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J. S. HIGH

1,765,586

REPRODUCING DEVICE

Filed June 24, 1927.

Fig. 1.

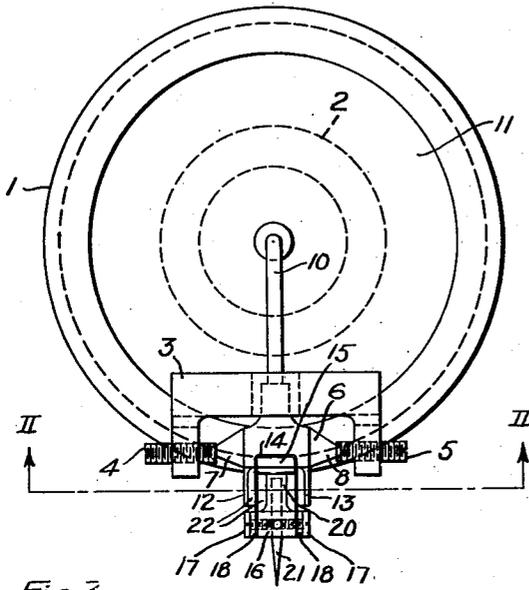


Fig. 2.

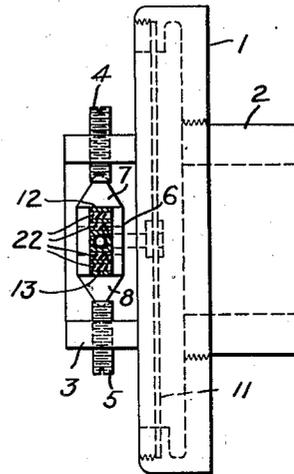


Fig. 3.

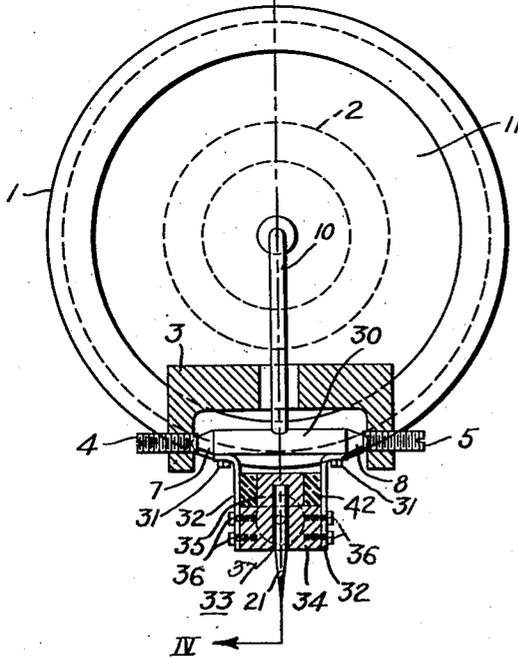
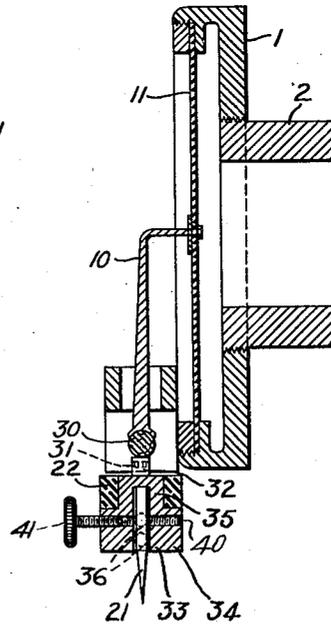


Fig. 4.



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REPRODUCING DEVICE

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My invention relates to reproducing devices, and it has particular relation to phonograph reproducers and to reproducers of the type known as "pick-up" devices.

5 One object of my invention is to provide, in a phonograph reproducing device, means for removing the disagreeable scratching noises that are caused by the point of the needle scraping the bottom of the record
10 groove.

Another object of my invention is to provide, in a phonograph reproducing device, means for absorbing needle vibrations caused by irregularities in the bottom of the record
15 groove, without appreciably lowering the response of the device to intentionally recorded vibrations of the same frequencies.

Numerous attempts have been made to eliminate the scratching noises from phonographically reproduced music, among which
20 may be mentioned the addition of a sound-proof cover that may be lowered over the record and reproducer when the phonograph is operated, and the provision of record-materials that are substantially grainless
25 in texture. Although both of these schemes accomplish a certain amount of good, a definite amount of noise is still noticeable, even in connection with phonographs that are
30 among the best on the market.

