers has been provided for the suppression, in recordation, of a rise in response and of spurious oscillation tendencies both occurring at that low frequency whereat the effective mass of the translating device **30** as seen at the recording stylus **51** resonates with the dynamic compliance of the record (i. e., the restoring force developed on the recording stylus per unit penetration into the moving record). The other of the absorbers has been provided for the suppression, in reproduction, of the rise in response at that also low (though usually distinct from the last-mentioned) frequency whereat the effective mass of the translating device **30** resonates with the effective compliance of the coupling means for the reproducing stylus **52** (e. g., of the holder extension portion **50***c*). These absorbers are cantilever-mounted to the lower portion of the clamping plate **41**; each may be of the general form disclosed in my co-pending application, Serial No. 149,861, filed June 23, 1937, now Patent No. 2,177,692, issued October 31, 1939, wherein an absorber was shown particularly for the first of the two above-mentioned functions.

The description of the translating device **30** having been completed, attention may be directed to the illustrated means for selectively positioning the cradle **10** and hence selectively conditioning the translating device for recordation and reproduction. These means may include a tension spring **70** biasing the cradle to a rearward or recording position; this spring may be terminally secured between an ear **7***b* downhanging from the rear of the carriage side frame portion **7***a* and an ear **13***b* downhanging from the cradle side portion **13** near its rear extremity. These means may further include a lever **71** for moving the cradle forwardly against its bias; this lever may be a vertical one, journalled about

the upper cylindrical carriage cross-member 8 and held centrally thereof by cylindrical bushings 12 encircling the cross-member 8 between the lever and each of the carriage side frames 6 and 7. At its top extremity the lever 71 may be provided with a knob 73; at its lower extremity, which may be at approximately the elevation of the bottom of the carriage, the lever may be widened in a front-and-back direction and provided with upwardly extending front recess 74, central recess 75, and rear recess 76. A detent to engage these recesses may be provided by a cylindrical cross-member 77, supported as a forwardly extending bail from ears 6c and 7c downhanging from the central portions of the carriage side frame portions 6a and 7a, and upwardly biased as by tension spring 78 between it and a pin 79 secured in the carriage side frame 7 thereabove. The cradle 10 is provided with a bracket 80 extending forwardly from its forward cross-portion 11, and carrying a horizontal transverse pin 81 which extends in front of the lever 71 a little above the lower extremity of the lever. When the knob 73 occupies a forward position and the detent 77 engages the front recess 74, the cradle is permitted to occupy its rearward position—the recording position shown in Figure 3. When the knob 73 is moved somewhat rearwardly so that the central recess 75 is engaged by the detent 77, the lever 71 moves forwardly the pin 81 and hence the cradle 10, to an intermediate position illustrated in Figure 4. When the knob 73 is moved still further rearwardly so that the rear recess 76 is engaged by the detent 77, the lever 71 moves further forwardly the pin 81 and hence the cradle 10, to the reproducing position illustrated in Figure 2.

The intermediate cradle position illustrated in Figure 4 is a "neutral" position, wherein it is desirable that both styli be disengaged from the record. Accordingly there may be provided means, operated by the lever 71 when the knob 73 and the lever are in their central or neutral positions, for moving forwardly the pin 49 at the top of the translating device and thus effecting stylus disengagement from the record. This means may include an arm 82, pivoted to an ear 6b extending rearwardly from an intermediate point on the vertical portion of carriage side frame 6; extending upwardly from its pivot to the elevation of pin 49 and being there folded over and provided with a relatively large diamond-shaped aperture 83 surrounding the pin (see Figure 2a); extending forwardly from its pivot and having the portion 84 folded toward the lever 71; and terminating near the lever in an upwardly directed cam 85 disposed in a front-and-back vertical plane. The forwardly extending portion of the arm 82 is biased upwardly as by tension spring 87 terminally secured between it and a pin 88 secured in the carriage side frame 6 thereabove. A pin 86 is secured in the lower portion of the lever 71 to extend leftwardly therefrom toward the cam 85. The relative positions of the pin 86 and cam 85 are such that when the lever knob 73 is in its rearward position the front surface of the cam, and when the knob is in its forward position the rear surface of the cam, will be in contact with the pin; and the arm 82 is so formed that under either of these conditions the sides of the aperture 83 will in no way interfere with stylus engagement with the record. As the lever 71 is moved to its central or neutral position, however, the pin 86 will ride up to the top of the cam 85, forcing the cam downwardly and hence moving forwardly the upper portion of the arm 82; the pin 49 will be engaged in the rear apex 83a of the aperture 83 and moved forwardly, centralizing the translating device 30 from side to side and lifting the styli from the record.

It may here be noted that while the reproducing stylus 52 is centered in the translating device, the recording stylus 51 and the boss 50b in which it is held are offset slightly in the direction toward which the carriage is caused to travel; accordingly if the apparatus has been used to reproduce to the end of matter already recorded on a record, its readjustment by knob 73 for further recordation on the record will be certain to engage the recording stylus with a fresh record portion.

