June 1, 1943. C. W. DANN 2,320,572

PHONOGRAPH

Filed May 1, 1940 3 Sheets-Sheet 1

Fig. 1

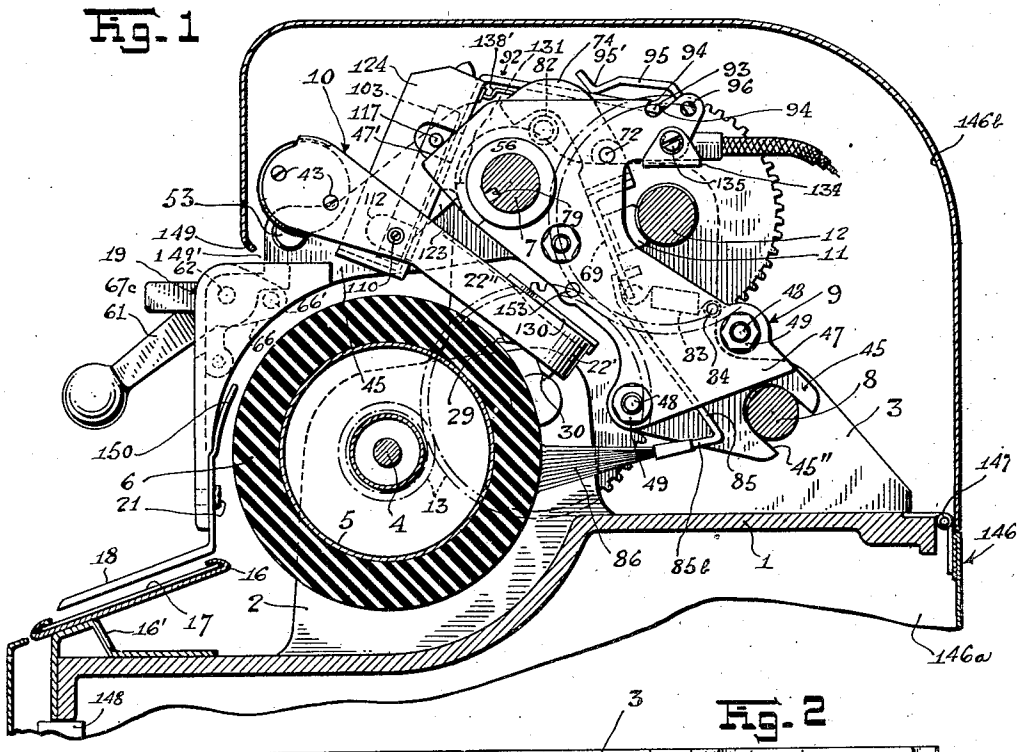
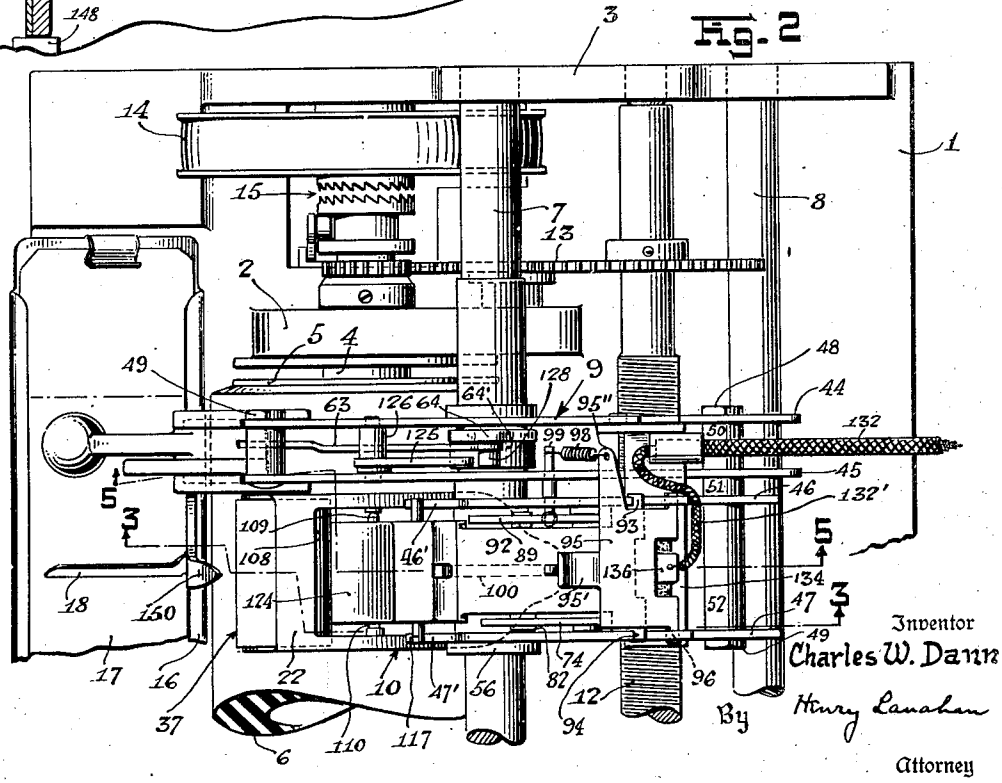


