July 7, 1931. C. HUENLICH 1,812,957

ELECTRICALLY OPERATING SOUND RECORDER AND REPRODUCER

Filed Nov. 3, 1928 2 Sheets-Sheet 1

Fig. 2

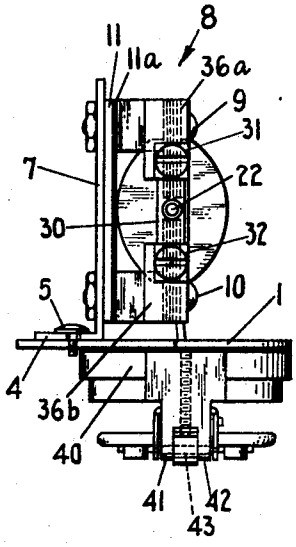


Fig. 1

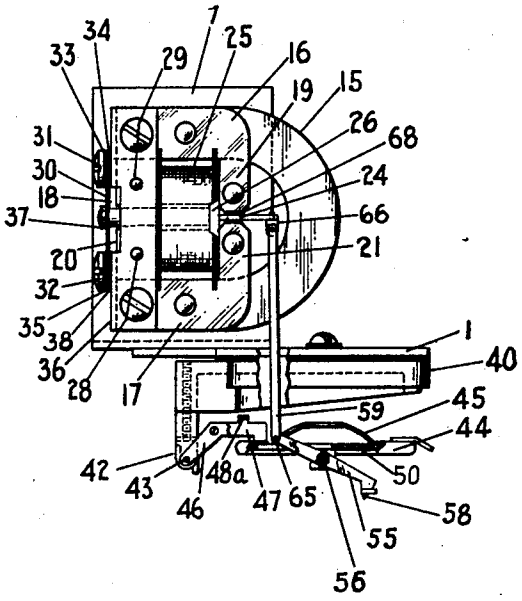
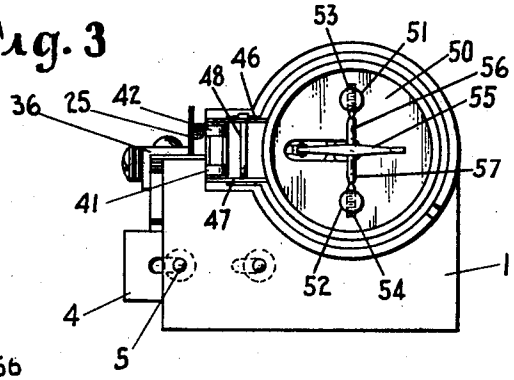