When the knob 73 is in its rearward or reproducing position and the cradle 10 accordingly in its forward position, the rocker system and with it the entire translating device are free to rotate about the rocker system pivot rods 22, providing the requisite freedom of movement of the reproducing stylus 52 in an arc on the record essentially parallel to the path of the carriage. Since the center of gravity of the translating device during reproduction is always approximately at or slightly below the elevation of the pivot rods 24, and since this elevation is slightly below that of the rocker system pivot rods 22, the center of gravity during reproduction is always definitely below the rocker system pivoting. Further, not merely because the rocker system is small relative to the translating device, but in any event because the center of gravity of the rocker system is itself (by virtue of its illustrated and described configuration) below the line of rocker system pivoting, the center of gravity of the translating device and rocker system, taken together, is likewise definitely below the rocker system pivoting. It is by virtue of this arrangement that the simple action of gravity on the entire translating device lightly biases the reproducing stylus to a mean position within its arc of free movement. For the precise adjustment of this mean position the center of gravity of the translating device may be adjusted horizontally parallel to the carriage path; and for effecting this adjustment I have shown in the heel 35 of the translating device frame 32 a pair of horizontally aligned screws 59, one on each side of the center of the heel.

When the knob 73 is in its central or neutral position and the cradle 10 accordingly in its central position, the rocker system and translating device are still left free to rotate about the rods 22; but the gravity-caused engagement of pin 49 in the aperture apex 83a in arm 82 then insures a definite centralization of the translating device from side to side.

When the knob 73 is in its forward or recording position and the cradle 10 accordingly in its rearward position, the then desirable elimination of freedom of stylus movement parallel to the carriage path may be effected by then automatically locking the rocker system against rotation about its pivot rods 22. The means for performing this locking may comprise the locking rods 26 already described as a part of the rocker system 20, the spring 70 already described, and two cam surfaces 90 respectively carried by the carriage side frame portions 6a and 7a—against which surfaces the spring 70, acting through the cradle 10, forces the locking rods 26. These cam surfaces may comprise the respective lower edges of respective lug portions 91 extending upwardly and forwardly from the rear of the side frame portions 6a and 7a, respectively. It will be understood that these

surfaces 90 are so positioned relative to the other components that, in a forward movement of knob 73 and accompanying rearward movement of the lower portion of lever 71, the locking rods 24 will be locked against the cam surfaces 90 and the cradle 10 so established in its recording position just before the detent 77 fully engages the front recess 74; this has been indicated by the minute spacing of pin 81 in front of lever 71 in Figure 3.

While I have illustrated and described my invention in terms of a preferred embodiment thereof, it will be understood that I intend no unnecessary limitations by virtue of the details of that embodiment, as there will be readily suggested to those skilled in the art various modifications, many of them wide, which may still lie within the true spirit and proper scope of the invention. In many of the appended claims I undertake to express that scope broadly, subject however to such proper limitations as the state of the art may impose.

I claim:

1. In a phonograph including means for supporting a record and a carriage movable in a path adjacent the record: the combination of a rocker system pivoted in the carriage along a substantially horizontal axis transverse to said path; a translating device pivoted to said rocker system below said axis and having a portion adjacent the record; and a record-engaging stylus included in said portion of the device, said device during the engagement of said stylus with the record having a center of gravity at approximately the elevation of, and displaced toward the record from, the line of pivoting of said device.

2. In a phonograph including means for supporting a record and a carriage movable in a path adjacent the record: the combination of a rocker system pivoted in the carriage along a substantially horizontal axis transverse to said path; a translating device pivoted to said rocker system below said axis and having a portion adjacent the record; and a record-engaging stylus included in said portion, said device during the engagement of said stylus with the record having a center of gravity at approximately the elevation of the line of its pivoting, and said device extending principally vertically upwardly from said line to said stylus.

3. In a phonograph including means for supporting a record: the combination of a translating device having mounting pivots supporting it with the upper portion of the device adjacent the record; a pair of vertically displaced styli included in said upper portion of the device, said portion being biased toward the record whereby to bring one of said styli into engagement with the record, and said styli being principally vertically disposed above the axis of said pivots when either is in such engagement; and means connected with said pivots for moving them in a substantially horizontal direction, whereby to rock said device about said pivots and thereby control the stylus engagement with the record selectively as to the two styli.

4. In a phonograph including means for effecting movement of a record: the combination of a translating device having mounting pivots supporting it with a portion of the device adjacent the record; a pair of styli included in said portion, said styli being displaced, in the direction of the record movement adjacent them, from each other and from the axis of said pivots, and said portion being biased toward the record whereby to bring one of said styli into engagement with the record; and means connected with said pivots for moving them transversely to said direction, whereby to rock said device about said pivots and thereby control the stylus engagement with the record selectively as to the two styli.

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