

PATENT SPECIFICATION

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340,789

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COMPLETE SPECIFICATION.



Improvements in and relating to Sound-reproducing Devices.

We, COLUMBIA GRAPHOPHONE COMPANY, LIMITED, of 102—108, Clerkenwell Road, London, E.C.1, a Company registered under the laws of Great Britain
 5 (Assignees of FRANK LUSHBURGH CAPPS, of C/o Columbia Phonograph Company, Inc., Bridgeport, Connecticut, United States of America, and HARRY ANDERSON SUMMERS, of 1819, Broadway, New York,
 10 New York, United States of America, both citizens of the United States of America), do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to sound-reproducing devices for converting mechanical vibrations into electrical impulses or vice
 20 versa, the invention having particular although not exclusive reference to the so-called electrical "pick-ups" adapted to reproduce sound waves recorded upon a gramophone record.

25 An object of the invention is to provide a sound-reproducing device of the character described in which the armature of the device is given a free balance and at the same time has its motion damped.

30 A further object is to provide a sound-reproducing device having relatively great sensitivity and in which the armature is given a more stable balance than heretofore and to provide a construction
 35 in which the parts may be easily and quickly assembled and wherein the armature may be accurately centred and locked in place.

In connection with such apparatus it
 40 has previously been proposed to employ an armature, pivotally mounted between magnetic pole pieces, provided with an upwardly projecting extension adapted by its position in a liquid bath, or in or
 45 between rubber blocks, to damp the movements of the armature, but in such prior proposals the extension is stiff and rigid with the armature.

50 The present invention consists in a sound-reproducing device of the character referred to comprising an armature having a flexible elastic reed projecting therefrom and damping means adapted to

embrace a part of said reed.

Said reed preferably comprises a flexible
 55 spring member arranged to project outwardly from an air gap formed by adjacent pole pieces of a magnet, the projecting end of the reed being embedded or embraced by a block of rubber or other
 60 damping material.

Further features of the invention will hereinafter appear.

In the accompanying drawings.—

Figure 1 is a plan view of a pick-up,
 65 a part of the arm or support therefor being shown;

Figure 2 is a plan view of a pick-up disconnected from the arm and with its
 70 cover removed;

Figure 3 is a front elevation of the pick-up shown in Figure 2;

Figure 4 is a longitudinal view taken along the line 4—4 of Figure 2;

Figure 5 is a transverse view taken
 75 along the line 5—5 of Figure 2;

Figure 6 is a plan view of the magnet and pole pieces, the armature and damping means being omitted;

Figure 7 is a side view of the armature
 80 removed;

Figure 8 is a view taken at right angles to Figure 7;

Figure 9 is a view similar to Figure 3 but showing a slightly modified form;

Figure 10 is a view similar to Figure 8 but showing the modification;

Figure 11 is a view similar to Figure 7, but showing the armature used in the
 90 structure of Figure 9; and

Figures 12 and 13 are diagrammatic views showing action of stiff and flexible reeds.

Referring in detail to the accompanying drawings, at 1 is shown the pick-up
 95 adapted to be mounted in a yoke such as that shown at 2 in Figure 1, the yoke being carried by an arm 3 adapted to be mounted for swinging movement over a turntable or other structure carrying a
 100 record. The pick-up includes a base 4 on which is assembled the different parts, the base co-operating with the cover 5 (see Figures 1, 3 and 9) to form a closure
 105 for the parts.

Mounted on the forward portion of the

[Price 1/-]

base is a permanent horseshoe magnet 6 between the arms of which are disposed pole pieces 7 and 8. The pole faces 9 and 10 incline upwardly and the pole faces 11 and 12 are concave. Disposed within the space between the pole pieces is an electromagnetic winding 13, in the form of a bobbin, the same being wound upon the support 14.