Fig. 3



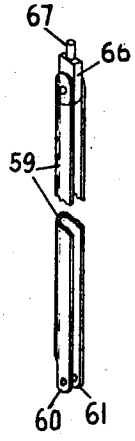


Fig. 4

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ELECTRICALLY OPERATING SOUND RECORDER AND REPRODUCER

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Fig. 6

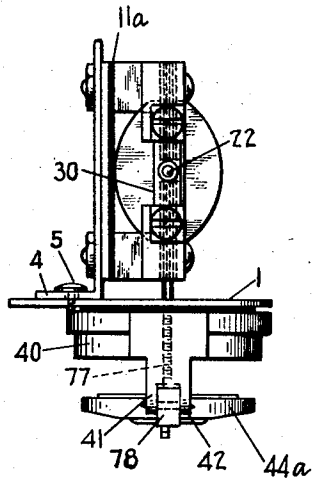


Fig. 5

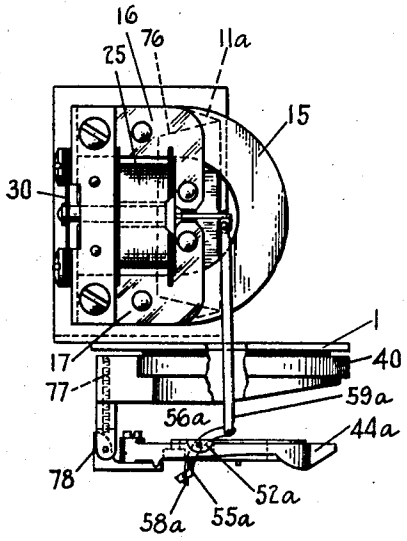


Fig. 7

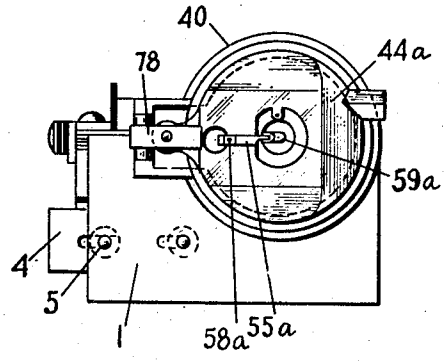
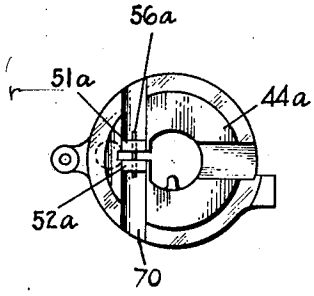


Fig. 8



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Patented July 7, 1931

1,812,957

UNITED STATES PATENT OFFICE

CHARLES HUENLICH, OF BLOOMFIELD, NEW JERSEY, ASSIGNOR TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY

ELECTRICALLY OPERATING SOUND RECORDER AND REPRODUCER

Application filed November 3, 1928. Serial No. 316,896.

This invention relates to an electrically operating sound recorder and reproducer, and more particularly to apparatus for electrically recording and reproducing sounds on records of the type used on dictating machines, in which the stylus engraves a so-called "hill and dale" groove on a cylindrical record.

It is an object of the present invention to provide electrical recording and reproducing apparatus which is simple to construct, rugged and reliable in operation and which will engrave a record of high quality, that is to say, one in which the distortion introduced by the recording or reproducing apparatus itself is minimized.

It is still a further object of this invention to provide apparatus of the class described which is as little as possible affected by the presence of stray electrical disturbances in the neighborhood, such, for example, as the disturbances due to the electrical current operating the motor which drives the mandrel on which the record cylinder is mounted.

Still other objects and advantages of my invention will be apparent from the specification.

The features of novelty which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its fundamental principles and as to its particular embodiments, will best be understood by reference to the specification and accompanying drawings, in which:—

Figure 1 is a front elevation of a sound recorder according to my invention;

Figure 2 is a side elevation thereof;

Figure 3 is a bottom plan view thereof;

Figure 4 is a detail perspective view of the link;

Figure 5 is a front elevation of a reproducer according to my invention;

Figures 6 and 7 are, respectively, side elevation and bottom plan views of the reproducer shown in Figure 5, and

Figure 8 is a top plan view of the floating support for the reproducer lever.

In accordance with my invention, I provide a frame arranged to be attached to the dictating machine in such a manner as to permit a stylus to operate on the usual form of cylindrical record. Above the frame there is adjustably mounted a magnet support carrying an electromagnetic driving motor or pick-up. Below the frame there is provided a support pivoted at one side to the frame, which I term a "floating support." On one side of the supporting frame there is mounted a lever pivoted intermediate its ends for oscillation, on one end of which there is attached a suitable cutting or reproducing stylus.

The electromagnetic driving motor preferably consists of a balanced armature arrangement, in which there is provided an armature of magnetic material resiliently biased to neutral position and positively vibrated in either direction. A rigid link is provided between the end of the armature and the end of the lever opposite the stylus. The oscillating lever may be mounted upon insulation, which may also be mechanical damping material, and the armature may be supported upon insulating material, which may be mechanical damping material, in such a manner that the entire vibrating system is electrically and mechanically insulated from the frame, for a purpose which will be described more in detail.

Referring now more particularly to Figures 1 and 2, 1 designates the frame or base plate, by means of which the apparatus may be positioned upon the usual type of dictating machine. The magnet support comprises a plate having a portion 4 arranged to be clamped to the base plate 1 by means of suitable clamping bolts 5, and the holes in plates 1 and 4, or either of them, are so arranged as to permit of adjustment of the magnet support on the base plate 1. In the preferred form, I provide slots in the plate 4. The plate 4 is provided with a vertical extension 7 on which there is mounted the electromagnetic driving motor designated generically as 8, and held in position by means of suitable clamping bolts 9 and 10 passing through the motor assembly and the support 7. The motor assembly may be spaced from and insulated from the support 7 by the use of an

interposed spacer of metal 11 and a strip of insulating material, such as bakelite or fibre 11*a*. The driving motor itself comprises a U shaped permanent magnet 15, and a pole piece assembly 16 secured to one of the poles of the magnet, and a similar pole piece assembly 17 secured to the opposite pole.

