

June 12, 1934.

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1,962,304

ELECTROMAGNETIC TRANSLATING DEVICE

Filed Dec. 17, 1931

2 Sheets-Sheet 1

FIG. 1

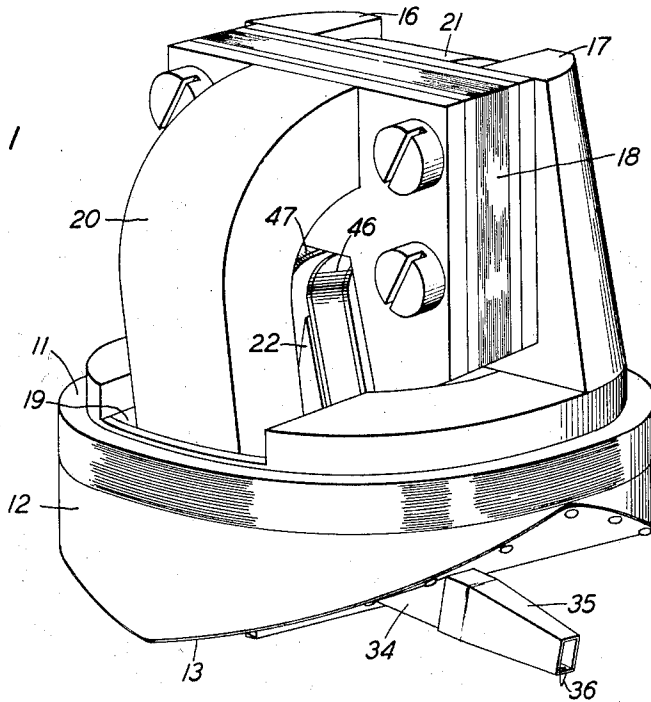
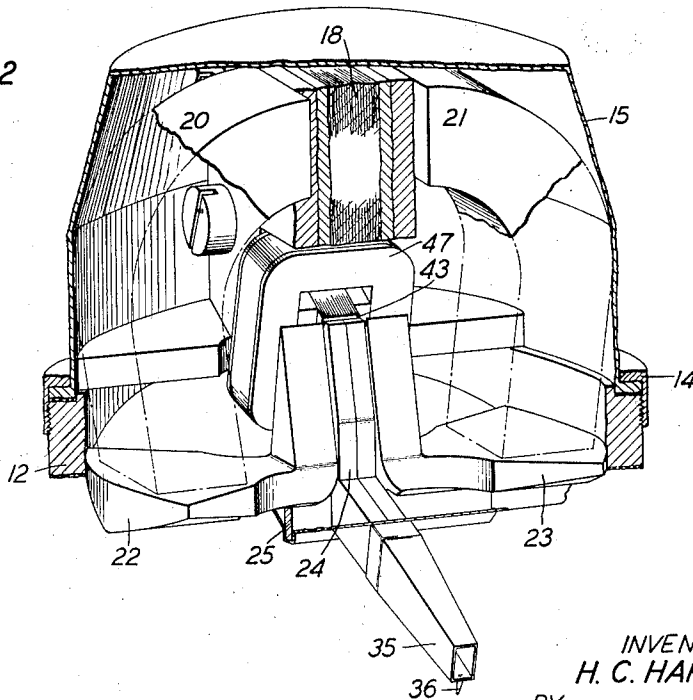