10 An armature is disposed within the winding 13 and comprises a body portion 15 having a head 16 substantially in the shape of a pyramid and as shown in the assembled view, this head is disposed in the air gap between the pole faces 9 and 10, and presents a surface to each pole face, which surface is substantially the area of the pole face. In this connection, it is to be noted from Fig. 6 that the upper pole pieces taper toward the faces 9 and 10 and that the pole faces are unbroken and are not spaced from the head 16 by blocks of rubber or the like. Further, the armature comprises a pair of bearing portions 17 and 18, the bearing portion 18 being hollow and internally screw threaded, whereby a clamp screw 19 may be used to clamp a stylus 20 in the socket 21, also formed in the armature. Bearings 17 and 18 are as shown, disposed between the pole faces 11 and 12, a strip or sheet of rubber being disposed about the bearings.

35 Secured in the head 16 and projecting upwardly therefrom, is a flexible reed or fin 22 of metal or the like. To serve its intended purpose, this reed should preferably be highly flexible and we have found that a reed comprising a thin strip of brass is suitable for this purpose.

40 As clearly shown in Figures 3 and 5, reed 22 is embedded in a block or slab 23 of rubber or other vibration absorbing material, although soft rubber has been found to be highly satisfactory. It is clear that the block 23 is disposed within a housing, casing or carrier 24 suitably shaped to receive the block of rubber and having outwardly extending horizontal arms 25 and 26 provided with elongated openings 28 for the passage of screws 29. These elongated openings permit the housing and its contents, the block of rubber, to be shifted slightly one way or the other, so as to centre the armature head 16 in the air gap between the pole faces 9 and 10.

55 Rearwardly of the permanent magnet 6 and also mounted on the base 4 is a block 30 carrying contacts 31 and having sockets 32 to receive plugs 33 attached to the wires 34, leading to any amplifying system. Wires 35 connect contacts 31 to the winding 13.

65 In Figure 10 a reed 36 is shown attached

to the armature head 16, this reed being in the form of a "T", its upper arms 37 and 38 extending in opposite directions and being held against the top of the casing 24 by means of the block 23. These arms extend into contact with the side walls of the casing. In Figures 10 and 11, this reed is shown with its armature, disassociated from the remainder of the pick-up. Figure 12 shows the unequal rubber compression resulting from the use of a stiff spring, while Figure 13 shows the compression resulting in the use of the present device. Considering the operation of the device, it is to be noted that there is in effect, two fulcrum points for the armature, a fixed fulcrum point formed by the bearings 17 and 18 and a floating fulcrum point formed at the juncture of the armature head 16 and the reed 22. The greatest movement of the reed or spring 22 takes place adjacent to the head of the armature at the lower surface of the rubber block.

It is desired to provide a balancing force which is to some extent dependant on a metallic part. Metal springs such as would be necessary to give the desired free balance to the pick-up armature would not damp motion. Damping of the motion is necessary to improve the frequency character, and in the present instance, damping is accomplished by surrounding a balancing spring with rubber in such a manner that normal vibrations will not be heavily damped but excessive vibrations causing the spring or reed 22 (Figures 1 to 8) or 36 (Figures 9 and 10) to vibrate violently, will be damped in accordance with the amplitude of their motion.

The structure shown in Figures 9, 10 and 11 has been found not quite as efficient as that shown in the remainder of the Figures. This is due to the fact that vibrations are apt to pass through the spring or reed to the point of contact in the supporting housing and reflect back again without completely losing their energy in the rubber. However, this structure (Figures 9, 10 and 11) has many advantages.

With the structure shown in Figures 1 to 8, where the reed or spring 22 has its free end embedded in the rubber so as to float therein, the vibrations passing through the reed or fin are completely lost in the rubber.

A further advantage is due to the fact that the large mass of rubber is only under a slight pressure, the force necessary to maintain the armature in balance being not sufficient to cause permanent deformation of the rubber. Formerly, there have been structures using a thread

or membrane of rubber about $\frac{1}{16}$ inch square which after some use is permanently reduced to about $\frac{1}{32}$ inch in thickness. With the present structure, a much larger section or block of rubber is used. This keeps the stress in the rubber below the point where permanent deformation takes place. In addition, due to the fact that a larger area is present for damping effect, it is not necessary to drive the molecules of rubber through such a large hysteresis loop. Reducing the size of the hysteresis loop also tends to increase the life of the rubber.

