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ACOUSTIC DEVICE

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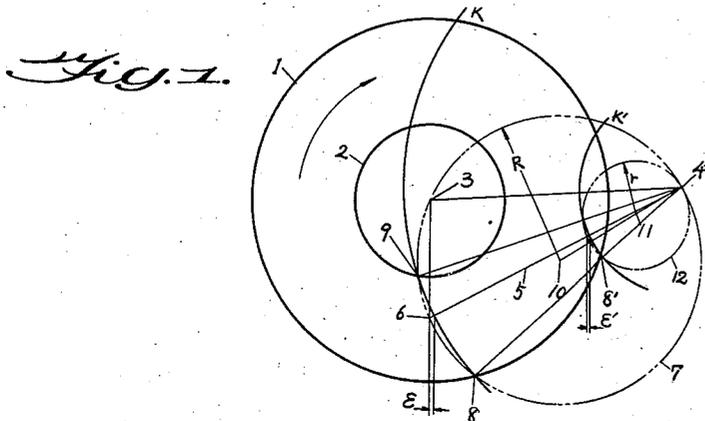


Fig. 2.

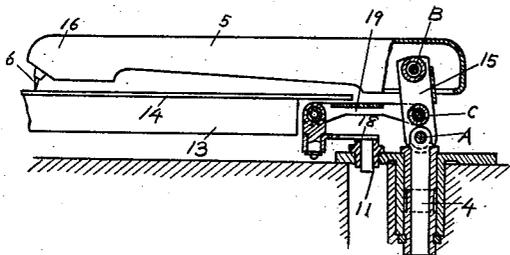


Fig. 3.

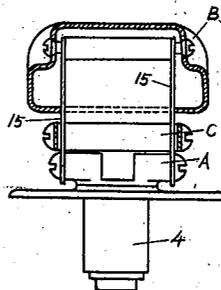
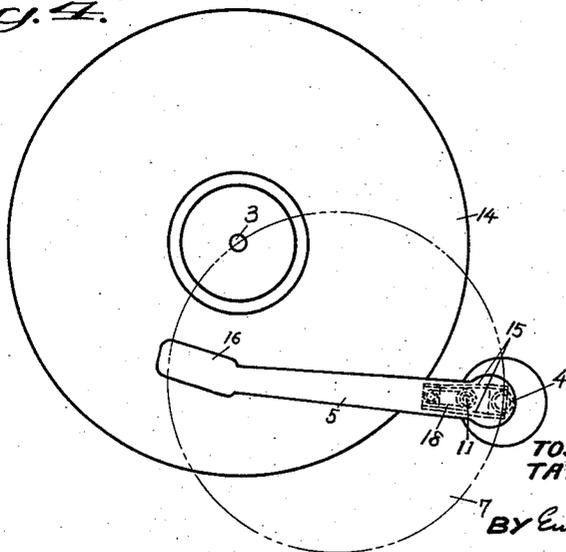


Fig. 4.



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ACOUSTIC DEVICE

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6 Claims. (Cl. 274-1)

This invention relates to improvements in sound reproducing devices of the disc record type, and, in particular, to an automatic regulating mechanism of the tone arm having sound translating means such as a sound box or pick-up of gramophones or sound recorders.

One object of this invention is to obviate undesirable vibration of the needle of a pick-up of a gramophone along successive convolutions or sound grooves of a record so that distortionless reproduction of sound is possible.

Another object of this invention is to attain the above mentioned results without varying the length of tone arm.

It is a well known fact that the needle of the sound reproducer of a gramophone is not shifted in normal direction to every sound groove of a record. Accordingly, there remains a component of the needle movement along the sound groove so that the reproduced sound will be distorted and unpleasant noise due to friction will be heard.

In accordance with this invention, the needle of the sound reproducer is shifted along an arc of a circle passing through the centre of rotation of the record and the centre of rotation of the tone arm.

For more complete understanding of this invention, reference is had to the accompanying drawing; wherein Fig. 1 is a diagram for explaining the principle of operation of this invention; Fig. 2 is a longitudinal, sectional view of the device embodying this invention; Fig. 3 is a side view, and Fig. 4 is a plan view of said device.