Fig. 2



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Fig. 3

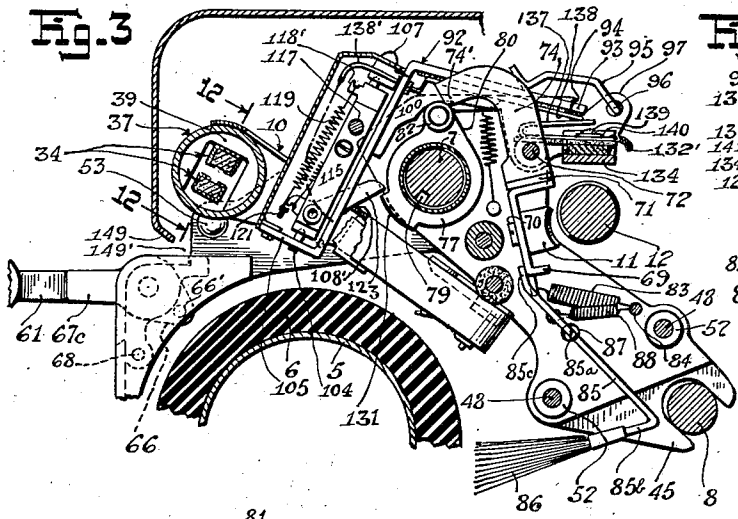


Fig. 4

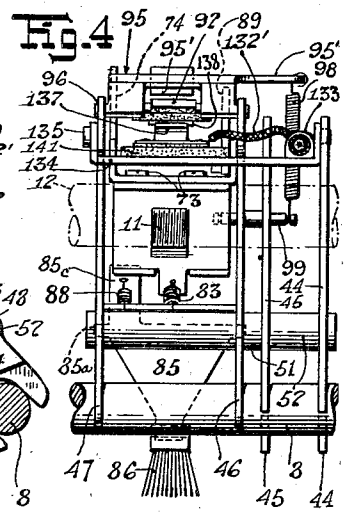


Fig. 5

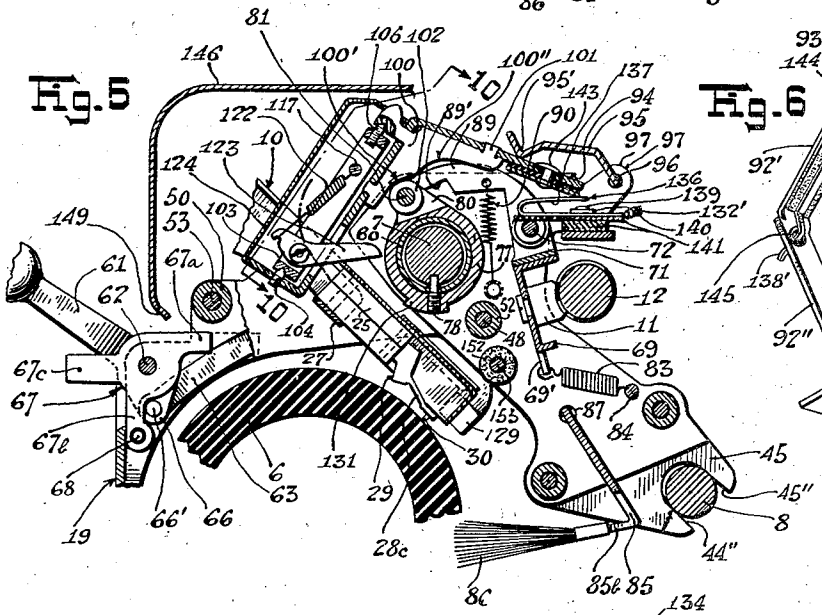


Fig. 6

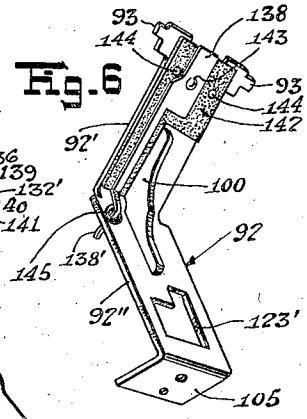
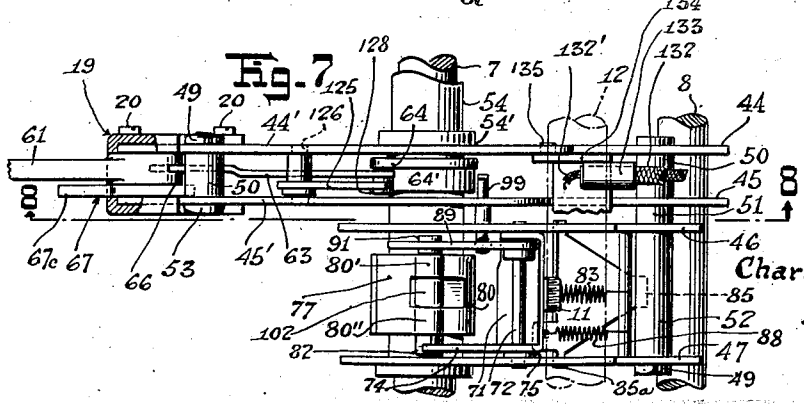


Fig. 7



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Fig. 8

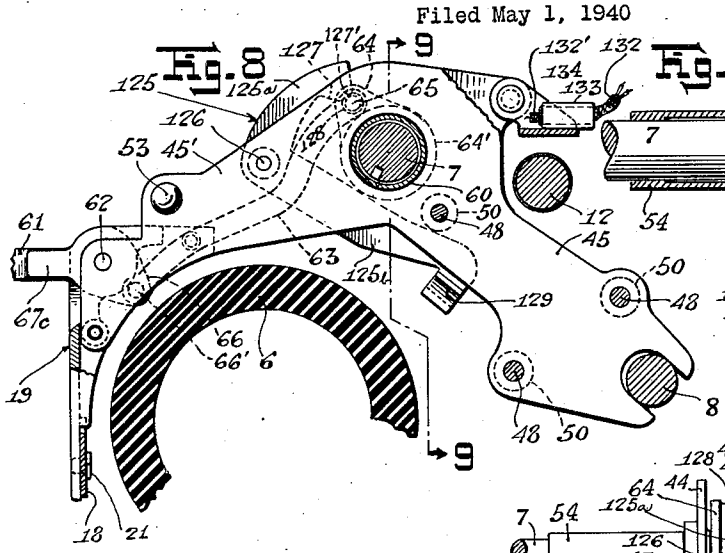


Fig. 9

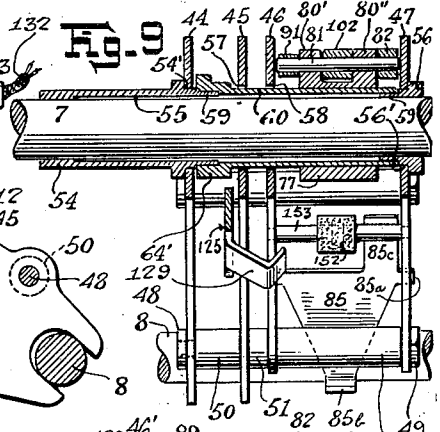


Fig. 10

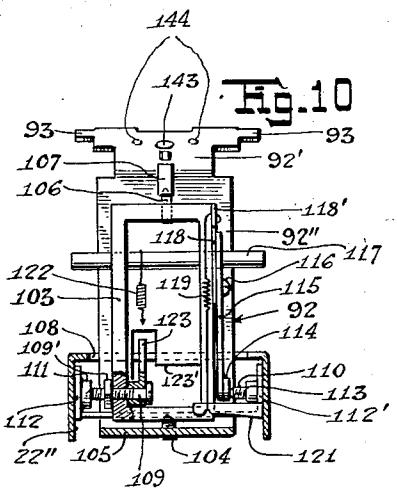


Fig. 11

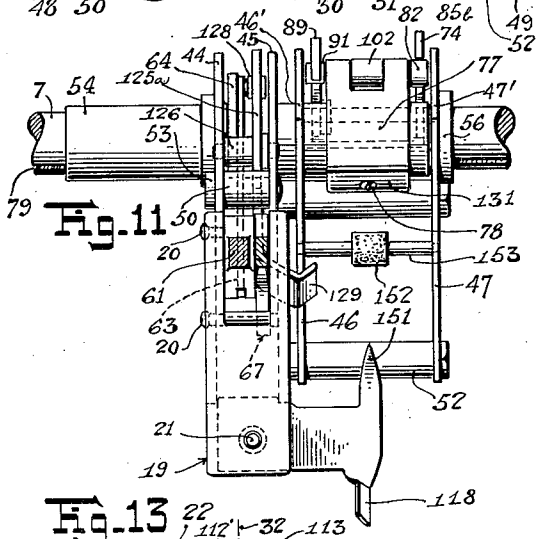


Fig. 12

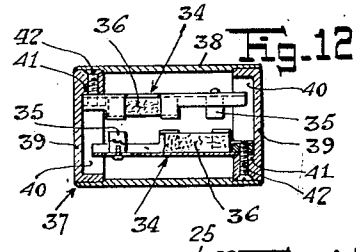


Fig. 13

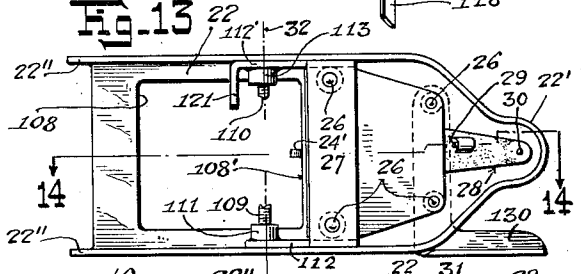


Fig. 14

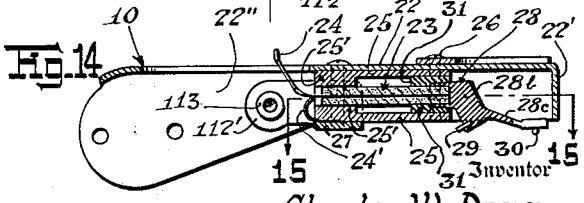
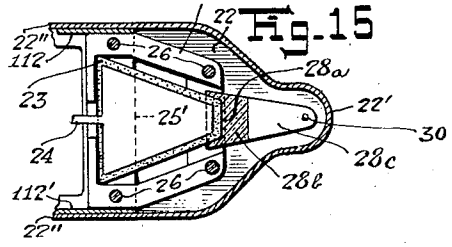


Fig. 15



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Patented June 1, 1943

2,320,572

UNITED STATES PATENT OFFICE

2,320,572

PHONOGRAPH

Charles W. Dann, East Orange, N. J., assignor to Thomas A. Edison, Incorporated, West Orange, N. J., a corporation of New Jersey

Application May 1, 1940, Serial No. 332,722

19 Claims. (Cl. 179—100.4)

This invention relates to phonographs and to an improved arrangement of a phonograph with its cabinet, and is especially concerned with the provision of an improved carriage for phonographic translating devices and with improved mechanism for adjusting such translating devices in relation to a record.