A very important effect resulting from the present invention is that once a piece of rubber or other damping means of given material and size has been determined upon, no adjustment for compression is necessary. The only adjustment made with the rubber is to slide the container 24 back and forth to centre the armature in the air gap. Should the pick-up subsequently become defective, it will not be due to failure in the rubber, but will be due to loosening of the screws which hold the container. To correct this, it is only necessary to re-centre the armature by sliding the container or housing 24, and again tightening the screws. Magnetic leakage is also reduced due to the present arrangement, since there are no slots in the pole faces 9 and 10 to receive damping material. This reduces flux leakage and makes possible the use of narrower pole pieces with a correspondingly lighter moving member.

A further advantage resulting from this structure is that the low unit pressure exerted by the rubber block 23 makes possible a more reliable adjustment. In turn, this makes it possible to have a balance allowing the armature to swing freely from side to side. Accordingly, wear on records is decreased, since the lateral pressure necessary to secure a given deflection is also decreased.

Greater sensitivity is also obtained. The small lateral force necessary for a given deflection of the armature causes less bending in the needle point and results in less motion of the entire pick-up and its supporting arm. Therefore, more of the vibratory motion of the record groove is transmitted to the top part of the armature, thus improving the sensitivity or efficiency of the pick-up. Heretofore, it has been readily possible to get a free balance with high sensitivity, but without stable adjustment. Further it has been easy to obtain a sturdy adjustment at the sacrifice of sensitivity, and at the cost of wear on the records. With the present arrangement, low sidewise force and great sensitivity

is obtained due to the use of the flexible reed and the block of soft rubber as a damping means.

In the present instance, owing to the fact that the rubber is compressed only to a low value, there is almost no chance of any deformation in the rubber. The result is a high degree of stability of adjustment. Moreover, the motion is transmitted from the armature to the rubber through a flexible member, and therefore, the stability of adjustment obtained by using a large mass of rubber is not attained at the expense of a free balance with its accompanying high sensitivity.

There is a certain advantage resulting from the placing of the rubber 23 in a housing or casing 24. The rubber can be made sufficiently close to a selected standard so that a definite size of block and a casing or housing suitably dimensioned to fit it, may be chosen. Thus, instead of the necessity of balancing two pads one against the other, and testing the balance to make sure it is not too free, nor too stiff and properly centred, it becomes only necessary to assemble the rubber into the housing or casing and position this assembly over the spring or reed and slide the assembly to one side or the other until the armature is accurately centred in the air gap, after which, the screws 29 are tightened.

It is to be understood that the invention is applicable to forms and styles of pick-ups other than the type shown, and that the invention is not to be limited to the details of construction, arrangement and operation described above, since the invention may be modified within the scope of the appended claims depending upon any practical considerations that may have to be fulfilled.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A sound-reproducing device of the character described comprising an armature having a flexible elastic reed projecting therefrom and damping means adapted to embrace a part of said reed.

2. A sound-reproducing device as claimed in Claim 1 wherein said reed is adapted to project outwardly from an air gap formed by adjacent pole pieces of a magnet.

3. A sound-reproducing device as claimed in Claim 1 or 2 wherein the armature is mounted for a rocking movement about a substantially horizontal pivot and is provided with a head disposed in an air gap formed between adjacent

magnetic pole pieces, said reed being secured to the head of said armature and being adapted to project upwardly therefrom out of said air gap.

5 4. A sound-reproducing device as claimed in any of the preceding claims in which the damping means is adapted to engage the upper surface of said pole pieces.

10 5. A sound-reproducing device as claimed in any of the preceding claims wherein said damping means comprise a block of rubber.

15 6. A sound-reproducing device as claimed in any of the preceding claims in which one end of said reed is embedded in a block of rubber.

7. A sound-reproducing device as

claimed in any of the preceding claims wherein said damping means is enclosed within a housing. 20

8. A sound-reproducing device as claimed in the preceding claim wherein said housing is laterally adjustable whereby to centre the armature in the air gap. 25

9. A sound-reproducing device as claimed in any of the preceding claims wherein the reed is substantially T-shaped. 30

10. A sound-reproducing device substantially as described or as illustrated in the accompanying drawings.

Dated this 6th day of January, 1930.
MARKS & CLERK.