I have established the fact that the noise just mentioned is caused by minute irregularities in the bottom of the record groove that are made during the process of forming
35 the record, which irregularities tend to actuate the needle-point in a plane substantially perpendicular to the plane in which the needle is moved by the undulations representing the sounds it is desired to reproduce.

40 In order that the undesired vibrations initiated by the aforementioned irregularities shall be absorbed and prevented from causing the objectionable background noise, I have, by the present invention, provided
45 a phonograph reproducer with a needle-holding device so constructed as to damp out all movements of the needle in the said perpendicular plane. Specifically, I prefer to mount the needle holder on the sound box
50 by a plurality of springs that flex under the

influence of the scratch-irregularities but which are rigid in a direction to transmit the desired vibrations to the diaphragm, or to the moving armature or coil of a pick-up device. In addition, I associate damping
55 means, such as soft rubber, with the said springs, which absorbs and dissipates the scratch-energy and assists in preventing it from reaching the diaphragm or analogous
60 device.

Among the novel features of my invention, are those particularly set forth in the appended claims. The invention in its generic aspect, however, will best be understood by
65 reference to the following description of certain specific embodiments, taken in connection with the accompanying drawings, in which:

Figure 1 is an end view of a phonograph reproducer embodying a preferred form of
70 my invention;

Fig. 2 is a view of the device as seen from below, the needle-holding elements being shown as sectionalized along a line corresponding to the line II—II of Fig. 1;
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Fig. 3 is an end view of a modified form of my invention, partly in cross-section, and

Fig. 4 is a sectional view of the modification shown in Fig. 3, taken along a line corresponding to the line IV—IV of that figure.
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Referring specifically to Figs. 1 and 2, a preferred embodiment of my invention comprises a housing 1 provided with a tubular extension 2 by means of which it may be affixed to a phonograph tone arm
85 and which also carries a bearing device 3 affixed to one face thereof. The bearing device is of substantially U shape, the two arms thereof being provided with threaded openings through which extend a plurality of
90 bearing elements 4 and 5, each having a conical depression in the inner end thereof.

A shaft 6, having conical end portions 7 and 8 and carrying a lever arm 10 which is connected to a diaphragm 11, is rotatably
95 mounted between the bearing elements.

The shaft 6 is provided with a plurality of depending abutment members 12 and 13 which extend in a direction diametrically
100 opposite to that of the lever arm 10.

A spring 14 of U shape, preferably extremely thin and of high-quality steel, is mounted in a depression in the lower surface of the shaft 6, and is held in position by a small block 15 which is brazed or soldered in place. The legs of the spring 14 extend in a direction parallel to the depending abutment members 12 and 13.

A needle-holding block 16 is suspended between the depending portions of the spring 14 and is clamped thereto by a plurality of screws 17 and washer members 18. The block 16 is provided with an upward extension 20, in which an opening is formed of sufficient size to receive and hold a phonograph needle 21 of the usual type.

Small pieces 22 of resilient material, preferably rubber, having a fairly low sulphur content, are inserted between the depending members 12 and 13 of the shaft and the spring 14, and also between the spring and the upward extension 20 of the needle-carrying block 16.

Referring specifically to Figs 3 and 4, a modification of the needle-holding assembly comprises an oscillatory shaft 30 to which are affixed, by screws 31 or otherwise, two depending flat springs 32.

A needle-carrying block 33 having a lower rectangular portion 34 and an upper cylindrical portion 35, is mounted between the springs 32 and affixed thereto by means of a plurality of screws 36.

The block 33 is provided with an axial opening 37 having a diameter just sufficiently large to accommodate a phonograph needle of the usual type. A threaded opening 40 is also provided in the block for the accommodation of a needle-holding set screw 41, opening 40 being perpendicular to the opening 37 designed to accommodate the needle, as is customary in devices of this character.

A ring 42 of damping material, such as soft rubber, surrounds the cylindrical extension 35 of the needle-carrying block 33 and is maintained slightly compressed between the springs 32 and the said extension.

In the operation of the modification of my invention, shown in Fig. 1, movements of the needle-carrying block in a plane parallel to the flat sides of the U shaped spring will be transmitted directly to the diaphragm through the lever arm. These are the movements which represent the musical or other sounds that have been intentionally recorded on the phonograph record. Other vibratory movements of the needle in planes substantially perpendicular to the aforementioned plane will cause the spring to flex. When the spring flexes to either the one or the other side, the small pieces of rubber will be more or less compressed, and the energy tending to cause the flexure will be absorbed therein to a very great extent.

The drag of the phonograph needle in the bottom of the record groove transmits motion to the needle-carrying block which tends to cause it to vibrate in planes in which the springs are flexible. It is this energy which, as previously pointed out, tends to cause the disagreeable background of scratching noise and, since it is absorbed by the rubber or other damping material, it is transmitted to the shaft which carries the lever arm to a very slight extent only.