Referring to the drawing, 1 represents the outermost convolutions or sound groove of a record; 2 is the innermost sound groove of the record; 3 the axis of rotation of the record; 4 the centre of oscillation of a tone arm 5 having the sound reproducer; and 6 designates the needle or stylus of the sound reproducer. 7 is a circle having the straight line

3-4

as its chord, the circle 7 intersecting the sound grooves 1 and 2 at the points 8 and 9 respectively. If, now, the locus of the needle point 6 be the circle 7, the angle $\angle 3.64$ will be constant over the operating range 8 to 9 of the needle 6. Accordingly, if the needle be once set to vibrate normally to a sound groove, the needle 6 may always vibrate at right angles to the groove at its every position. For accomplishing the results, the effective length of the tone arm may be automatically regulated. But the results may be attained without varying the actual length of the tone arm in the following manner. Let 10 be the centre of the circle 7 and draw a circle 12 which has its centre 11 on the straight line

4-10

and touches internally with the circle 7. The circle 12 intersects the chords

4-8 and 4-9

of the circle 7 at 8' and 9' respectively. Then the sectors 4-8-9 and 4-8'-9' constitute similar figures. K is a circle having its centre at 4 and passing through the point 8, which shows the locus of the needle point 6 if it is mounted on a tone arm of a definite length having no regulating means. Draw a similar circle K' passing through the point 8'. Let ϵ be the difference between the locus 7 and K, and ϵ' be the difference between the locus 12 and K'. Then, from the above mentioned similarity between the sectors 4-8-9 and 4-8'-9', $\epsilon:\epsilon'=R:r$, where R is the radius of the circle 7 and r is the radius of the circle 12. Accordingly, by providing a mechanism for drawing the circle 12 of radius r having the centre at 11 so as to produce the displacement ϵ' , and by interlocking the mechanism with the tone arm 5 in such a manner that the displacement ϵ' is transmitted to the arm 5 to produce the displacement ϵ , the needle 6 will accurately be shifted on the circle 7.

Figs. 2 to 4 illustrate a device embodying this invention. 13 represents a rotating disc; 14 is a record and 16 is sound translating means such as the sound reproducer; other parts being designated by the same reference numerals as those of corresponding parts shown in Fig. 1. In this embodiment, the rotatable tone arm support on the axis 4 and the tone arm 5 are connected through a lever 15 at pivotal pins A and B respectively. An arm 18 is rotatably secured to a shaft turning on an axis positioned at 11 of Fig. 1 so as to draw the circle 12 by the free end and a link 19 is pivoted to the free end of the arm 18, the other end of the link 19 being connected to the lever 15 at the pin C. The connecting point of the link 19 to the lever 15 is so selected that the ratio of lengths

\overline{AB} to \overline{AC}

is equal to R to r.

With the above mentioned device, the pin C will be subjected to the displacement ϵ' through the link 19. Then the pin B will be displaced by

$$\epsilon' \times \frac{R}{r} = \epsilon$$

to displace the tone arm by ϵ . Accordingly, the needle 6 will be shifted accurately on the circle 7 so that the needle may always be shifted normally to the sound grooves of the record. Thus, the undesirable component of the needle movement along the sound groove of the record will be substantially obviated and the sound translating means 16 may accurately reproduce or record the sound from or on the recording disc

14. The additional mechanisms 18 and 19 only occupy the space below the record 14 so that the Gramophone embodying this invention is neither affected in its appearance by applying the present invention thereto, nor the changing of the recording disc is obstructed therefrom. The mechanism 18 and 19 is shown to be attached at the left side of the axis 4, but it may, of course, be provided at the right side of the axis 4. In this case, the lever 15 should be extended and the pin C is secured to the lower side of the pin A.

This invention may equally be applicable to sound recorders.