The pole piece assembly 16 has projecting pole pieces 18 and 19 defining between them a winding-receiving space. The pole piece assembly 17 is similarly provided with pole pieces 20 and 21 extending toward the pole pieces 18 and 19. A coil or winding 25 is positioned within the winding-receiving space and may have over it, if desired, a sheet of copper 26. The armature 22 passes between the pole pieces 18 and 20, through the coil or winding 25 and between the pole pieces 19 and 21, and is preferably made substantially cylindrical, except where is passes between the pole pieces 19 and 21, where it is made relatively wide and thinner than at the opposite end.

The pole pieces 18 and 20 are separated by a greater gap than the pole pieces 19 and 21, but are so arranged as to leave only a very small space between them and the armature 22, whereas the pole pieces 19 and 21 are so arranged as to leave a slightly greater space between them and the armature at point 24. The pole piece assemblies 16 and 17 may, if desired, be in the form of a plurality of laminations bolted or otherwise clamped together.

For the purpose of supporting the armature, there is provided a non-magnetic yoke 36 secured over the pole pieces by means of bolts 28 and 29 and having ears 36*a* and 36*b*, which are turned downwardly over the ends of the pole piece assembly. A spring 30 of phosphor bronze or other suitable material is secured to the ears 36*a* and 36*b* by means of suitable bolts 31 and 32, and the spring is insulated from the yoke by means of insulating members 33, 34, 35 and 38. A hole is provided in the spring 30, into which the end of armature 22, which is preferably tapered or provided with a portion of smaller diameter at its end, may be inserted. A collar 37 may then be placed around the extending portion, which is then upset over the collar, as, for example, by hammering. The armature is thus secured in position and is biased by the action of the spring 30 to neutral position in the air gap.

It will now be understood that by passing voice currents of a suitable value through the winding 25, the armature 22 is caused to vibrate in accordance with such currents.

For the purpose of inscribing such vibrations upon the record, there is provided a base ring 40 mounted below the plate 1. This base ring is provided at one side with a downwardly extending portion terminating in formed arms 41 and 42 carrying a suitable pivot 43 on which the floating support 44 is mounted.

The support 44 may comprise, for example, a metal stamping having an upset edge and an internal domed portion 45; the upset edge of the support 44 secures in position a disc of suitable insulating and damping material such as bakelite. Attached to the floating support 44 there are provided a pair of arms 46 and 47, held together by means of a bolt 48 and integral yoke 48*a*, the extremities of which are provided with tapered openings for receiving the tapered points of the shaft or pivot 43.

Mounted upon the disc 50 there are provided a pair of support blocks 51 and 52, which are secured only to the insulator 50 and not to the support 44. Suitable bearing pivots 53 and 54 are threaded through the blocks 51 and 52. The oscillating lever 55 is provided with oppositely extending arms 56 and 57, provided at their extremities with tapered holes for receiving the tapered points of the bearings 53 and 54, by means of which the lever 55 is allowed to rock. On one end of the lever 55 there is provided a cutting stylus, such as a jewel 58. A rigid link 59 is provided for connecting the other end of the lever 55 and the free end of the armature 22. The insulator 50 and the support 44 are provided with suitable openings to permit the passage of said link.

The link 59 is preferably made as light as possible consistent with sufficient rigidity, and for this purpose is substantially U shaped in cross section and provided with extensions 60 and 61 at its lower end, arranged to embrace the end of lever 55, and a suitable rivet 65 is passed through the extensions 60 and 61 and the end of the lever 55. The link is connected at its upper end to the armature through the medium of a block 66 pivotally secured in the end of the link, as shown in Figure 4, which block is provided with an extension 67 passed through a hole in the armature and soldered therein. The connection of the link at each end is so arranged as to permit free rotation of the link on each pivot, but in a manner substantially to prevent any play or rattle.

The floating support permits the stylus to move up and down to accommodate itself to irregularities in the surface of the record while in motion, while at the same time the stylus is maintained in contact with the surface and caused to engrave the surface in accordance with the vibrations of the armature.