The operation of the modification shown in Fig. 3 is substantially the same as the operation of the first described modification. Vibrations of the needle occasioned by sounds intentionally recorded on a record are such as to be transmitted to the shaft through the springs in a plane which may be passed through the lever arm and the needle perpendicular to the shaft. To such vibrations, the springs are rigid, inasmuch as the plane referred to is parallel to the flat sides of the said springs. Vibrations in planes, other than the plane referred to, tend to cause flexure of the springs and are absorbed and damped out by the rubber ring which encircles the cylindrical portion of the needle-carrying element.

In either modification, I prefer to so construct the springs and the needle-holding block carried thereby that the assembly has a natural period of vibration well above the highest frequency necessary for satisfactory phonograph reproduction. In a commercial embodiment of my invention, I have found that a frequency of 5000 cycles per second is quite desirable.

It is, accordingly, apparent that a phonograph reproducer or a pick-up device constructed according to my invention will have the characteristics of an acoustic filter. Vibrations imparted to the needle by the undulations of the record which represent intentionally recorded sounds are transmitted, unimpaired, to the diaphragm. On the other hand, the vibrations imparted to the needle by the drag of the point thereof in the bottom of the record groove are absorbed by the flexible springs and the rubber damping means. As a consequence, the back-ground of scratching noise is noticeably absent from the music or other sounds reproduced by a phonograph equipped with my invention.

The invention is also applicable to magnetic pickups without modification, inasmuch as such pick-up devices are equipped with a needle-carrying assembly which is substantially the same as that employed in most phonograph reproducers.

The principal advantage of my invention lies in the fact that it greatly improves the sound output of either an ordinary phonograph or an electrically actuated phonograph. There is also an additional advantage in that the record itself is subjected

to somewhat less wear than when it is utilized to actuate a reproducer of the usual type, the semi-resilient mounting of the needle-carrying assembly of my invention tending to somewhat reduce impairment of the sound groove by the point of the needle.

The device also has an additional advantage in that it permits the elimination of relatively costly electric filters that have been found necessary in connection with pick-up devices of the ordinary type. It has been customary to connect such a filter, comprising an inductor and condenser in series, in shunt to the output circuit of an electrical pick-up device and to tune the filter to a frequency of approximately 4,000 cycles per second in order to eliminate the scratch noises. When this is done, however, the filter also eliminates certain desired frequencies from the sound output itself and, consequently, although it lowers the scratch back-ground, it, at the same time, impairs the quality of the music or other sound being reproduced. On the other hand, a device constructed according to my invention eliminates the scratch frequencies directly at their source without, in any way, impeding the transmission from the record to the diaphragm of equivalent frequencies representing musical tones.

The device is quite inexpensive to manufacture, and, if damping means of high-quality rubber are utilized, it will have substantially as long a life as a reproducer of any of the usual types.

Although I have illustrated only two specific forms in which my invention may be embodied, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be limited except in so far as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In a reproducing device, a diaphragm, a needle-carrying assembly rigidly connected to said diaphragm in the plane in which the needle is actuated by the undulations of a phonograph record representing sound intentionally recorded thereon and flexibly connected to said diaphragm in planes approximately perpendicular to the first-mentioned plane.

2. In a reproducing device, a needle-carrying assembly constructed in the form of an acoustic filter, said filter comprising spring elements having natural periods higher than those necessary for satisfactory phonographic reproduction.

3. In a reproducing device, a needle-carrying assembly constructed in the form of an acoustic filter, said filter comprising damping elements and spring elements having a natural period above five thousand cycles per second.

4. In a reproducing device, a needle-carrying assembly constructed in the form of an acoustic filter, said filter comprising springs, and damping elements associated with said springs to limit the flexing thereof.

5. In a reproducing device, a diaphragm, a needle-holding device, means interposed therebetween for rigidly transmitting vibrations in one plane only, and further means for absorbing vibrations in other planes.

6. In a sound-reproducing device, a diaphragm, a stylus-bar affixed at one end to said diaphragm, a stylus-receiving device, and a mechanical filter connecting said stylus-receiving device and the other end of said stylus bar, said filter being resilient in one plane and being rigid in a plane substantially at right angles thereto.

7. In a vibratory system, a shaft, bearings in which said shaft is rotatably mounted, a needle holder affixed to the shaft by means rigid in a plane perpendicular to said shaft and resilient in a plane parallel to said shaft, and means for damping oscillations of said affixing means in said last mentioned plane.

In testimony whereof, I have hereunto subscribed my name this 16th day of June, 1927.

JURJEN S. HIGH.

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