15 We claim:

1. A sound reproducing device, comprising a tone arm having a sound translating means at one end and pivotally supported at the other end on a lever, a recording disc arranged to rotate upon a fixed axis to one side of the axis around which said tone arm is rotated, and means comprising an arm pivoted between said axes and having its free end connected to said lever by a link for automatically restricting the movement of the needle of said sound translating means on a circle having its center on a line passing through the axes of rotation of said last named arm and tone arm and its circumference passing through the centre of rotation of a record and the centre of rotation of said tone arm.

2. A sound reproducing device comprising a rotatable support for a disc record having a spiral sound groove successive convolutions of which lie at different distances from its axis of rotation, a tone arm carrying a sound translating means at its free end including a stylus cooperating with said groove, the other end of said tone arm being hinged to a pivoted support to swing on an axis transverse to its length in a plane parallel to that of the disc record, said pivoted support being rotatable on an axis parallel to that of said record support, a guide arm pivoted on an axis parallel to said supports and positioned in the space between them at a distance from said pivoted support equal to the radius of said arm, and a connection from the free end of said arm to said tone arm support pivoted to the latter to move with the tone arm as it follows the sound groove.

3. A sound reproducing device comprising a rotatable support for a disc record having a spiral sound groove successive convolutions of which lie at different distances from its axis of rotation, a tone arm carrying a sound translating means at its free end including a stylus cooperating with said groove, the other end of said tone arm being hinged to a pivoted support to swing on an axis transverse to its length in a plane parallel to that of the disc record, said pivoted support being rotatable on an axis parallel to that of said record support, a guide arm pivoted on an axis parallel to said supports and positioned in the space between them at a distance from said pivoted support equal to the radius of said arm, and a connection from the free end of said arm to said tone arm support pivoted to the latter to move with the tone arm as it follows the sound groove, the pivot point of said connection to said tone arm support being intermediate the ends of the latter such that the proportional relation between the respective distances from the pivot point of the support upon its axis of

rotation to the pivot point of said connection and to the hinge point of said tone arm to said support is equal to that between the length of said guide arm and one-half the length of said tone arm.

4. A sound reproducing device, comprising a sound translating means, a tone arm of a definite length supporting said sound translating means at its free end and at its opposite end supported by means pivoted to rotate around a fixed axis, a recording disc mounted to turn on an axis parallel to that around which said tone arm is pivoted to be rotated, said tone arm supporting means comprising a lever pivoted at one end to swing around said latter axis and pivoted at its opposite end to the pivoted end of said tone arm at pivot points A and B respectively, a rotary mechanism having an arm adapted to describe a circle of radius r touching at said latter axis with another circle of radius R passing through said first and second axes, and an interconnection between said lever and said rotary mechanism, said interconnection being connected to said lever at the point C intermediate its ends such that

$$\overline{AB}:\overline{AC}=R:r$$

5. A sound reproducing device, comprising a recording disc having a fixed axis of rotation, a sound translating means, an articulated tone arm having a principal member for supporting said sound translating means at one end and a hinge member at the other end, said hinge member being rotatable about a second axis spaced from that around which said disc is rotated, said members being hinged to maintain their alignment radially with respect to said second axis, and means for automatically varying the effective length of said tone arm comprising a pivoted arm operatively connected to said second member at one end and at the other end guided in an arc of a circle in such a manner that the needle of said sound translating means moves substantially on a circle tangent to said first circle and passing through said first and second axis.

6. A sound reproducing device, comprising a recording disc having a fixed axis of rotation, a sound translating means having a stylus, an oscillatable tone arm supported at one end and carrying said sound translating means at its free end, a pivot around which said tone arm is caused to oscillate, a pivoted link for supporting the supported end of said tone arm, said link being provided with pivot points A and B and pivoted at A to said pivot and at B to said tone arm, an arm of length r mounted on a shaft having its axis located on the diameter of the circle of radius R which is the ideal locus of said stylus passing through the axis of said recording disc and the center of oscillation of said tone arm, the free end of said arm describing a circle of radius r which touches tangentially with said ideal circle of radius R at said center of oscillation of said tone arm, and a link for connecting the free end of said arm to said pivoted link at a point C such that

$$\overline{AB}:\overline{AC}=R:r$$

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