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2,027,168

VIBRATION TRANSLATING DEVICE

Filed Sept. 29, 1934

FIG. 1

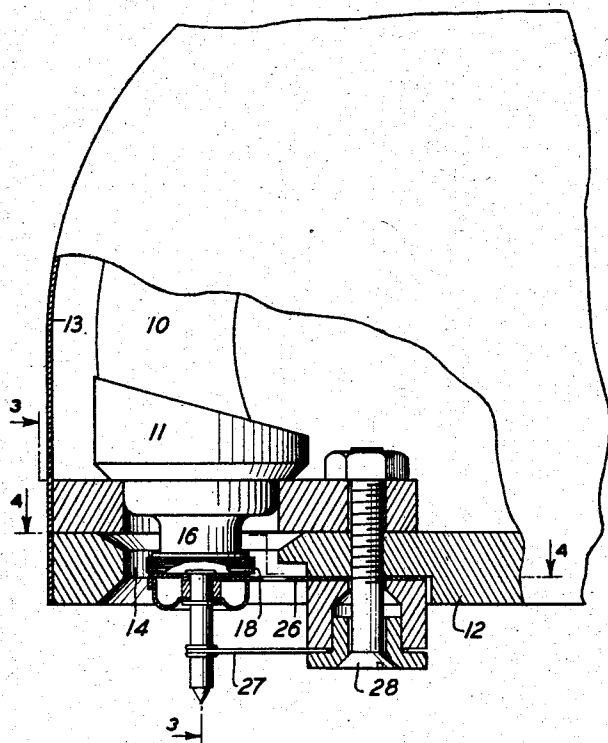


FIG. 2

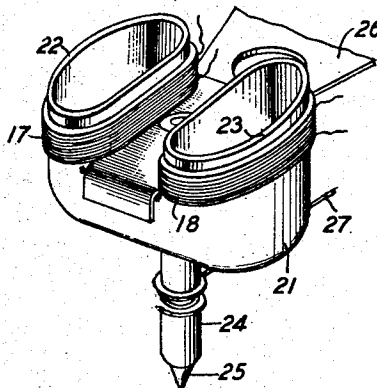


FIG. 3

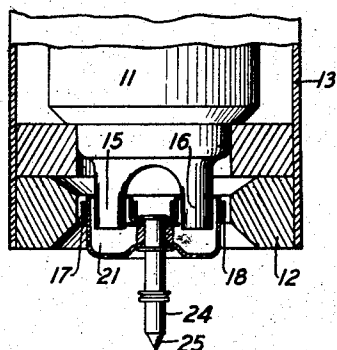


FIG. 4

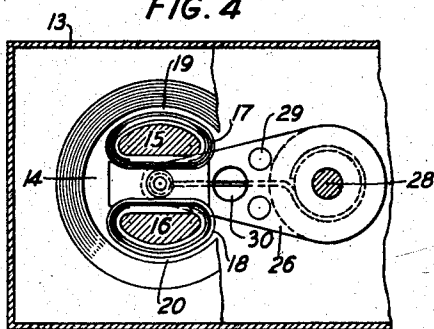


FIG. 5

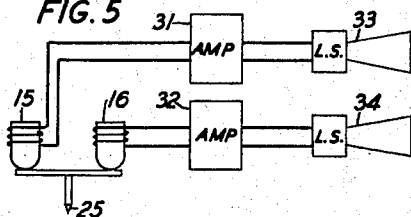
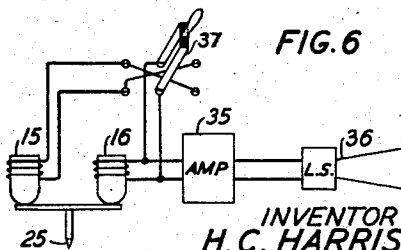


FIG. 6



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VIBRATION TRANSLATING DEVICE

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Application September 29, 1934, Serial No. 746,073

8 Claims. (Cl. 179—100.41)

This invention relates to phonograph reproducers and more particularly to those capable of playing both vertical and lateral cut records.

The object of the invention is a reproducer of this type which is adapted to reproduce either vertical or lateral cut records and also to give simultaneous separable reproductions of vertical cut and lateral cut recordings in the same groove.

According to the invention the moving system of the reproducer has two generating elements, preferably coils laterally spaced and rigidly connected to a single stylus. The coils are vibratably supported in operative relation to a suitable magnetic circuit by a plurality of supporting springs which permit the coils to move vertically either in the same or in opposite directions depending on whether the stylus is driven from vertical or lateral cut records.

Both leads of each coil are brought out so that either coil may be used alone as a universal generating element, switching means may be provided for reversing the relative polarity of the coils so that the outputs of both coils may be utilized with either type of record or the coils may be connected to suitable external circuits to provide separate reproductions of two recordings in the same record groove. A system of this latter type is disclosed and claimed in my copending application Serial No. 742,761, filed September 5, 1934.

These and other features of the invention will be more clearly understood from the following detailed description and the accompanying drawing in which:

Fig. 1 is a general view, partly in section, of a reproducer according to the invention showing particularly the vibratory system and its relation to the magnetic circuit;

Fig. 2 is a perspective view of the vibratory system;

Fig. 3 is a vertical sectional view taken as indicated by the line 3—3 in Fig. 1;

Fig. 4 is a horizontal sectional view taken along the line 4—4 of Fig. 1;

Fig. 5 is a circuit diagram showing a separate reproducing system for each of the generating elements; and

Fig. 6 is a diagram of a circuit for utilizing the output of both generating elements when the reproducer is used on either hill and dale or lateral cut records.

Referring now to the drawing, the structures of Figs. 1 to 4 have been shown considerably enlarged and the conventional portions of the reproducer in Fig. 1 which are not essential to an understanding of the invention have been omitted.