The invention has especial significance and is herein illustrated and described, in connection with phonographs of the commercial type which employ cylindrically-shaped records; but it will be understood that no unnecessary limitation of my invention to phonographs of this type is intended. In some respects this invention has certain features in common with those disclosed and claimed in my copending application, Serial No. 215,754, filed June 25, 1938, and entitled "Phonographs," and with a copending application of Michael J. Di Toro, Serial No. 187,388, filed January 28, 1938, entitled "Phonographs" and connected by common ownership with the present application.

Commercial phonographs of the dictating machine type are usually so constructed as to be selectively operable not only to record but also to reproduce in order that the operator during the operation of recording dictation may, following an interruption, be able to "listen-back" on previously recorded matter and pick up the run of his thoughts. Such reproduction of previously recorded matter involves both readjusting the translating device between recording, neutral and reproducing positions, and properly spacing the device along the record, both of which are usually manually effected. Particularly to facilitate the manipulating of the translating device in the reproduction of previously recorded matter, as well as in other normal operations of the machine, it is important that the phonograph be arranged so that the record be exposed to aid the operator in selectively positioning the device along the record with respect to recorded and unrecorded areas, and also that the controls for adjusting the translating device be carried with the latter to permit both readjusting the device and manually moving the same along the record by a simple manipulation of the hand. In addition, it is important that the arrangement of the phonograph be such as to provide a great measure of protection to the record and to working parts of the machine while the machine is in working condition.

It is an object of my invention to provide an arrangement of a phonograph with its cabinet wherein the desired objectives above stated are attained to an unusually high degree in a highly improved manner.

Another object of my invention is to provide a phonograph which is improved both in respect of the degree of its enclosure and the convenience of its arrangement.

Another object is to provide an arrangement of a phonograph wherein during the use of the machine all working mechanism is provided with a substantially complete enclosure for improved appearance and protection and the record is provided with a sufficient closure to protect the same from damage, and yet wherein the record and manipulatable parts are so exposed as to render the machine conveniently operable.

It is another object of my invention to provide a generally improved carriage for a phonographic translating device and particularly one adapted to a phonograph constructed in accordance with the above stated objects.

It is another object to provide improved means to permit easy detachment of the translating device from the carriage.

Another object is to provide, as in the case of an electrical-type translating device, simple means by which the electrical connections to the device are automatically made and broken upon mounting the device on and detaching the same from the carriage.

Another object is to provide improved mechanism for adjusting or conditioning a translating device in relation to a record. It is a feature of my invention that this adjusting mechanism shall operate to shift a combined recorder-reproducer unit between recording and reproducing positions in relation to a record without producing any dragging of the unit on the record.

Other objects of my invention lie in providing a compact arrangement and an economical construction of the component parts of the translating device, of the carriage for the device, and of the mechanism for adjusting the device in relation to the record.

Another feature of my invention lies in the provision of a carriage for supporting the translating device in relation to a cylindrical record, which comprises an assembly of cheaply constructed elements, such as stampings and screw machine parts; this carriage is provided with an arm projecting through an opening in the phonograph cabinet, which supports manipulatable controls on its outer end portion at a point that is adjacent to the record and spaced from the translating device both circumferentially and longitudinally of the record.

Other and allied objects and features of my invention will more fully appear from the following description and the appended claims.

In the description of my invention reference is had to the accompanying drawings, of which:

Figure 1 is a partial, right-hand view in vertical section of a phonograph and cabinet arranged in accordance with my invention, the parts of the phonograph being in the positions they occupy when the phonograph is conditioned for recording;

Figure 2 is a partial, top plan view of the structure of Figure 1, the cover being however removed;

Figure 3 is a partial, vertical section taken substantially along the line 3—3 of Figure 2 but showing the phonograph parts in the positions they occupy when the phonograph is in neutral or inoperative condition;

Figure 4 is a rear view of the structure of Figure 3;

Figure 5 is a partial, vertical section taken principally along the line 5—5 of Figure 2 but showing the phonograph parts in the positions they occupy when the phonograph is conditioned for reproducing;

Figure 6 is an enlarged view in perspective showing a part, in detail, of the means for connecting the translating device to the carriage;

Figure 7 is a partial, top plan view of the structure of Figure 3;

Figure 8 is a partial, vertical section taken substantially along the line 8—8 of Figure 7 but showing the parts in the positions they occupy when the machine is in neutral condition;

Figure 9 is a rearward vertical section taken substantially along the line 9—9 of Figure 8;

Figure 10 is a section view taken substantially along the line 10—10 of Figure 5 and showing the mechanism by which the translating device is mounted on the carriage;

Figure 11 is a partial, front elevation of the structure of Figure 2;

Figure 12 is a sectional view taken substantially along the line 12—12 of Figure 3;

Figure 13 is a bottom view of the translating device;

Figure 14 is a sectional view of the translating device taken substantially along the line 14—14 of Figure 13; and

Figure 15 is a partial, sectional view of the translating device taken substantially along the line 15—15 of Figure 14.

A phonograph incorporating my invention is shown in Figures 1 and 2, and comprises a frame in the form of a base plate 1 provided with an intermediate standard 2 and with left and right standards of which the leftward standard appears as 3. Journalled in the intermediate standard 2 is a shaft 4 for a mandrel 5 which is adapted to carry a cylindrical record 6 along the front part of the machine. Carried between the left and right standards abovementioned are rods 7 and 8 on which a carriage 9 for a translating device 10 is slidably mounted for movement along the record. A driven movement of the carriage, in a rightward direction along the record, is effected through the medium of a feed nut 11 on the carriage which, as hereinafter explained, is mounted for movement into engagement with a rotatable feed screw 12 that is journalled between the left and right standards. The feed screw 12 is coupled to the shaft 4 by means of a train of gears 13 so that the carriage may be driven simultaneously with a rotation of the record. The driving of the phonograph may be effected by any suitable motor, not shown, which may be coupled to a drive pulley 14; this pulley is journalled on the standard 3 at a point in line with the shaft 4 and is connectable, at will, to the shaft by means of any suitable clutch mechanism such as the mechanism 15. At the front of the record there is provided means to permit the operator to make annotations along the record as with respect to particular portions of recorded matter; such means may comprise any suitable holder 16 for an index or annotation slip 17 and a pointer 18 on the carriage which is extended transversely across the slip 17 to serve as a guide for a pencil or the like, the holder 16 being mounted on a bracket 16' supported by the base plate 1 and the pointer 18 being held to the carriage in the manner hereinafter explained.

It will be understood that my invention is particularly concerned with the construction and arrangement of the translating device 10 and of the carriage 9, and with the structural arrangement between these parts and other parts of the machine, wherefore the translating device and carriage are now described in detail.

