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PHONOGRAPH REPRODUCER

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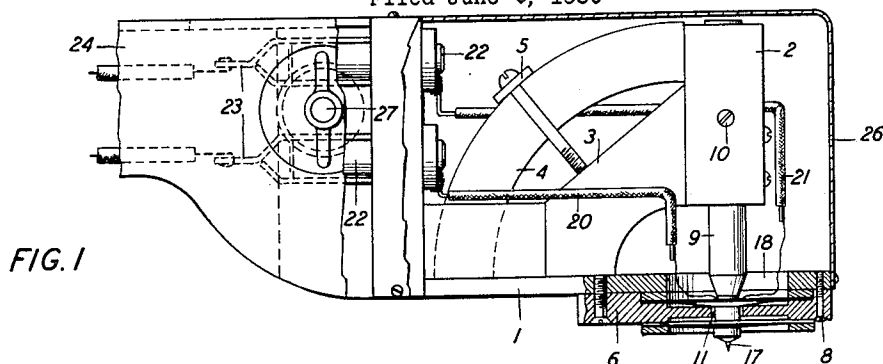


FIG. 2

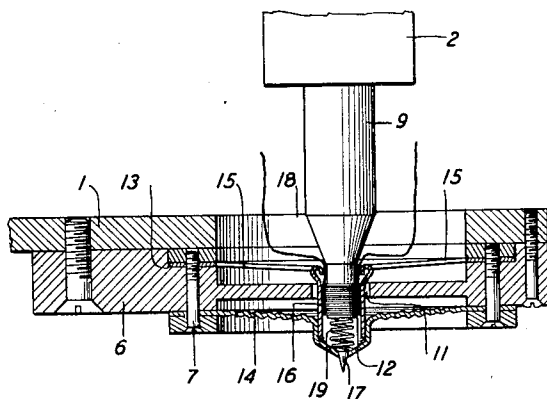
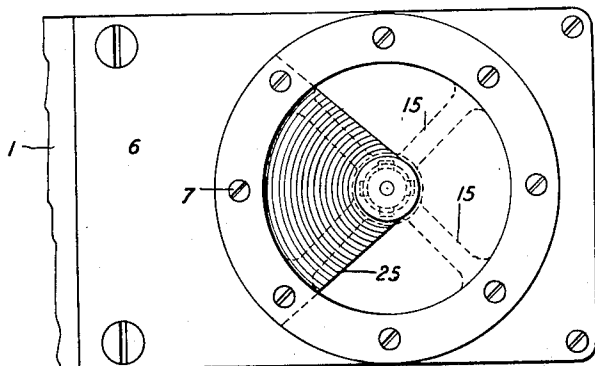


FIG. 3



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PHONOGRAPH REPRODUCER

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3 Claims. (Cl. 179—100.41)

This invention relates to phonograph reproducers for hill and dale records and the object of the invention is to provide a reproducer of this type which has certain novel features of construction and is well adapted for high quality performance in general use.

The general principles of the construction used have been explained heretofore in a copending application of A. C. Keller 402,128, filed October 24, 1929. Broadly stated these devices consist of a generating element such as a coil elastically supported in a magnetic field, the mass and stiffness of the element and the support being of very small magnitude and so proportioned that the device is capable of tracking a groove embracing a wide range of frequencies with an unusually low pressure so that the wear on the groove is negligible. When such a reproducer is intended for reproduction from commercial pressing only, higher bearing pressures may be used than when reproduction from soft recording material is desired. It therefore may be desirable in some cases to take advantage of this fact by designing the reproducer with somewhat larger mechanical constants with a view to obtaining a more rugged device.

In accordance therefore with the general features of this invention the generating coil is mounted between or adjacent two parallel, spaced, elastic members so that it may be driven readily in a vertical direction but is highly resistant to torsional forces which would oscillate the coil about a diameter and thereby introduce extraneous noises into the reproduction. The upper one of these members is preferably of spider like construction which results in minimum impedance to vertical movement but practically as great impedance to torsional movement as would be provided by a solid diaphragm. The lower member may be a very light weight diaphragm which serves also as a stylus mounting and a closure for the reproducer casing, or, if even lower mass is required than is readily attainable with this construction, this member may take the form of a sector of diaphragm without excessively reducing the torsional rigidity of the moving system.

In some cases it is found when the mass of the system is made sufficiently low, that when the reproducer rests upon the groove the initial deflection of the support is so great that the device is operating on the curved portion of the force-deflection characteristic, that is to say, the effective stiffness of the system under this condition is much higher than when the dia-

phragm is in a substantially plane condition. A feature of this invention is a structure adapted to take advantage of the lower stiffness of the plane condition of the diaphragm. In its preferred form this structure consists of a small spring or other device of low elasticity normally tending to bow the diaphragm outwardly slightly so that when the reproducer is placed on the record the weight of the reproducer system tends to restore the diaphragm to a substantially plane condition.