The magnetic circuit of this reproducer includes a permanent magnet 10 contacting at one end a central pole-piece 11 and at the other end, not shown, the outer pole-piece 12 which also serves as a bottom closure for the casing 13. The pole-piece 11 extends downwardly into the substantially circular opening 14 in the pole-piece 12 and is furcated at its lower end to form two pole tips 15 and 16 for the coils 17 and 18. The pole tips are contoured to form short working air-gaps 19 and 20 at the outer sides of the coils.

The coils are wound on a lightweight duralumin cup 21 which has two upwardly extending tubular pieces 22, 23 for supporting the coils 17 and 18 as shown more clearly in Fig. 2. Projecting downwardly from the center of the cup is a lightweight tube 24 fitted at its lower end with a stylus 25. This vibratory system is mounted in operative relation to the magnetic circuit by means of the spaced parallel cantilever springs 26, 27 which are clamped to the pole-piece 12 by a screw 28.

The upper spring 26 is preferably V-shaped and is conveniently made from thin sheet material so that it is of very low stiffness for vertical and torsional deflections but of relatively high stiffness for lateral deflections. In proportioning the spring to obtain the necessary high ratio of stiffnesses for different deflections, it is sometimes advantageous to perforate the spring 26 with holes, such as 29 and 30. The lower spring 27 should be of low stiffness for both vertical and lateral deflections and these requirements are conveniently met by using a single strand of fine wire as shown.

When the stylus 25 is driven by a vertical cut record the springs 26 and 27 will both deflect vertically, the coils 17 and 18 will be vibrated vertically in the same direction in the gaps 19 and 20 and the currents generated in the coils will correspond to the stylus vibrations. When the stylus is driven by a lateral cut record, the lateral vibrations will deflect the spring 27 laterally but in this case the spring 26, due to its high lateral and low torsional stiffness, will act as a pivot by deflecting torsionally so that the coils are vibrated vertically but in opposite directions. As in the previous case, both coils will generate currents corresponding to the stylus vibrations but due to the opposite directions of their vibratory movements the currents will be of relatively opposite polarity.

If the leads of coils 15 and 16 are connected to separate amplifiers 31, 32 and loud-speaking receivers 33, 34 as shown in Fig. 5, it will be ap-

parent that either or both of these reproducing systems is operative to reproduce either vertical or lateral cut records. A more economical system for utilizing the output of both coils from either type of record is shown in Fig. 6 in which only a single amplifier 35 and a single loudspeaking receiver 26 are used, one of the coils, 15, being connected directly to the amplifier and the other coil being connected through a reversing switch 37. When using the system for vertical cut records the currents are in the same direction in both coils and the switch is therefore closed to the left to connect corresponding terminals of the coils in parallel. When lateral records are used the currents are in opposite directions in the two coils and by closing the switch to the right the connections of coil 15 are reversed so that the currents are additive in the amplifier input circuit as before.

The invention has been described with reference to a device having moving coil generating elements but it will be apparent that applicant's vertically resilient pivot construction for supporting the vibratory system is equally applicable to electromagnetic, electrostatic or other known types of reproducer or other vibratory translating device. Various changes may also be made in the design of the device shown but the invention is intended to be limited only by the scope of the following claims.

What is claimed is:

1. In a reproducer, a magnetic circuit, a moving system comprising a pair of spaced coils in operative relation to the circuit and a stylus for driving the coils and resilient means supporting the system between the coils for both lateral and vertical vibrations of the stylus.
2. In a reproducer, a magnetic circuit, a moving system comprising a pair of spaced generating elements in operative relation to the circuit and a stylus for driving the elements and two spaced springs of different lateral stiffnesses secured to the system between the coils supporting the system for both lateral and vertical vibrations of the stylus.
3. In a reproducer, a magnetic circuit and a moving system comprising a pair of spaced coils, a coil supporting member, a stylus for driving said member and means for mounting the system with the coils in operative relation to the circuit including a spring attached to the member be-

tween the coils and free to deflect both vertically and torsionally in accordance with the stylus vibrations.

4. In a reproducer, a magnetic circuit, a member carrying two laterally spaced coils in operative relation to the circuit, a stylus, means connecting the stylus to the member between the coils and supporting means therefor including a spring between the coils free to deflect both vertically and torsionally but not in a lateral mode.

5. In a universal phonograph reproducer, the combination with a magnetic circuit having two spaced air-gaps and a moving system comprising two coils, means for supporting the coils in spaced relation for vibration in the air-gaps, and a stylus for driving the coils, of spaced parallel spring supports for the system constituting a vertically resilient pivot between the coils.

6. A moving system for phonograph reproducers comprising a lightweight cup member having two laterally spaced upwardly extending tubular coil supports, a coil on each of the supports, a stylus connected to the cup between the coils and spaced parallel springs of different lateral stiffnesses for supporting the system for vertical and lateral vibrations of the stylus.

7. In a universal reproducer, a magnetic circuit including two air gaps, a pair of laterally spaced generating elements in the gaps, a stylus, a member connecting the stylus to the elements, a vertically and torsionally resilient spring of high lateral stiffness constraining the elements to move in the same direction for vertical stylus vibrations and in opposite directions for lateral stylus vibrations, and means for combining the outputs of the elements in aiding relationship when vibrating in either the same or opposite directions.

8. In a reproducer, the combination with a magnetic circuit including an outer pole piece having an aperture and an inner pole piece projecting into the aperture and having furcations defining arcuate gaps on opposite sides of the aperture and a moving system comprising a coil on each furcation having one side disposed in the gap and the other side flattened to increase the spacing between the coils, a stylus and means for connecting the stylus to the coils, of resilient supporting means secured to the system between the flattened sides of the coils.

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