The insulating material interposed between the oscillating lever 55 and the floating support and the insulating material interposed between the armature assembly and the frame serve to electrically isolate the vibrating apparatus and minimize the effect of stray currents flowing through the frame of the machine due, for example, to the ground-

ing of the electric motor used for driving the record. At the same time the insulating material acts as a mechanical damping means and serves to isolate the vibrating system from the frame of the machine, preventing mechanical vibrations from being impressed upon the record. The damping function of the bakelite or other insulator serves also to minimize or prevent the establishment of parasitic resonance such as that due to the natural period of the armature and its support, which would distort the record and which resonance I have found to cause a sharp and nasal quality in the record in case the insulator 50, for example, is omitted, and the vibrating lever mounted directly upon the floating support 44 or upon a disc of metal in place of the insulator 50.

The provision of the insulating and damping means around the armature supporting spring serves the same purpose, as I have found that without these insulators the recorded sounds are inclined to be somewhat sharp and nasal.

Under certain conditions, if excessive amplitudes of current are used, it may be found that the end of the armature 22 will strike the pole piece, giving rise to a rattle which is undesirable. This may be prevented, and resonance which may be due to the natural period of the armature itself and its spring support may be further decreased by the interposition of suitable damping means between the armature 22 and the pole pieces 19 and 21; this damping material may be in the form of paper folds 68 or thin strips of rubber, or the like, inserted between the armature and the pole pieces, as shown in Figure 1.

Referring now more particularly to Figures 5, 6, 7 and 8, I have shown a device according to my invention more particularly adapted for use as a reproducer and in which the same reference numerals designate the same parts as in the previous figures. The magnetic unit in this case is substantially the same as that shown in Figures 1 and 2.

The reproducing lever 55*a*, carrying stylus or jewel 58*a*, is pivotally mounted on shaft 56*a* upon the upper side of the floating support 44*a*. In this instance, shaft 56*a* passes through lugs 51*a* and 52*a* in groove 70 on the upper side of floating support 44*a*. The reproducing lever 55*a* is preferably made somewhat shorter than the recording lever 55, and is mounted with its stylus toward the axis of the floating support, and the free end of the lever 55*a* is connected to the armature by link 59*a*.

For convenience in bringing up the leads the upper end of fibre strip 11*a* may be folded down as at 76 to provide room for the leads to emerge if they are connected upon the inner side of the insulating member, and terminals not shown may be secured to strip 11*a*, to which terminals the leads may be connected.

The operation of this arrangement, it is believed, will be clear from what has already been said. The stylus or jewel 58*a* engages the record and is vibrated thereby. The vibrations of the lever 55*a* are transmitted through link 59*a* to the armature, which is caused to vibrate in the air gap. The vibration of the armature varies the flux passing through coil 25 and causes the generation in that coil of an electromotive force which is closely proportional to the vibrations of the stylus. The floating support upon which the lever 55*a* is pivoted is allowed to move up and down due to irregularities in the thickness of the record, without substantially affecting the reproduction, as will be understood.

For the purpose of preventing the floating support from swinging too far downwardly, an adjustable stop may be formed by a screw 77, which engages block 78 carried by the support. It is clear that by rotating the screw 77 in a direction to raise its lower end, the floating support is allowed to swing further downwardly, and, conversely, rotating the screw to lower its lower end decreases the point to which the floating support can drop.

While I have shown and described certain preferred embodiments of my invention, it will be apparent that modifications and changes may be made without departing from the spirit and scope of my invention, as will be understood by those skilled in the art.

I claim:—

1. An electrical sound recorder comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted for oscillation on said floating support, a stylus mounted on one end of said arm, a link pivotally secured to the other end of said arm, a magnetic driving motor mounted on said frame and comprising a vibratile armature biased to neutral position, and electromagnetic means for positively actuating said armature in either direction, and a pivot connection between said armature and said link.

2. An electrical sound recorder comprising, in combination, a frame, a magnet support secured to said frame, a magnetic driving motor positioned on said frame, said motor comprising a vibratile armature, spring biased to neutral position, and electromagnetic means for positively actuating said armature in either direction from neutral, a floating support pivotally secured to said frame, a lever mounted for oscillation thereon, a stylus mounted on one end of said lever, and a link pivotally connected on one end to the other end of said lever, and on the other end to said armature.

