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H. C. HARRISON
PHONOGRAPH REPRODUCER
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2,133,815

FIG. 1

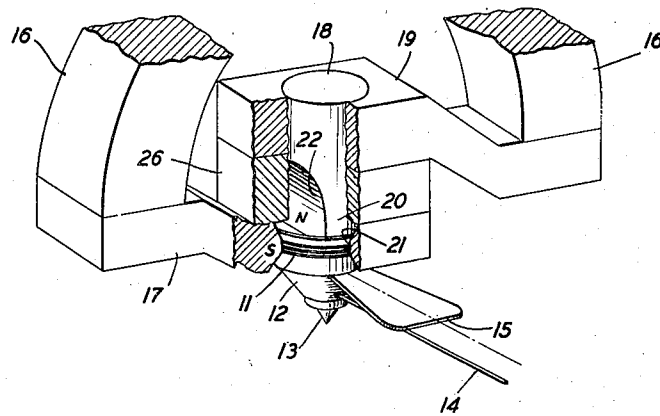
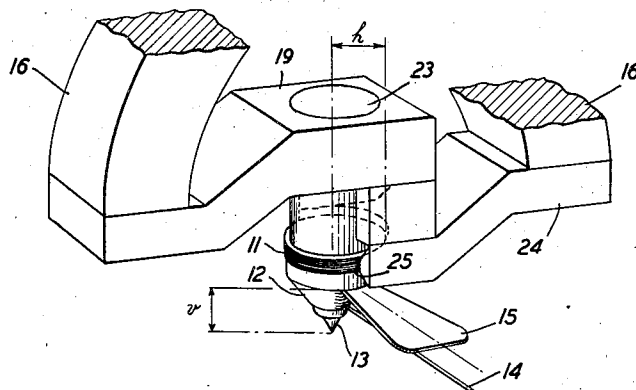


FIG. 2



INVENTOR
H.C. HARRISON
BY *G.M. Campbell*
ATTORNEY

UNITED STATES PATENT OFFICE

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PHONOGRAPH REPRODUCER

Henry C. Harrison, Port Washington, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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2 Claims. (Cl. 179—100.41)

This invention relates to phonograph reproducers and the object of the invention is a high quality reproducer of the universal type which will operate at satisfactory efficiency on either hill and dale or lateral cut records.

Universal reproducers of various types have been proposed heretofore. Some of these involved switching or some other operation in changing from one type of record to the other and other previous types required a moving system which was not symmetrical with respect to the vertical axis.

In accordance with the general features of this invention a stylus is rigidly and coaxially connected to a circular coil positioned in an air-gap at one side of the coil and mounted to respond to either vertical or lateral stylus vibrations without requiring any special attention on the part of the operator as to the type of record being played. In one embodiment the air-gap is defined by an outer pole-piece surrounding the coil and a central pole-piece within the coil shaded on one side to provide a gap of the required configuration and in an alternate construction the gap is defined by a circular central pole-piece and an outer pole-piece presenting a pole face to only one side of the coil.

The coil and stylus assembly is preferably supported by spaced parallel cantilever springs of the type shown in Patent 2,027,168, granted to me January 7, 1926. One of the springs is free to deflect both vertically and laterally and the other spring is free to deflect both vertically and torsionally but not laterally so that either vertical or lateral vibrations of the stylus will vibrate the active portion of the coil vertically in the air-gap.

In such a structure with the coil rigidly attached to the stylus the coil velocity is always equal to that of the stylus for vertical vibrations thereby fixing the efficiency of the device for vertical records. The lateral efficiency will vary, however, with the relative magnitude of the distances from the stylus point and the active side of the coil to the horizontal axis of rotation. When the reproducer is required to have the same efficiency on both types of record these distances should be equal but it will be understood that the lateral efficiency may be made greater or less than the vertical efficiency by proper proportioning of the moving system.

In the drawing,

Fig. 1 is a reproducer according to the invention with a shaded central pole-piece, and

Fig. 2 is an alternate construction having a

solid center pole and an outer pole with a semi-circular pole face.

