

June 3, 1958

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2,837,340

MECHANICAL SOUND REPRODUCING DEVICE

Filed April 7, 1952

2 Sheets-Sheet 1

FIG. 1.

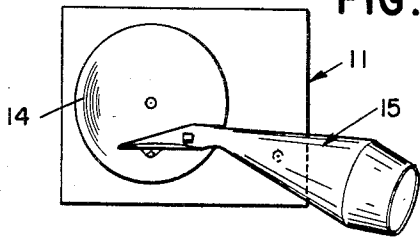


FIG. 2.

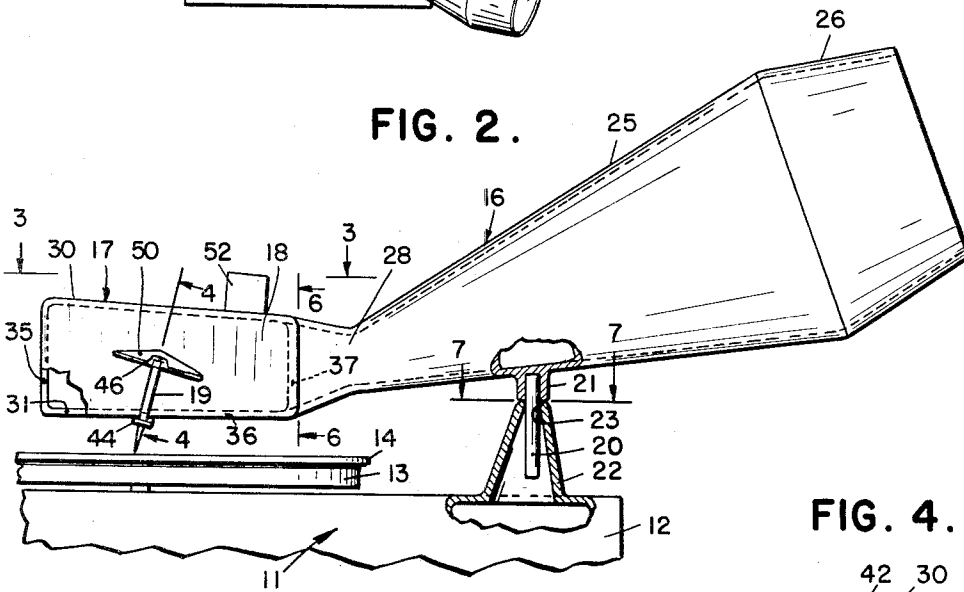


FIG. 3.

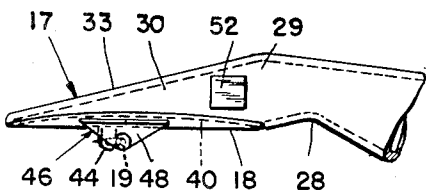


FIG. 5.

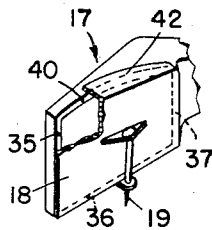


FIG. 4.

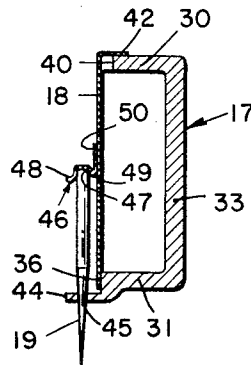


FIG. 6.

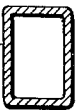


FIG. 8.

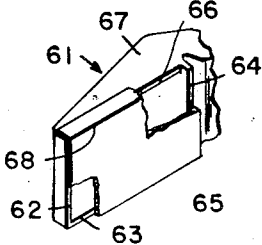
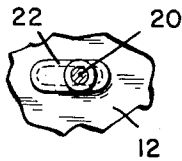


FIG. 7.



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FIG. 9.

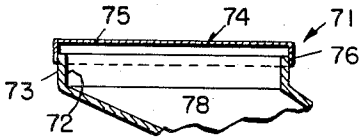


FIG. 10.