The translating device 10 is a combined recorder-reproducer which is preferably of a unitary construction as shown in Figures 13, 14 and 15; this device comprises a housing 22 provided with a converging end portion 22' and with a flange 22'' extending along its sides to form a shell-like structure. In the housing near the converging end portion 22' there is provided the recorder-reproducer proper which, by way of example, is shown in the form of a trapezoidally-shaped piezo-electric bending unit 23 of the so-called "bimorph" type—i. e., a type wherein two thin crystals, say of Rochelle salts, are secured face-to-face and arranged for simultaneous voltage application thereto by way of leads 24 and 24' to cause one crystal to expand longitudinally as the other contracts, and vice versa, whereby to result in a bending of the unit. The bending unit 23 is cantilever-mounted between two similar trapezoidally-shaped shells 25 which are secured face-to-face and which are provided with base portions 25' of increased thickness that bear from opposite sides against the base portion of the bending unit, leaving the remaining portion of the unit free for vibration in accordance with electrical oscillations impressed across the leads 24 and 24'. The assembly of the shells 25 and bending unit 23 is held together and secured to the housing 22 by four screws 26 which are located beyond the bending unit at the corners of the shells. Each of these screws pass freely through the top of the housing and through the upper one of the shells 25; the two screws at the free end of the unit then thread into the lower one of the shells 25 while the other two screws, the ones at the base portions of the shells, also pass freely through the lower one of the shells 25 and then thread into a metal plate 27 so as to clamp the assembly against the top of the housing.

At the free end of the bending unit 23 there is provided a unitary holder 28 for recorder and reproducer styli 29 and 30. This holder comprises a cup-shaped portion 28a fitting the free end of the bending unit and secured thereto as by cementing, a stiff main portion 28b rigidly securing the recorder stylus 29 to the free end of the bending unit, and a flexible fin-like portion 28c extending from the main portion 28b longitudinally of the housing 22 and adapted to resil-

iently connect the reproducer stylus 30 to the free end of the bending unit. The holder 28 may be suitably moulded of plastic material such as that known commercially as "Lucite." A material of this kind exhibits both elastic and damping properties each of which are utilized to great advantage in the present instance in that, through the simple means of the fin-like portion 28c, there is provided both a complaint and a resistance (or damped) coupling of the reproducer stylus to the free end of the bending unit, the damping of this coupling being highly valuable in that it serves to mitigate resonance effects in the translating device and to thereby render the response characteristic of the translating device more uniform.

For the purpose of suppressing or mitigating resonance effects of the bending unit itself, and for safeguarding the bending unit from excessive strain or breakage such as may be occasioned by improper handling of the translating device, there is provided a pair of resilient pads 31, made for example of rubber, which are interposed at the free end portion of the bending unit between the unit and the upper and lower shells respectively.

For the purpose of suppressing or mitigating undesired resonance or vibration of the translating device as a whole relative to its support—the device being pivoted to its support about an axis 32 (see Figure 13) as is hereinafter fully explained—there is provided, at the end of the housing 22 remote from the recorder proper, a damped vibration absorber in the form of a pair of cantilever-type beam structures 34, shown in Figure 12. A damped vibration absorber of this type has been described and claimed in a copending application of Michael J. Di Toro, Serial No. 311,325, filed December 28, 1939, and entitled "Oscillation translating systems." The absorber proper may in the present instance be sufficiently described by the statement that the beam structures 34 are predeterminately tuned and each provided at their free end portions with a localized mass 35 and along their intermediate portions with a damping material 36 which may typically be that known commercially as Du Pont "Viscoloid." Since damping materials such as "Viscoloid" are subject to deterioration when exposed to the atmosphere it is important that the beam structures be housed within a hermetically sealed chamber. I provide simple means for so housing the beam structures and for supporting the same in highly compact arrangement. This means comprises a cylindrical container 37 which is adapted to fit longitudinally between the side flanges 22'' of the housing 22 and which has as its components a tubular casing 38 and identical circular walls 39 that are fitted and hermetically sealed as by cementing into the ends of the casing. These end walls are provided at their inner faces with recesses 40 forming bases 41 offset from the center of the end walls on which the beam structures 34 are respectively clamped by screws 42. The end walls are, however, oriented 180° from each other about the longitudinal axis of the container so that the beam structures will clear one another and have their movements commonly directed; also the container as a whole is oriented relative to the housing so that the direction of the movements of the beam structures will be substantially tangential to a circle through the beam structures about the axis 32, in which oriented position the container is held by screws 43 which pass through the side flanges 22'' to thread into the end walls, as shown in Figure 1.

The carriage 9 which supports the translating device 10 and the mechanism for adjusting the device relative to the record is in the form of an assembly of relatively simple parts—i. e., parts which are cheap to manufacture such as stampings, die castings and screw-machine parts. The carriage has for its frame four flat plates which may be sheet metal blanks and which appear from left to right as 44, 45, 46 and 47. The adjacent plates 44 and 45 are identical in shape, and so are the adjacent plates 46 and 47, but the first pair 44 and 45 are different in shape from the second pair 46 and 47, principally in that they are respectively provided with forwardly extending arms 44' and 45' curved to conform to the record 6 circumferentially thereof; these arms serve as a means to support manipulatable controls at a remote end portion of the carriage and at a place spaced circumferentially of the record from the translating device, as is hereinafter more fully explained. The plates are held parallel to one another in fixed spaced relationship by three identical rods 48 having nuts 49 threaded on their outer end portions which press the plates together against spacers 50, 51 and 52 provided on each of the rods 48 respectively between the plates 44 and 45, 45 and 46, and 46 and 47, as shown for example in Figure 7. Also holding the plates 44 and 45 together, at their arms, is a bolt 53 having a nut such as 49 at its outer end which clamps the arms together against a spacer on the bolt such as 50.

The carriage 9 is supported on rods 7 and 8 directly above the record in a position wherein the arms 44' and 45' extend forwardly of the machine about and to the front of the record, as shown in Figure 1, and is slidably mounted on the rods for movement along the record. The slidable mounting of the carriage on the back rod 8 is achieved by merely providing slots 44'' and 45'' in the rear end portions of the plates 44 and 45 into which the rod 8 slidably fits; the mounting of the carriage on the front rod 7 however comprises a long leftwardly extending sleeve 54 which is staked as at 54' to the central portion of the leftward plate 44, and a bushing 56 which is staked as at 56' to the rightward plate 47 at a point axially in line with the sleeve 54 (see Figure 9). This sleeve and bushing slide on the rod 7, the intermediate plates 45 and 46 being provided with enlarged openings 57 and 58 through which the rod extends. In order that the place of bearing of the sleeve 54 on the rod will be localized at the outer end portion of the sleeve and be widely spaced from that of the bushing 56, the sleeve 54 is made quite long and is counter-bored as at 55 from its inner end; such limited and widely spaced bearings of the carriage on the rod provide a free and positively guided movement of the carriage.

The inner end portions of the sleeve 54 and bushing 56 are reduced in diameter to provide left and right bearings 59 for an operating sleeve 60, as shown in Figure 9. This sleeve extends freely through the openings 57 and 58, in the plates 45 and 46, and surrounds the carriage support rod 7, there being however a substantial clearance between the bore of the sleeve and the rod. This operating sleeve is controlled by a control lever 61 which is pivoted on a pin 62 between the front portion of the carriage arms 44' and 45'. The control lever 61 is operatively con-

nected with the operating sleeve 60 by means of a link 63 extending along and between the carriage arms 44' and 45', the link being pivotally connected at its rearward end to an arm 64 of a collar 64' on the left end of the sleeve by means of a stud 65 riveted to the arm, and being fitted at its forward end between the fingers of a short bifurcated arm 66 on the control lever and pivoted to that arm by a pivot pin 66'. The control lever 61 has a central or neutral position—which is the position occupied by the lever in Figure 3—and extreme or terminal positions below and above its neutral position—which are the positions occupied by the lever in Figures 1 and 5 respectively. These lower and upper terminal positions, which are hereinafter respectively referred to as the recording and reproducing positions of the control lever, are defined respectively by the contact of a rightward extension of the pivot pin 66' with rearwardly and downwardly extending lugs 67*a* and 67*b* of a stop member 67 which is interposed between the control lever and the carriage arm 45' as shown in Figures 5 and 7, the stop member being carried on the pivot 62 for the control lever and being held from turning about this pivot by a short pin 68 connecting the lower leg 67*b* of the stop member to the carriage arm 45'. On the stop member 67 is a finger 67*c* which is in line with the neutral position of the control lever 61; this finger is provided as an aid in locating and manipulating the control lever 61.