In Fig. 1 the coil 11 is wound on a shallow cup member 12 to which the stylus 13 is rigidly secured on the vertical axis of the coil. This assembly is resiliently mounted by means of the spaced parallel springs 14 and 15 which are clamped to a portion (not shown) of the stationary structure of the reproducer. The permanent magnet 16 has a pole-piece 17 surrounding the coil 11 and a central pole-piece 18 within the coil and magnetically connected to the other pole of the magnet by the member 19. The central pole-piece 18 is cylindrical in form but is shaded or cut away in its lower portion to form an end piece 20 of semi-circular cross-section.

These two pole-pieces therefore define a semi-circular gap 21 in the magnetic circuit on the right side of the coil but substantially no flux flows across the left side of the coil from the face 22 of the pole-piece 18. The member 26 is composed of brass or other non-magnetic material and serves merely as a spacer for the adjacent portions of the magnetic circuit.

In Fig. 2 the moving system is identical with that of Fig. 1. The central piece 23, however, is cylindrical throughout its length and the outer pole-piece 24 extends only half way around the coil 11 to form a semi-circular air-gap 25 at the right side of the coil as in Fig. 1.

When the stylus is vibrated vertically by a hill and dale record, the whole assembly moves vertically as a unit and the right half of the coil in either construction cuts the flux in the air-gap and generates voltages corresponding to the stylus vibrations. When the stylus is vibrated laterally, the spring 14 also deflects laterally but the spring 15, being rigid in a lateral sense, deflects torsionally and a rocking motion is imparted to the coil. For the small amplitudes at which the stylus is vibrated the motion of the right side of the coil in the air-gap will be substantially vertical as in the case when the stylus is driven by a hill and dale record.

As stated above the response or efficiency of the reproducer on hill and dale records is determined by the design of the magnetic circuit and coil structure and is substantially independent of the relative lengths of the vertical and horizontal lever arms v and h (Fig. 2) since the stylus is rigidly connected to the coil. The velocity of the coil in the gap when the reproducer is operating on lateral records, however, will be directly dependent on the ratio of these two arm lengths and the difference between the

hill and dale response and the lateral response in decibels is therefore

$$20 \log \frac{v}{h}$$

5 In the device shown the radius (h) of the coil 11 is about .135 inch and the distance v from the tip of the stylus 13 to the upper spring 15 is about .215 inch. The ratio

$$10 \frac{v}{h}$$

is therefore 1.59 which corresponds to about 4 decibels better response on hill and dale than on lateral records. If $v=h$, the reproducer obviously will be equally efficient on either type 15 record and if for example $h=.342$ inch and v is .215 inch then

$$\frac{v}{h}=.63$$

20 Substituting this value in the above equation

$$20 \log .63=-4$$

the lateral response will therefore be about 4 25 decibels better on lateral than on hill and dale records.

It will be readily seen, however, that as the coil diameter is increased the mass and the mechanical impedance of the moving system become greater so that in general a high relative

lateral efficiency is obtainable only at the expense of greater wear on the records and in most cases it is preferable to design the device for slightly lower response on lateral than on vertical records.

While the invention has been described for purposes of illustration with reference to particular embodiments it is intended to be limited only by the scope of the following claims.

What is claimed is:

1. In a universal reproducer, a moving system comprising a circular coil, a stylus, and means for holding the coil and stylus in spaced coaxial relation, a magnet system having an outer pole-piece surrounding the coil and an inner pole-piece shaded to form a semi-circular gap at one side of the coil, and a vertically and torsionally resilient spring supporting the system with one side of the coil within the gap.

2. In a universal reproducer, a moving system comprising a circular coil, a stylus, and means for holding the coil in spaced coaxial relation, a magnet system having pole-pieces defining a semi-circular air-gap at one side only of the coil, and a vertically and torsionally resilient supporting spring attached to said moving system at a distance from the tip of the stylus which is of the same order of magnitude as the radius of the coil.

HENRY C. HARRISON. 30