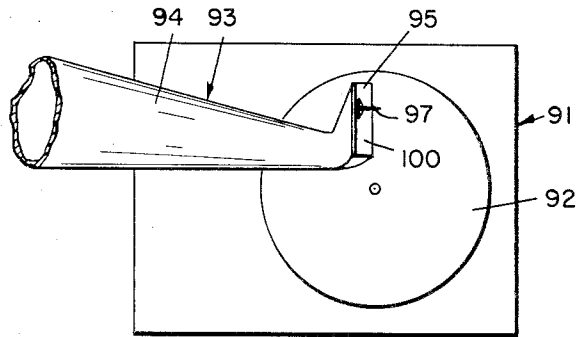


FIG. 11.

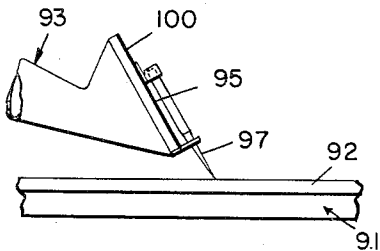
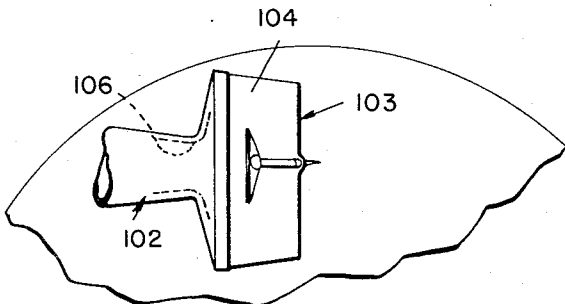


FIG. 12.



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## MECHANICAL SOUND REPRODUCING DEVICE

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Application April 7, 1952, Serial No. 280,867

6 Claims. (Cl. 274—25)

This invention has to do generally with sound reproducing devices such as used with phonographs and the like.

An object of this invention is to provide an improved, novel, mechanical sound reproducing means designed particularly for a toy phonograph.

Another object is to provide a mechanical sound reproduction device which produces a relatively loud and faithful tone in proportion to its size.

A further object is to provide an inexpensive sound reproduction device consisting of but few parts which are readily fabricated and assembled.

More particularly it is an object to provide sound reproducing means embodying a novel diaphragm construction which has certain advantageous features not possessed by conventional types of diaphragms. Also, it is an object to provide sound reproducing means in which the needle and diaphragm are so constructed and arranged that the needle acts as a lever directly to transmit to the diaphragm vibrations or oscillations received by the point of the needle riding in a record groove.

Another object is to provide a diaphragm of unique shape whereby the inner end of the needle can be mounted substantially at the center of the diaphragm without sacrificing the effective size of the diaphragm. Further in this connection it is an object to provide a diaphragm which is considerably longer than it is wide and which is so constructed that it is relatively flexible at the center despite its narrow width. Also, it is an object to provide an elongated diaphragm which is flexible in the center without being unduly loose or flexible at its ends.

A further object is to provide a diaphragm construction in which the diaphragm is so mounted that it is much less taut than in conventional diaphragms and one which requires relatively little energy or force to drive it.

Also, it is an object to provide sound reproducing means having a novel needle mount in which the needle can be readily mounted or removed.

Another object of the invention is to provide a sound reproducing device in which a horn and diaphragm are incorporated into a single novel unit.

Another object is to provide a novel horn construction and a novel mounting for the horn.

These and other objects will be apparent from the drawing and the following description.

Referring to the drawing:

Fig. 1 is a plan view of a phonograph upon which there is shown mounted the sound reproducing means of the invention;

Fig. 2 is an enlarged elevational view of the sound reproducing means of the invention, the view being partly broken away;

Fig. 3 is a fragmentary plan view on line 3—3 of Fig. 2;

Fig. 4 is a sectional view on an enlarged scale on line 4—4 of Fig. 2;

Fig. 5 is a perspective view, partly broken away, of the tone head;

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Fig. 6 is a section on line 6—6 of Fig. 2;

Fig. 7 is a section on line 7—7 of Fig. 2;

Fig. 8 is a perspective view, partly broken away, of a modified form of tone head;

Fig. 9 is a sectional view of a modified diaphragm mounting;

Fig. 10 is a plan view of another modification;

Fig. 11 is a fragmentary elevational view of the tone head portion of the device of Fig. 10; and

Fig. 12 is a plan view of an alternate type of tone head.