When the control lever 61 is shifted from recording to reproducing positions, and vice versa, the link 63 is moved to turn the operating sleeve about the bearings 59 in counter-clockwise and clockwise directions respectively, through an angle of approximately 60°. The turning of the operating sleeve is utilized principally to shift the feed nut 11 into and out of engagement with the feed screw 12 and to place the translating device into inoperative condition and respective operative conditions for recording and reproducing. The means for causing the shifting of the feed nut by the turning of the operating sleeve is now explained.

Reference being had to Figures 3, 4, 5 and 7, in particular, it will be seen that the feed nut 11 is suitably secured to a bracket 69, as by a screw 70, and that this bracket is carried between the plates 46 and 47 rearwardly of the support rod 7 by means of a bail 71 pivoted on a rod 72 bridging the plates, the connection between the bracket and the bail being made by means of screws 73. The bracket 69 is biased rearwardly, to normally maintain engagement of the feed nut with the feed screw, by means of a tension spring 83 connected between the lower end 69' of the bracket and a rod 84 bridging the carriage plates 46 and 47. The operative connection between the bail and the operating sleeve 60 comprises a cam arm 74 on the right end of the bail; this arm extends forwardly adjacently of the carriage plate 47 into a position above the sleeve 60, but is held free from the plate 47 by means of a spacer 75 provided on the rod 72 between the right end of the bail and the plate. On the sleeve 60 substantially midway between the plates 46 and 47 there is provided a wide collar 77 which is secured to the sleeve by means of a set screw 78. On the collar 77 there is provided an arm 80 which for reasons hereinafter explained is bifurcated to terminate into left and right fingers 80' and 80''. These fingers carry a rod 81 which extends longitudinally of the sleeve substantially through the distance of spacing between the plates 46 and 47. On the right end of the rod 81, between the finger 80'' and the plate 47, is a roller 82 which is adapted to cooperate with a V-shaped tooth 74' on the arm 74. When the control lever 61 is in recording and reproducing positions the roller 82 is respectively on opposite sides and out of contact with the tooth 74' to permit the feed nut to be maintained in engagement with the feed screw in response to the action of the biasing spring 83, but as the control lever 61 is moved from either recording or reproducing position to neutral position the roller 82 impinges against the tooth 74' and rocks the bail 71 in a clockwise direction to disengage the feed nut from the feed screw.

In order that the support rod 7 will be rotatably coupled to the operating sleeve 60 so as to serve as a means of coupling the control lever 61 to stationary parts of the machine (not shown) the rod 7 is suitably pivotally mounted on the left and right standards of the base plate 1 and provided along its length with a slot 79 which is slidably engaged by the set screw 78.

Positioned between the carriage plates 46 and 47 near the former and pivoted on the rod 72 is a detent lever 89 which cooperates with the operating sleeve 60 so as to yieldably retain the control lever 61 in its recording, neutral and reproducing positions respectively. This detent lever extends forwardly from its pivot axis over the operating sleeve in much the same manner as the cam arm 74 above described, and is biased downwardly by a tension spring 90 into contact with a roller 91 carried on the rod 81 between the plate 46 and the finger 80'. In the detent lever 89 is a V-shaped notch 89' which registers with the roller 91 when the control lever 61 is in neutral position so as to yieldably retain the control lever in this position. As the control lever is moved from neutral to either of its terminal positions—i. e., to recording or reproducing positions as defined by the contact of the pivot pin 66' with stop member 67—the roller 91 is first moved out of engagement with the notch 89' by the turning of the operating sleeve but thereafter the sleeve is urged by the downward biasing of the detent lever, in the direction of its turning to bias the control lever into whichever terminal position it is being moved.

Positioned between the lower rearward portion of the carriage plates 46 and 47 is a holder 85 for a chip brush 86, as shown in Figures 3 and 9. This holder may comprise a triangular plate having trunnions 85*a* on opposite corners engaging holes 87 in the plates 46 and 47, to form a pivotal connection of the holder to the carriage, and also having a turned-over nose 85*b* at the other or lower corner on which is fitted the chip brush 86. This holder is biased by a tension spring 88 connected between an upwardly extending arm 85*c* on the holder and the rod 84 to normally maintain the brush 86 in contact with the record; however, when the control lever 61 is moved to neutral position the holder is rocked, by the impingement of the feed nut-carrying bracket 69 with the arm 85*c*, to move the brush away from the record.

On the front of the carriage arms 44' and 45' there is fitted a nosepiece 19 which is secured to the left arm 44' by means of screws 20. This nosepiece extends downwardly from the control lever along the front of the record and carries the pointer 18, above described, the pointer being secured to the nosepiece as by means of a screw 21.

The translating device 10 is connected to the carriage 9 by means of a support link 92 which is in the form of a flat strip having portions or legs 92' and 92'' bent approximately at right angles to each other, as shown in Figures 1, 3 and 6. This support link is held between the plates 46 and 47 of the carriage in position wherein the legs 92' and 92'' respectively extend rearwardly over the operating sleeve 60 and downwardly along the front of this sleeve. The support link is pivoted to the carriage by means of trunnions 93 at the rear end of the leg 92' which engage notches 94 in the upper part of the plates 46 and 47. Overlying the rearward portion of the leg 92' is a flap 95 which is pivoted as at 96 to ears 97 provided on the plates 46 and 47 as at a point just behind the notches 94. This flap has a forwardly extending and downwardly curved tail member 95' adapted to contact the leg 92' centrally thereof, and is urged downwardly to bear against the leg 92' by means of a tension spring 98 connected between a leftwardly extending arm 95'' (see Figure 2) on the flap and a pin 99 on the carriage. This bearing of the flap against the support link serves to hold the link in place on the carriage. The flap 95 may however be manually moved upwardly, at will, so as to permit the trunnions 93 to be removed from the notches 94 and the link to be thereby detached from the carriage.

The link 92 is angularly controlled, as is hereinafter explained, by means of the operating sleeve 60, the operative connection between the sleeve and link comprising a cam plate 100 (see Figure 5) fitting the vertex between the legs 92' and 92'' and riveted to the link as at 101, and a roller 102 (see Figures 9 and 11) on the rod 81 between the fingers 80' and 80'' on which the cam plate rests.

The translating device is supported, for universal movement as hereinafter explained, by the support link 92 through the medium of a rectangular frame 103 shown in Figures 3 and 10. This frame is carried by the support link along the front of the leg 92'' and is pivotally connected to this leg about a vertically inclined axis normal to the longitudinal axis of the record. The pivotal connection between the frame and the leg 92'' comprises a pivot pin 104 carried by a forwardly extending lug 105 at the lower end of the leg 92'' and engaging the lower side of the frame, and a pivot screw 106 threaded through the upper side of the frame to engage a forwardly extending arm 107 at the upper end portion of the leg 92'', which arm may be an integral part of the cam plate 100 above described.