FIG. 2



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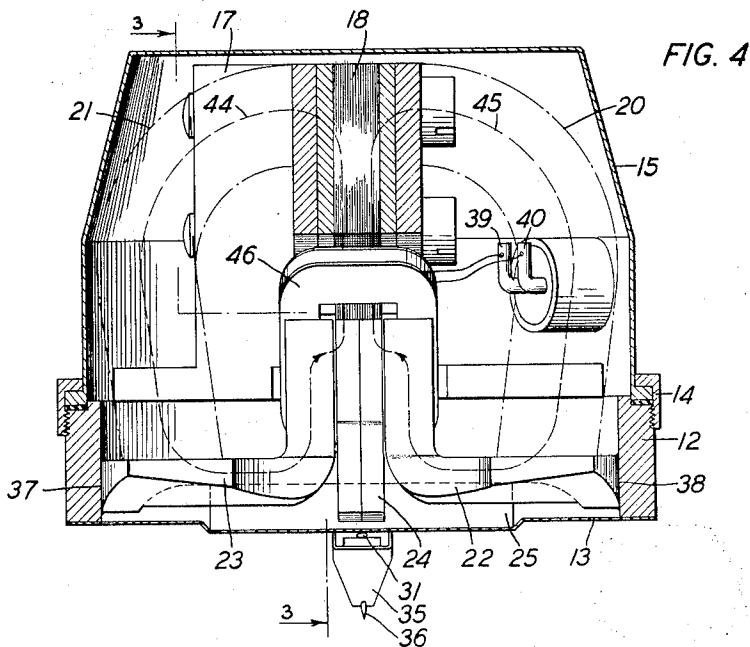
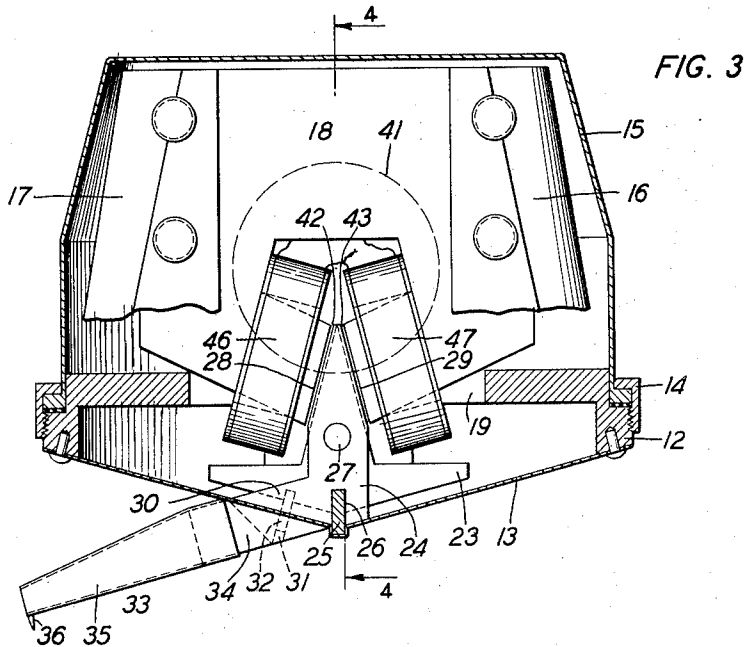
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ELECTROMAGNETIC TRANSLATING DEVICE

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5 Claims. (Cl. 179—100.41)

This invention relates to electromagnetic translating devices such as phonograph recorders or reproducers and the object of the invention is to provide an improved device of this kind which is of simple construction, inexpensive to make and yet capable of very high quality performance.

One common form of such devices used heretofore is known as the balanced armature type in which an armature secured to a shaft vibrates between bifurcated poles. For phonograph devices, more or less complicated connecting linkages are required between the shaft and the stylus bar particularly in the cases of recorders and reproducers of the hill and dale type.

In accordance with the general features of the invention the moving system of the device which is particularly adapted for hill and dale work, is in the form of a single lumped mass to which damping is directly applied so that transient oscillations are more easily controlled than in previous structures. In the preferred form of the invention, the armature is tapered at one end to form working gaps with a single bifurcated pole piece carrying the signal current coils; the flux is fed to the gap through the armature which is pivoted in closely spaced relation to one of the poles of the magnet.

An important feature of the invention is a diaphragm forming a closure for the casing and of such shape that the stylus bar may be connected to the armature through the diaphragm and in the plane of the armature pivot.

A further feature of the invention is a novel magnetic system comprising twin magnets disposed on either side of the arm to provide the required high flux density in a structure of minimum overall size by feeding the flux into the armature from both sides independently of the diaphragm.

In the drawings Fig. 1 is a perspective view with the casing removed of a recorder according to this invention.

Fig. 2 is another perspective view partly in section showing particularly the magnetic circuit and the armature pivot; and

Figs. 3 and 4 are sectional views taken as indicated.

The main frame 11 of the recorder shown has a short tubular section 12 cut at its lower end to form a seat for the V-shaped diaphragm 13. The upper end of the section is threaded to receive the clamping ring 14 which holds the enclosing casing 15 in place. Upright members

16 and 17 integral with the frame, support the laminated pole piece 18 in a central position in the casing and a wide slot 19 is provided to permit the twin magnets 20, 21 to extend downwardly into contact with the flux feeding members 22, 23. The armature 24 is held between these members by a pivoting rod or bar 25 in the groove 26 of the armature and corresponding grooves in the members 22 and 23. These members preferably are brazed to the inner side of the frame 11 at 37 and 38 as shown in Fig. 4. The armature may be made up of two or more laminations held together by a rivet 27 and tapered upwardly to give the required distribution of flux across the inclined pole faces 28 and 29 of the pole piece 18 with the minimum effective armature mass. At its lower end the armature, as shown in Fig. 3, has a laterally extending member 30 in contact with the inner side of the diaphragm 13 and is secured to the stylus arm 33 by a set screw 32 engaging the hole 31 in the member 30. The stylus arm consists of a tapered portion 34 and a lightweight but a very stiff extension member 35. The tapered portion is in contact with the outer side of the diaphragm 13 so that in effect the arm is a continuation of the armature through the diaphragm and the diaphragm seals the necessary damping fluid within the casing. The member 35 may be a tapered hollow tube or it may be rectangular in section as shown, the essential requirement being that the armature shall have low effective mass with such high stiffness that the vibrations of the armature are faithfully transmitted to the cutting stylus 36.