3. An electrical sound recorder comprising, in combination, a frame, a magnet support adjustably secured to said frame, a magnetic driving motor positioned on said frame, said motor comprising a vibratile armature, spring

biased to neutral position, and electromagnetic means for positively actuating said armature in either direction from neutral position, a floating support pivotally secured to said frame, a lever mounted for oscillation thereon, a stylus on one end of said lever, and a rigid link pivotally connected between one end of said armature and the end of said lever opposite said stylus, said link being so arranged as to positively drive said stylus in either direction of movement.

4. An electrical sound recorder comprising, in combination, a frame, a magnetic driving motor positioned on said frame, said motor comprising a vibratile armature, a spring for supporting said armature in neutral position and insulating means interposed between said spring and its seat, and electro-magnetic means for positively actuating said armature in either direction from neutral position, a floating support pivotally secured to said frame, a lever mounted for oscillation thereon, a stylus on one end of said lever, and a rigid link pivotally connected between one end of said armature and the end of said lever opposite said stylus, said link being so arranged as to positively drive said stylus in either direction of movement.

5. An electrical sound recorder comprising, in combination, a frame, a magnetic driving motor positioned on said frame, said motor comprising a vibratile armature, a spring for supporting said armature in neutral position, and electro-magnetic means for positively actuating said armature in either direction from neutral position, a floating support pivotally secured to said frame, an insulator mounted on said support, a lever pivotally mounted for oscillation on said insulator, a stylus on one end of said lever, and a rigid link pivotally connected between one end of said armature and the end of said lever opposite said stylus, said link being so arranged as to positively drive said stylus in either direction of movement.

6. An electrical sound recorder comprising, in combination, a frame, a magnetic driving motor positioned on said frame, said motor comprising a vibratile armature, a spring for supporting said armature in neutral position, insulating means interposed between said spring and its seat, and electro-magnetic means for positively actuating said armature in either direction from neutral position, a floating support pivotally secured to said frame, an insulator mounted on said support, a lever pivotally mounted for oscillation on said insulator, a stylus on one end of said lever, and a rigid link pivotally connected between one end of said armature and the end of said lever opposite said stylus, said link being so arranged as to positively drive said stylus in either direction of movement.

7. An electrical sound recorder comprising, in combination, a frame, a magnetic driving motor positioned on said frame, said motor comprising a magnet having pole pieces extending toward each other, and each having projecting portions at each end defining a winding-receiving space, a winding therein, an armature positioned between said pole pieces and interlinking said winding, a spring for supporting said armature in neutral position for oscillation, and damping means interposed between said armature and said pole pieces at the point of maximum vibration amplitude of said armature.

8. An electrical sound recorder comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted for oscillation on said floating support, a stylus mounted on one end of said arm, a link pivotally secured to the other end of said arm, a magnetic driving motor mounted on said frame and comprising a vibratile armature biased to neutral position, a magnet having pole pieces defining a pair of air gaps at opposite ends of said armature, a coil surrounding said armature, and a pivot connection between said link and said armature in the plane of said air gaps.

9. An electrical sound recorder comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted for oscillation on said floating support about an axis parallel to the axis of said support but offset therefrom, a stylus mounted on the end of said lever arm remote from the axis of said support, a magnetic driving motor mounted on said frame and comprising a magnet having a pair of pole pieces defining an air gap, an armature of magnetic material mounted for vibration within said air gap, and a connection between said armature and the free end of said lever arm.

10. An electrical sound reproducer comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted for oscillation on said floating support, a stylus mounted on one end of said arm, and means for converting movements of said stylus into electrical currents, comprising a magnet having pole pieces defining a plurality of air gaps, an armature positioned within said gaps for vibration therein, a coil surrounding said armature, and a connection between the free end of said lever arm and said armature.

11. An electrical sound reproducer comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted for oscillation on said floating support about an axis parallel to the axis of said support but offset therefrom, a stylus mounted on one end of said lever, and means for converting movements of said stylus into electrical currents, comprising a magnet having pole pieces defining a pair of air gaps, an armature biased to neu-

tral position and mounted for vibration within said gaps, and a connection between the free end of said lever arm and said armature.

12. An electro-mechanical translating device comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted on said support for oscillation thereon, a stylus mounted on one end of said arm, a magnet mounted on said frame, pole pieces defining an air gap mounted on said magnet, an armature mounted for vibration in said gap and biased to neutral position, and a connection between said lever and said armature.