[This Drawing is a reproduction of the Original on a reduced scale.]

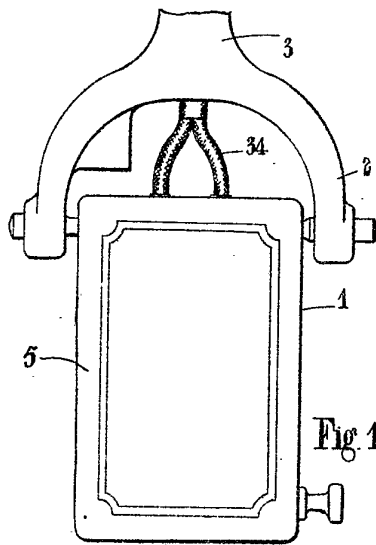


Fig. 1.

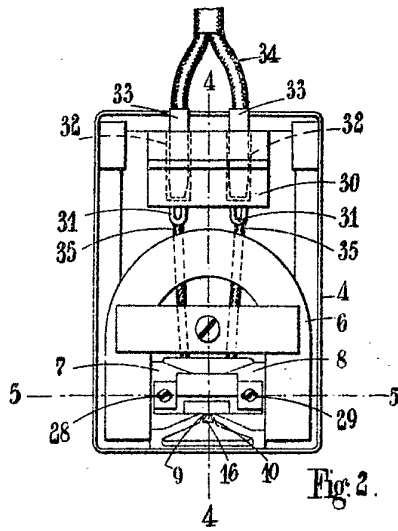


Fig. 2.

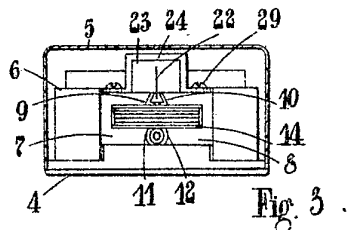


Fig. 3.

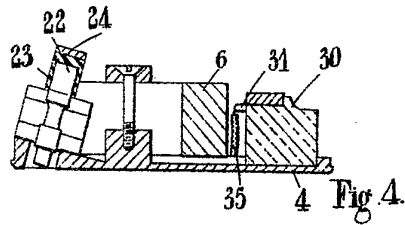


Fig. 4.

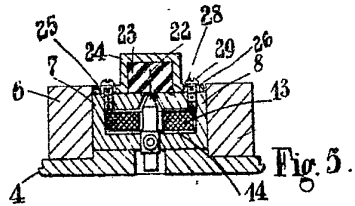


Fig. 5.

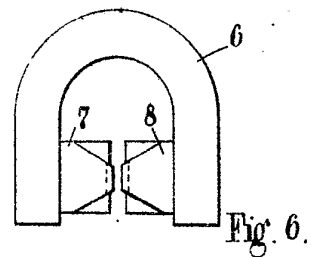


Fig. 6.

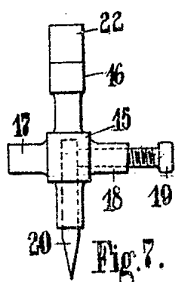


Fig. 7.

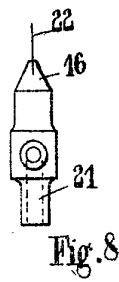


Fig. 8.

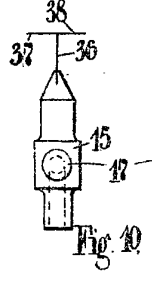


Fig. 9.

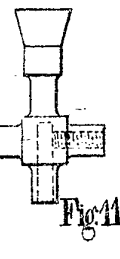


Fig. 10.

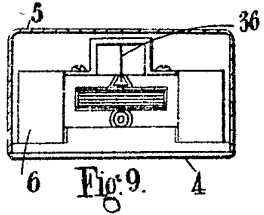


Fig. 11.

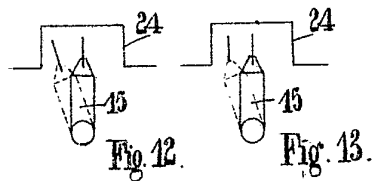


Fig. 12.

Fig. 13.