It will now be apparent from Figs. 3 and 4 that the armature assembly just described is in effect a single vibrating mass and that due to the shape of the diaphragm the arm 33 may be positioned so that its axis extends through the pivot of the armature as shown. The recorder is intended to be mounted on a supporting arm with the lower side of the member 35 substantially parallel to the surface of the record being cut and when so mounted it will be seen that the motion of the stylus point will be substantially vertical so that the recorder is well adapted for hill and dale work. If, on the other hand, the usual flat diaphragm is used an L-shaped stylus arm is required to provide working clearance between the diaphragm and the record and since the axis of the stylus arm is then below the pivot point the stylus point does not move vertically

at the record surface and hence a distorted groove contour is produced.

The signal current coils 46 and 47 which are connected to the external circuit through terminals 39 and 40, set up in the pole face 18 an alternating flux representing the selection to be recorded which, in general, follows the low reluctance path indicated by the dotted line 41 in Fig. 3. While a single magnet may be used for producing the necessary steady flux in the working gaps 42 and 43, applicant has found that the device may be materially reduced in size by using twin magnets feeding flux into either side of the armature from members 22 and 23 as shown by dotted lines 44 and 45 of Fig. 4. These flux feeding members are spaced from the armature just enough to permit the armature to vibrate freely between them and since the armature moves laterally with respect to the members the reluctance of these small gaps is substantially constant.

When the armature is centrally located between the pole faces 28 and 29, the steady flux flowing from the armature to the pole piece 18 divides equally between the gaps 42 and 43 and hence does not deflect the armature but when the coils 46 and 47 are energized the alternating flux produced unbalances the pull on the armature and vibrates it according to the signal current variations. For example, if at any instant the signal flux flows around path 41 in a clockwise direction, the total effective flux is reduced in gap 43 but increased in gap 42 so that the armature moves towards the pole face 28 and the stylus 36 cuts deeper into the record blank. When the signal current reverses and the signal flux flows in a counterclockwise direction, the flux is increased in gap 43 and reduced in gap 42 whereupon the armature moves towards the pole piece 29 and the stylus moves upwardly to reduce the depth of cut.

The stiffness of the pivoting bar 25 should be correlated to the magnetic pull on the armature to provide sufficient restoring force to prevent the armature from adhering to the pole faces without unnecessarily reducing the efficiency. The damping fluid with which the casing is partially filled is moved laterally in the gaps 42 and 43 by the vibrations of the armature and in this manner undesired resonance effects are eliminated and a flat frequency characteristic is obtained over the range desired.

The general principles of the invention have been described with reference to a recorder structure but it will be understood that the invention is applicable to other devices such as receivers and that the design may be modified in various ways within the scope of the following claims.

What is claimed is:

1. In an electromagnetic translating device,

the combination with a casing, a magnet within the casing, a bifurcated pole piece contacting one of the poles of the magnet and a diaphragm closing the casing, of a moving system in a single lumped mass comprising a tapered armature pivoted in close spaced relation to the other pole of the magnet and the pole piece, and a stylus arm secured to the armature through the diaphragm with its axis in the horizontal plane of the armature pivot.

2. In an electromagnetic device, a casing, a magnet within the casing, a laminated pole piece for the magnet having two polar extensions terminating in angularly opposed pole faces associated with one pole of the magnet, a coil on each of the extensions, an armature associated with the other pole of the magnet and tapered at its upper end to form working gaps with the opposed pole faces, a tapered magnetic member disposed on each side of the armature for insuring a uniform distribution of flux across the air gaps, means for vibratably supporting the armature between the members and counteracting the pull of the magnet flux on the armature, a V-shaped diaphragm closing the casing, and an arm secured to the armature through the diaphragm.

3. In a vibration translating device, the combination with a casing, a furcated pole piece within the casing having opposed pole faces and an armature vibrating between the pole faces, of magnets providing a flux between the armature and the pole faces, a diaphragm closing the casing, a pivot for the armature, and a stylus carrying member with its axis extending horizontally through the pivot secured to the armature through the diaphragm.

4. In a recorder for cutting hill and dale records, the combination with a casing, a magnet within the casing, a bifurcated pole piece contacting one of the poles of the magnet, a flux feeding member contacting the other pole of the magnet and a V-shaped diaphragm closing the casing, of a moving system in a single lumped mass comprising an armature pivoted at the V of the diaphragm in close space relation to the flux feeding member and the pole piece, and a stylus arm secured to the armature through the diaphragm with its axis in the plane of the armature pivot.

5. In an electromagnetic translating device for hill and dale phonograph records the combination with a casing containing a viscous damping medium, a V-shaped diaphragm closing the casing and a magnetic circuit including an armature and a pivot therefor within the casing, of a stylus arm with its axis extending horizontally through the armature pivot and secured to the armature through the diaphragm.

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