The frame 103 extends downwardly through an opening 108 in the top of the housing 22 of the translating device and is pivotally connected to the housing at a point therewithin as shown for example in Figures 3 and 10. This pivotal connection comprises left and right pivot screws 109 and 110 disposed in the axis 32 through the center of gravity of the translating device (see Figure 13). The pivot screw 109 is threaded through the lower portion of the left side of the frame to engage an inwardly projecting boss or bearing 111 on the housing 22, this bearing being carried by a strip 112 bent over along the side flange 22'' of the housing from the plate 27 as shown in Figure 13, and the pivot screw being locked in its threaded position by means of a lock nut 109' bearing against the frame. The right pivot screw 110 is threaded through a boss 113 which is provided on the right side of the housing 22 directly opposite the boss 111 and which is carried by a strip 112' bent over from the plate 27 such as the strip 112; this pivot screw engages a resiliently mounted bearing on the frame 103 in the form of a drilled boss 114. This boss is carried at the lower or free end of a spring arm 115 secured to the upper portion of the right side of the frame 103 by a screw 116 and a rod 117 (hereinafter explained) which extends laterally through the frame, the spring being disposed along the right side of the frame 103 and being spaced therefrom by means of a spacer 118 between the frame and the spring at the base of the latter. The reason for the resilient mounting of the bearing 114 is to obtain a freely pivoted connection of the translating device to the frame 103 without requiring a critical adjustment of the pivot screws 109 and 110 in relation to their bearings.

It is seen that the translating device is supported for universal motion in relation to the record in that the device has two degrees of freedom: a freedom of motion about an axis parallel to the record axis—i. e., about the pivots 109 and 110—and a lateral freedom of motion about an axis normal to the record axis—i e., about the pivots 104 and 106. The first freedom of motion here mentioned is obviously necessary to permit the device to freely follow the surface of the record during recording and reproducing and also to permit the translating device to be placed into and out of engagement with the record—i. e., into operative and inoperative positions in relation to the record. The lateral freedom of motion of the device is necessary to permit the reproducer stylus to freely track or follow the groove in the record during reproducing. To aid the device in tracking the record the device is centrally biased in relation to its lateral freedom of movement. This is accomplished gravitationally by inclining the axis through the pivots 104 and 106 rearwardly, displacing the same ahead of the center of gravity of the device and then supporting the device on the record in a downwardly inclined position, all as shown in Figure 5.

In order that the biasing of the translating device towards the record about the pivots 109 and 110 will not be critical with respect to vibrations of the machine no inertia biasing is employed; instead the device is pivotally supported about the axis 32 through its center of gravity and is biased about this axis wholly by spring means. These spring means are connected between the translating device and the pivotally mounted frame 103 in order that the biasing of the device on the record will be independent of the lateral motion of the device about the pivots 104 and 106. Also this biasing means is arranged so that it may be differentiated between two predetermined limits; this is done in order that a different (or smaller, as in the present instance) biasing of the device may be obtained for recording than for reproducing.

A biasing means fulfilling the objectives just stated may well comprise two separate biasing units, one of which is effective all the time and the other of which may be rendered effective and ineffective as desired. The constantly effective biasing unit may consist merely of a tension spring 119 connected at one end to the frame 103 as on a hooked arm 118' on the spacer 118 and at the other end to a lug 121 turned over from the strip 112' (see Figures 3 and 10). The controllable biasing unit may comprise a tension spring 122 also connected at one end to the frame 103, as on the rod 117, but connected at the other end to one arm of a bell crank lever 123 which is

pivoted on the pivot screw 109, the other arm of the lever being extended rearwardly through an opening 123' in the support link 92 and out of the opening 108 in the housing 22 so as to bear against this housing at the rearward edge 109' of the opening 108, as shown in Figure 5. To render this second biasing unit ineffective it is only necessary to turn the bell crank lever 123 about its pivot out of contact with the housing 22; this is done automatically as an incident of placing the translating device in position for recording as is hereinafter explained. A cover 124 is provided over the frame 103 and biasing units above described, being hooked on the arm 107 at the top and fitted on the lug 105 at the bottom, as shown in Figures 1 and 3.

The placing of the translating device into neutral, recording and reproducing positions is effected by suitably rocking the device about its pivots on the frame 103 so as to cause a selected one of the styli 29 and 30 to be moved into and out of engagement with the record, and by rocking the support link about its pivots on the carriage to selectively move the styli into position for engagement with the record. The rocking of the translating device about its pivots on the frame is effected by means of a lift lever 125 which is pivoted between the plates 44 and 45 on a short rod 126 bridging the intermediate portion of the arms 44' and 45' of these plates, as shown in Figures 7 and 8. This lift lever is in the form of a bell crank, being provided with a short, upwardly projecting arm 125*a* and with a rearwardly extending lift arm 125*b*. The terminal portion of the arm 125*a* is provided with a cam 127 which is biased into contact with a roller 128 on the stud 65 by the weight of the lift arm 125*b*; the lift arm 125*b* is provided at its terminal end with a laterally projecting lift finger 129 adapted to engage a side fin 130 on the translating device to lift the device from the record, the fin 130 being secured to the housing of the translating device by the screws 26 aforementioned and the finger 129 being V-shaped so as to centralize the translating device each time it lifts the device from the record. The rocking of the support link 92 about its pivots on the carriage is effected by the turning of the operating sleeve 60 through the camming action between the roller 102 and the cam plate 100 as is presently explained.

It is important that when the translating device is shifted between neutral and respective operative positions for recording and reproducing that there occur no dragging of the styli on the record, particularly of the recorder stylus, as such dragging may mar the surface of the record to cause the recordation of extraneous noises. To avoid such dragging of the styli on the record I cause the support link 92 to be held angularly stationary and the translating device to be moved into and out of contact with the record by the lift lever 125 as an incident of the movement of the control lever 61 into and out of its terminal positions, the support link being swung about its pivots on the carriage and the lift lever being retained in a raised position during the movement of the control lever through the central portion of its travel between terminal positions. This action is effected in the manner now explained.

During the movement of the control lever 61 out of reproducing position the support link 92 is caused to be held angularly stationary, by reason of the forward cam face 100' of the cam plate 100 (the part of the cam plate then contacted by roller 102 as shown in Figure 5) being curved about the axis of the operating sleeve 60 as a center, but the lift lever 125 is at this time being raised, by the contact of the roller 128 with the cam 127, to cause the reproducer stylus 30 to be moved out of engagement with the record. During the movement of the control lever 61 through the central portion of its travel towards recording position the support link is permitted, because of the inclined cam face 100'' on the cam plate 100, to swing downwardly in response to its biasing until the recorder stylus is moved in a position in line for engagement with the record, this position being defined by the impingement of the opposite ends of the cross rod 117 of the frame 103 against the forward inclined edges 46' and 47' of the plates 46 and 47 of the carriage (see Figure 2); now however, the lift lever is held stationary in raised position by the contact of the roller 128 with the dwell 127' on the cam 127 (see Figure 8). During the movement of the control lever 61 into recording position the support link is yet held angularly stationary by the contact of the cross rod 117 with the carriage (the roller 102 having been withdrawn from the cam plate 100) but now the lift lever 125 is lowered, as the roller 128 moves off the dwell 127' of the cam 127, to permit the translating device to be moved by gravity to bring the recorder stylus into engagement with the record. When the control lever 61 is shifted from recording to reproducing position this process is reversed, the translating device being first rocked about its pivoted connection to the frame to move the recorder stylus directly away from the record, the support link 92 being then swung upwardly to bring the reproducer stylus in a position in line for engagement with the record, and thereafter the lift lever 125 being lowered to permit the reproducer stylus to be brought into engagement with the record in response to the biasing of the translating device. A rubber roller 152 is provided on a pin 153 between the carriage plates 46 and 47 forms a resilient stop to prevent inertia overthrow and a consequent bouncing of the translating device on the lift lever 125, when the device is raised from the record.

In addition to the function of the cross rod 117 in limiting the downward swing of the support link 92, as by the impingement of the rod against the plates 46 and 47 of the carriage, this rod has the important function of holding the translating device against turning laterally of the machine about the pivots 104 and 106 while the translating device is in a position for recording. As the translating device is placed in position for reproducing, the cross rod 117 is however moved out of contact with the carriage to restore to the translating device its lateral freedom of movement.