13. An electro-mechanical translating device comprising, in combination, a frame, a floating support pivotally mounted below said frame, a lever arm pivotally mounted on said support for oscillation thereon, a stylus mounted on one end of said arm, a magnet mounted on said frame, pole pieces defining a pair of air gaps mounted on said magnet, an armature mounted for vibration in said air gaps, resilient damping means surrounding a portion of said armature, and a connection between said lever and said armature.

14. An electro-mechanical translating device comprising, in combination, a frame, a floating support pivotally mounted below said frame, a lever arm pivotally mounted on said support for oscillation thereon, a stylus mounted on one end of said arm, a magnet mounted on said frame, pole pieces defining a pair of air gaps mounted on said magnet, an armature mounted for vibration in said air gaps, resilient damping means surrounding a portion of said armature, and a connection between said lever and said armature at a point outside the portion thereof included between said air gaps.

This specification signed this 31st day of October, 1928.

CHARLES HUENLICH.

DISCLAIMER

1,812,957.—*Charles Huenlich*, Bloomfield, N. J. ELECTRICALLY OPERATING SOUND RECORDER AND REPRODUCER. Patent dated July 7, 1931. Disclaimer filed April 13, 1934, by the patentee, and the assignee, *Thomas A. Edison, Incorporated.*

Hereby enter this disclaimer to that part of the said specification which consists of claims numbered 7, 9, 10, 11, 12, 13, and 14, which respectively are in the following words, to wit:

"7. An electrical sound recorder comprising, in combination, a frame, a magnetic driving motor positioned on said frame, said motor comprising a magnet having pole pieces extending toward each other, and each having projecting portions at each end defining a winding-receiving space, a winding therein, an armature positioned between said pole pieces and interlinking said winding, a spring for supporting said armature in neutral position for oscillation, and damping means interposed between said armature and said pole pieces at the point of maximum vibration amplitude of said armature."

"9. An electrical sound recorder comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted for oscillation on said floating support about an axis parallel to the axis of said support but offset therefrom, a stylus mounted on the end of said lever arm remote from the axis of said support, a magnetic driving motor mounted on said frame and comprising a magnet having a pair of pole pieces defining an air gap, an armature of magnetic material mounted for vibration within said air gap, and a connection between said armature and the free end of said lever arm.

"10. An electrical sound reproducer comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted for oscillation on said floating support, a stylus mounted on one end of said arm, and means for converting movements of said stylus into electrical currents, comprising a magnet having pole pieces defining a plurality of air gaps, an armature positioned within said gaps for vibration therein, a coil surrounding said armature, and a connection between the free end of said lever arm and said armature.

"11. An electrical sound reproducer comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted for oscillation on said floating support about an axis parallel to the axis of said support but offset therefrom, a stylus mounted on one end of said lever, and means for converting movements of said stylus into electrical currents, comprising a magnet having pole pieces defining a pair of air gaps, an armature biased to neutral position and mounted for vibration within said gaps, and a connection between the free end of said lever arm and said armature.

"12. An electro-mechanical translating device comprising, in combination, a frame, a floating support pivotally mounted on said frame, a lever arm pivotally mounted on said support for oscillation thereon, a stylus mounted on one end of said arm, a magnet mounted on said frame, pole pieces defining an air gap mounted on said magnet, an armature mounted for vibration in said gap and biased to neutral position, and a connection between said lever and said armature.

"13. An electro-mechanical translating device comprising, in combination, a frame, a floating support pivotally mounted below said frame, a lever arm pivotally mounted on said support for oscillation thereon, a stylus mounted on one end of said arm, a magnet mounted on said frame, pole pieces defining a pair of air gaps mounted on said magnet, an armature mounted for vibration in said air gaps, resilient damping means surrounding a portion of said armature, and a connection between said lever and said armature.

"14. An electro-mechanical translating device comprising, in combination, a frame, a floating support pivotally mounted below said frame, a lever arm pivotally mounted on said support for oscillation thereon, a stylus mounted on one end of said arm, a magnet mounted on said frame, pole pieces defining a pair of air gaps mounted on said magnet, an armature mounted for vibration in said air gaps, resilient damping means surrounding a portion of said armature, and a connection between said lever and said armature at a point outside the portion thereof included between said air gaps."

[*Official Gazette May 8, 1934.*]