A further feature of the invention is a plug and socket connection between the reproducer and its supporting arm which serves as both a mechanical support and an electrical connection to the external circuit.

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

Fig. 1 is a side view of the preferred form of the reproducer;

Fig. 2 is a large scale detail of the moving system; and

Fig. 3 is a bottom view of an alternative construction for the elastic supporting members.

Referring to Figs. 1 and 2 the magnetic members 1 and 2 are held in proper relative position by a non-magnetic spacer 3 to which the permanent magnet 4 is also secured by means of clamp 5. The pole piece 6 carries the reproducer moving system and for convenience in assembling and repairing the device is made readily detachable from the reproducer by means of screws 7, 7 and 8, 8. Magnetic member 2 is hollow to receive the pole piece 9 which, when held in proper position by set screw 10, projects through a circular opening 18 in the member 1 to form an annular gap 11 with the pole piece 6.

The moving system comprising the coil 12, the spider member 13 and the diaphragm 14 is shown clearly in Fig. 2. The spider is preferably made from duralumin, 2 mils in thickness with sectors stamped out so as to leave four supporting arms 15, as shown by dotted lines in Fig. 3. Other radial arms 16 are bent up to hold the coil 12 in its proper position in the gap. The diaphragm 14 is also of the 2 mil duralumin corrugated to increase its stiffness and permit greater amplitude of deflection. The center of the diaphragm is pressed out to receive the stylus, which may be a sapphire or a diamond, and to provide the necessary operating clearance when the reproducer is rest-

ing on the record. In assembling the moving system the diaphragm is first put into position and the spider member is then fastened to it by cementing the coil supporting arms 16 to the inner surface of the pressed out portion of the diaphragm, as shown, so that both the spider and the diaphragm move with the coil as it is driven in accordance with the record grooves.

The impedance of a moving system of this kind is such that the stylus may be kept in constant contact with the grooves when the unbalanced weight of the reproducer system is as low as from 15 to 20 grams, but even this small force would ordinarily cause a large initial deflection of the system, thereby very materially increasing its stiffness above its value when in a substantially undeflected position. If the reproducer were used with a moving system as so far described, this high operating stiffness would result in much more wear on the record than if it were driven about its substantially plane position. In order to take advantage of the lower stiffness of the system when in the plane position and thereby keep the wear on the record a minimum, there is provided a coil spring 19 or other suitable elastic member seated in a recess in the end of pole piece 9 and cemented to the diaphragm just above the stylus to provide an initial deflection in the diaphragm and spider member as indicated. For best results the constants of the spring should be proportioned with respect to the moving system and the unbalanced weight of the reproducer that the reaction of the record when the reproducer is resting on it will restore the system to its undeflected position.

The coil 12 is preferably made up of about 50 turns of No. 44 enameled copper wire, the adjacent turns being held together by cellulose acetate. The ends of the coil are brought out and soldered to the stiffer conductors 20, 21 leading to studs 22 which plug into the sockets 23 on the supporting arm 24. The sockets are preferably split so that the reproducer may be easily disconnected from the arm or held tightly in place by clamp 27 when in use. This arrangement is a decided advantage when the reproducer is to be changed frequently since with the usual construction one or more tools are necessary to connect and disconnect the leads and

mechanical supporting members. The casing 26 surrounding the reproducer improves its appearance, protects it from injury in handling and together with the diaphragm forms a dust tight closure for the moving system.

Another form of elastic supporting structure as shown in Fig. 3 is similar to that just described except that only a sector of diaphragm 25 is used. In some cases it may be necessary to resort to some such construction as this where very low stiffness is desired, but in general it will be found preferable to use the full diaphragm whenever possible in order to keep dust and other extraneous matter from accumulating in the air-gap.

The invention has been described with reference to certain specific embodiments, but obviously various changes might be made within the scope of the appended claims. For instance the generating element might be a moving armature rather than a coil as shown or both of the mounting members might be placed on one side of the generating element.

What is claimed is:

1. In a phonograph reproducer, a magnetic circuit having pole pieces forming an annular air gap, a stylus driven coil within the gap, elastic supporting means for the coil and an elastic member normally under compression between one of the pole pieces and the supporting means.

2. In a phonograph reproducer, a magnetic circuit including an air gap, a generating element in the gap, a stylus, supporting means for the element and the stylus comprising elastic members disposed in adjacent parallel planes, and auxiliary resilient means cooperating with one of the elastic members to reduce the effective stiffness of the supporting means.

3. In a phonograph reproducer, a magnetic circuit including pole pieces forming an air gap, a stylus driven coil positioned in the gap, supporting means for the coil comprising a diaphragm and a spider member connected together near their centers in spaced relation, and a coil spring member under compression between one of the pole pieces and the supporting means adapted to efficiently neutralize the effect of the weight of the reproducer on the stiffness of the supporting means.

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