In order that the biasing of the translating device towards the record will be differentiated, as between the recording and reproducing positions of the device, there is provided a shoulder 131 on the collar 77 which, as the operating sleeve 60 is turned by the movement of the control lever 61 into recording position, impinges against the bell crank lever 123 and moves the same out of contact with the housing 22 of the translating device, thereby rendering the spring 122 ineffective as a biasing means for the translating device. This leaves only the spring 119 hereinbefore described effective as a biasing means for

the translating device when the device is in recording position; however, as the device is placed in reproducing position the shoulder 131 is moved out of contact with the lever 123, by the turning of the operating sleeve 60, to restore the operative connection of the spring 122 with the translating device, thereby placing the translating device under the additive influences of both biasing springs 119 and 122.

The electrical connections, as from an amplifier not shown, to the translating device are made by means of a shielded single conductor cable 132 (see Figures 4 and 7) of which the shield of the cable is utilized as a ground connection to the device. The cable is anchored and the shield electrically connected to the carriage by way of a sleeve 133 gripping the cable and secured, for example by soldering, to a bail member 134 which is connected at opposite ends by screws 135 to the plates 44 and 47 of the carriage. The connection between the ground terminal of the translating device (say the lead 24') and the shield of the cable 132 is made by way of the housing 22 and its connecting linkage with the carriage, the lead 24' being clamped between the plate 27 and the lower one of the shells 25 to make connection with the housing 22, as shown in Figure 14. The connection between the conductor 132' of the cable and the other one of the terminals to the translating device (i. e., the lead 24) includes an electrical connector 136 as shown in Figures 4 and 5. This connector comprises, as its cooperating contact elements, a U-shaped spring 137, mounted on the bail member 134 at a point directly below the leg 92' of the support link 92, and a metal strip 138 carried by the leg 92' along the underside thereof, the spring 137 being secured to the bail member by means of rivets 139 and insulated from the bail member by means of insulating bushings 140 embracing the rivets and insulating plates 141 interposed between the spring and the bail member, and the strip 138 being secured to an insulating plate 142 by a rivet 143 and the plate 142 in turn to the support link by rivets 144 as shown in Figure 6. The conductor 132' is directly connected to the spring arm 137 and the strip 138 directly connected to the lead 24, each by a soldering, the connection between the strip 138 and the lead 24 being however made to a rigid arm 139' on the strip which extends forwardly through an insulating bushing 145 in the front leg 92'' of the support link as shown in Figure 3. These connections between the cable 132 and the translating device are adapted to permit ready detachment of the translating device from the carriage and ready remounting of the same on the carriage in that the connection between the shield of the cable and the lead 24' and that between the conductor 132' and lead 24 are made automatically, through the support structure for the translating device and connector 136 respectively, upon fitting the trunnions 93 of the support link 92 in the notches 94, and are each broken automatically upon detaching the support link from the carriage.

The phonograph structure is housed within a cabinet 146 having a lower portion 146a, fractionally shown in Figure 1, and an upper portion or cover 146b, the lower portion supporting the phonograph as by way of a hinge 147 connecting the base plate 1 to the rearward wall of the cabinet and by way of studs such as 148 at the front of the cabinet which project inwardly to form a support on which the base plate may rest. It is a feature of my invention that the phonograph structure and cabinet therefor be so coordinated one with the other as to form a machine which is both conveniently operable and yet closed sufficiently when in its operating condition to provide an unusually high degree of protection to its working parts. In the interest of convenience of operation of the machine it is highly desirable that the control lever for shifting the condition of the translating device—i. e., the lever 61—and other controls such for example as the guide member 18 for making annotations on the slip 17 be carried directly by the carriage in conveniently accessible positions and also that the record be sufficiently exposed to permit the operator to place the translating device in desired positions along the record as with respect to its recorded and unrecorded areas, as hereinbefore noted. To attain these objectives while yet providing an unusually high degree of protective closure to the working parts of the machine, the controls abovementioned are supported by the carriage at the remote end portion of arms 46' and 45'. In this way the controls are supported adjacently of the record but at a place spaced circumferentially of the record from the place where the translating device and its operating mechanism is supported, as clearly shown in Figure 1. The cover 146b for the cabinet I then extends downwardly at the front so that its rim 149 will be immediately adjacent the arms of the carriage but at a point slightly rearwardly of the place of support of the controls on the carriage so as to render these controls readily accessible to the front. To permit the rim 149 of the cover to be positioned unusually close to the record the portion of the carriage arms immediately adjacent the rim 149 is reduced in thickness as by the provision of a notch 149', and the cover 146b is extended so that the rim 149 thereof fits into this notch. By this arrangement it is seen that there is provided a protective closure for the record, the record being exposed only along its front between the rim 149 of the cover and the holder 16 for the index slip 17; that the controls such as 61 and 18 are positioned for ready accessibility and convenient operation at the front of the record; and moreover that such working parts as the mechanism for moving the translating device along the record and for adjusting the same relative to the record are substantially completely closed by the close fitting of the cover to the record. In order that the immediately active portion of the record—the portion circumferentially in line with the styli of the translating device—will be clearly exposed, the control lever 61 is offset along the record from the translating device by mounting the control lever between the carriage plates 44 and 45 and the translating device between the carriage plates 46 and 47 as heretofore explained. To aid in locating the styli along the record an indicating pointer 150, which may be integral with the pointer 18, is provided at the front of the record circumferentially in line with the styli of the translating devices.

Although I have herein shown a particular embodiment of my invention, it will be understood that this embodiment is subject to many changes and modifications without departure from the scope of my invention, which I endeavor to express according to the following claims.

I claim:

1. Apparatus for carrying a phonographic translating device of the type adapted to co-

operate with a cylindrical record, having a frame comprising an assembly of parallel plates supported in planes normal to the longitudinal axis of the record and spaced from each other longitudinally of the record, and means bridging said plates to hold the same in said fixed spaced relationship.

2. Apparatus for holding a phonographic translating device in position to coact with a cylindrical record and for carrying controls spaced circumferentially of the record from the place of coaction of the translating device with the record, comprising an assembly of parallel plates supported for movement along the record, means holding said plates perpendicular to the longitudinal axis of the record and in fixed relationship wherein the plates are spaced from one another longitudinally of the record, said assembly having a main portion and an arm portion extending from said main portion and circumferentially conforming to the record, and means bridging said plates and providing mountings for said translating device and said controls at said main and arm portions respectively.

3. Apparatus for holding a phonographic translating device in position to coact with a cylindrical record and for holding a manipulatable control in a position spaced both circumferentially and longitudinally of the record from the place of coaction of the translating device with the record, comprising an assembly of at least three parallel plates held in normal relation to the longitudinal axis of the record and spaced longitudinally of the record, means bridging two adjacent ones of said plates to hold said translating device, arms on two other adjacent ones of said plates circumferentially conforming to the record, and means bridging the outer end portions of said arms to hold said manipulatable controls.

4. In a phonograph having a translating device adapted to coact with a cylindrical record: the combination of a carriage movable along the record and having a main portion supporting said translating device in a position rearward of the front of the record; a forwardly extending arm on said carriage terminating at a place in front of the record; and control means on the forward end portion of said arm manipulatable to control said translating device, said arm being spaced from said translating device in respect of the direction of travel of the carriage along the record to offset said control means from the place of coaction between the translating device and the record, whereby to prevent the front portion of the record circumferentially in line with said place of coaction from being obstructed by said control means.

5. The combination with a unitarily movable translating device adapted to coact with a cylindrical record and having recording and reproducing styli spaced in a direction transverse to that of the longitudinal axis of the record, of means for positioning said device relative to the record to selectively place said styli into contact with the record comprising a control member shiftable between terminal positions; means, operated by said control member as an incident of the movement of the latter through the end portions of its travel into and out of said terminal positions, for imparting a motion to said translating device to cause said styli to be moved substantially radially towards and away from the record; and means, operated by said control member as an incident of the movement of the latter through the intermediate portion of its travel, for imparting a motion to said translating device transverse to the record through substantially the distance of spacing between said styli.

6. In a phonograph provided with a unitary translating device adapted to coact with a cylindrical record and having recording and reproducing syli spaced in a direction transverse to that of the longitudinal axis of the record: the combination of means for imparting a motion to said translating device towards and away from the record to cause a selected one of said styli to be moved substantially radially into and out of contact with the record; means for imparting a motion to said translating device in a direction transverse to that of the longitudinal axis of the record, whereby to select between said styli; and control means shiftable between terminal positions to actuate, in sequence, said first-mentioned motion-imparting means to move a selected one of said styli out of contact with the record, said second mentioned motion-imparting means to select the other of said styli, and then again said first mentioned motion-imparting means to move said other stylus into contact with the record.

7. Apparatus for detachably connecting a translating device to a carriage movable in relation to a record, comprising vertically extending portions on said carriage spaced in the direction of the relative movement between the carriage and record; means supported from between said portions for carrying said translating device, said portions having notches and said carrying means having pivots fitting said notches; and means for holding said pivots in said notches, manipulatable into inoperative position at will.

8. In a phonograph comprising a translating device and a carriage for said device: the combination of means coupling said translating device to said carriage including a part connected to said device and another part included in said carriage, one of said parts having bearings and the other of said parts having pivots movable into and out of said bearings; and means biased into position to hold said pivots in said bearings, said holding means being manually movable into a constrained position to free the pivots for movement out of said bearings, whereby to permit the detachment of said translating device from said carriage at will.

9. In a phonograph having a translating device arranged for cooperative movement in relation to a record: the combination of support means for said device comprising a member pivotally supported for movement about an axis normal to the direction of travel between said device and the record and a pivotal connection between said member and said device about an axis substantially coinciding with the center of gravity of the device and normal to said first-mentioned axis; and spring means, operatively interconnected between said device and said member, for biasing said device about its pivotal connection with said member into cooperative relationship with the record.

10. In a phonograph comprising a unitary translating device adapted to cooperate with a record and having recording and reproducing styli: the combination of a plurality of separate means each biasing said device towards the record to maintain a selected one of said styli in contact with the record; control means for positioning said device relative to the record to alternately place said styli into contact with the

record; and means, controlled by said control means, for rendering one of said biasing means effective and ineffective upon alternately placing said styli into contact with the record, whereby to differentiate between the styli in their biasing against the record.

11. In a phonograph comprising a unitarily movable translating device adapted to cooperate with a record on the machine and provided with recording and reproducing styli: the combination of a support; a pivotal connection between said device and said support, said device being balanced with respect to said pivotal connection; a plurality of separate spring means biasing said translating device about said pivotal connection to urge the device into cooperation with the record; means for moving said device relative to the record to selectively place said styli into contact with the record; and means controlled in accordance with the positioning of said moving means for rendering one of said spring biasing means effective and ineffective.

12. In a phonograph comprising a unitary translating device adapted to cooperate with a cylindrical record and having recording and reproducing styli spaced transversely of the longitudinal axis of the record: the combination of means for supporting said device in relation to a record; spring means biasing said translating device to cause said styli to be urged towards the record; means associated with said spring means and operable to change said biasing of the device between two predetermined limits; moving means for said translating device operable to selectively place said styli into contact with the record; and means for causing said bias-changing means to be operated by said moving means.

13. In a phonograph having a translating device provided with recording and reproducing styli and a carriage for said device movable in relation to a record: the combination of two spaced parallel plates included in said carriage and held normal to the direction of travel of the carriage relative to the record; a support member pivoted between said plates for swinging movement transverse to said direction of travel; a universal joint pivotally connecting said translating device to said support member and causing said device to have a freedom of movement both in and normal to said direction of travel; means for rocking said support member to alternately place said styli into contact with the record; a pair of faces on said plates respectively; and a cross member on said universal joint, moved by said support member against said faces as an incident of placing said recording stylus into contact with the record, for centralizing said translating device and restricting the same in its freedom of movement relative to the carriage in the said direction of travel between the carriage and record.

14. In a structure including an electrical phonographic translating device and a carriage for said device: the combination of a movable coupling between said device and carriage including two relatively movable portions separable to permit detachment of the device from the carriage; an electric circuit included in and leading from said translating device; two switch members in said circuit respectively associated with said coupling portions and held closed throughout the range of movement between said portions, said switch members being moved out of and into contact with one another upon separating and reconnecting said coupling portions; and means to maintain said coupling portions in coupled relation, said means being movable in one manipulation into an inoperative position permitting a detachment of said device.

15. Supporting apparatus for a phonographic translating device, comprising a carriage; means coupling said translating device to said carriage including a part connected to said device and another part included in said carriage, one of said parts having pivots and the other having bearings adapted to receive said pivots; and means for holding said pivots in said bearings, said holding means being manipulatable in one operation to free the pivots for movement out of the bearings whereby to permit a detachment of said translating device from said carriage at will.

16. In a phonograph having a translating device adapted to coact with the surface of a moving record: the combination of an adjusting means associated with said device and selectively operable to place the same into respective conditions wherein the device is effective to record on and to reproduce from the record; resilient means acting on said device to maintain a coaction of the same with the record; and means, controlling said resilient means in accordance with the conditioning of said translating device, for varying the bias of said device on the record.

17. In a phonograph having a translating device adapted to coact with the surface of a moving record: the combination of a support member for said device; a universal joint between said device and said support member including an intermediate coupling member having a pivotal connection with said support member and means providing a pivotal connection of said device to said intermediate member, the axes of said pivotal connections being at right angles to one another and so arranged that the first pivotal connection affords a lateral freedom of movement of the device in relation to said support member and the record and the second pivotal connection affords a freedom of movement of the device in a direction normal to the surface of the record; adjusting means associated with said device for placing it into respective conditions wherein the device is effective to record on and reproduce from the record; and means, moved into restraining relationship with said intermediate member upon a conditioning of said device for recording by said adjusting means, for holding said intermediate member against angular movement on its pivots whereby to restrict said device, during recording, in its said lateral freedom of movement.

18. In a phonograph having a translating device adapted to coact with the surface of a moving record: the combination of a support member for said device; a universal joint between said device and support member comprising an intermediate coupling member pivoted to said support member on an axis in a plane normal to the surface of the record, and means pivotally connecting said device to said intermediate member on an axis in a plane parallel to the record; means associated with said device to adjust it into respective conditions for recording and reproducing on and from the record; and means, acting on said intermediate member in a conditioning of said device for recording by said adjusting means, for centralizing and restricting said intermediate member in its pivotal movement on said support member.

19. In a phonograph comprising a translating unit mounted above a cylindrical record for trav-

eling movement therealong and having record-cooperable means at one end portion thereof: the combination of means supporting said unit in a downwardly inclined position wherein said end portion is in a downward position adjacent to the record, comprising a first member pivotally connected to said unit about an axis which is substantially parallel to the longitudinal axis of the record and which substantially coincides with the center of gravity of the unit whereby to provide a freedom of movement to said end portion towards and away from the record, and a second member pivotally carrying said first member on an axis normal to said first mentioned axis to provide a freedom of movement to the unit lateral in relation to the record, said last mentioned axis being spaced from said first mentioned axis in the direction away from said end portion whereby to place the unit under a gravitational bias tending to hold it centralized with respect to its lateral freedom of movement; and spring means biasing the unit about said first mentioned axis to maintain a normal engagement of said record cooperating means with the record.

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