More particularly describing the invention, I show at 11 a phonograph device which may have any suitable motor enclosed within the casing 12 to rotate a turntable 13 upon which a phonograph record 14 is placed. On the phonograph I mount a sound reproducing means, generally indicated by 15. This includes a horn element 16, a tone head or sound pick-up head 17, a diaphragm 18, and a needle 19 for riding in the groove of the record 14. The horn is provided with a mounting post 20 fixedly secured in a boss 21 and adapted to be received in a support 22 formed from the top wall of the casing 12. The support 22 is tubular, being circular at the top to define an opening 23 which receives the mounting post 20, and being flared below the opening in one direction to an elongated cross-sectional shape or opening as seen from Figs. 2 and 7. With this construction the horn may be readily detachably mounted, pivoted in any direction and can be tilted in one plane.

The horn 16 comprises a main substantially frustoconical, outwardly diverging central portion 25 and, at its outer end, an outer, outwardly converging frustoconical section 26. At the inner end of the main section 25 there is what may be termed a neck 28 of relatively small diameter. Rearwardly of this the horn enlarges somewhat to a substantially rectangular cross-sectional shape at the region 29. At the inner end of the horn is the tone head or sound pick-up head 17 forming an integral continuation thereof. This head has somewhat triangular upper and lower walls, 30 and 31, which are connected by a substantially rectangular side wall 33. The head provides three edges, indicated by 35, 36, and 37 which are in a common plane and an upper edge 40 which is concavely recessed from the plane of the edges 35, 36, and 37.

I provide a diaphragm 18 which is cemented to the edges 35, 36, and 37. The diaphragm is made to overlap the upper wall 30 being cemented thereto at 42. This leaves a partial fold or bend (Fig. 4) in the diaphragm at the top opposite the upper edge 40 and a space between the diaphragm and the edge 40 throughout substantially the entire length of the edge 40.

In order to mount needle 19 I provide a needle-holding bracket 44 on the lower wall 31 of the tone head. This bracket extends laterally forward of the plane of the diaphragm and is provided with a tapered opening 45 which is of a size to permit insertion of the needle to the proper distance. The upper or inner end of the needle is held by a flexible bracket 46 which is cemented to the diaphragm and is provided with an indentation or recess 47 in a shelf-like portion 48 to receive the end of the needle. The portion 48 is connected by a bend 49 to the base 50 of the bracket which is cemented to the diaphragm.

The horn, tone head, and diaphragm may be made of various materials, such as metal, paper, wood, and plastics. I have found that where the horn, tone head, and diaphragm are made of cellulose acetate excellent results are obtained. This is especially true where the diaphragm is made of such material having a thickness of about .003 of an inch. The diaphragm should be cemented in place to provide an airtight bond between the

diaphragm and the tone head, and where cellulose acetate is used for the tone head and diaphragm, acetone can be used for this purpose.

Also, I provide a weight 52 on the tone head to a little more than counterbalance the horn portion of the device.

With the above-described construction, it will be apparent that I provide a diaphragm which is relatively long as compared to its width. This permits me to mount the needle with the inner end thereof at about the center of the diaphragm whereby the needle can be used as the sole lever for transmitting the vibrations or oscillations picked up from the record directly to the center of the diaphragm. Also, with the elongated type of diaphragm construction, I find that I am able to obtain relatively high fidelity reproduction, since the diaphragm is responsive to a wide range of frequencies and yet is not peculiarly sensitive to any one frequency as is the case with taut diaphragms.

The construction of the diaphragm and its mounting embodying the bend or partial fold at the top edge opposite the concave edge 40 and the space provided between the diaphragm and this edge results in a diaphragm which is substantially as free to move across its width or widthwise as it is free to move lengthwise. This permits greater motion in the center of the diaphragm where this is needed and prevents unnecessary slack at the ends such as would cause loss in pressure waves. Where the diaphragm is made of a thin cellulose acetate sheet, with the construction provided, very little energy is required to vibrate or drive the diaphragm and in consequence of this the diaphragm is quickly responsive to the vibrations of the needle. Very little energy is required, therefore, to actuate the needle and thus the construction operates with very little needle drag on the record. In this connection it may be pointed out that the sound reproducing means I have described thus far is designed for use with records in which the sound waves appear in the record in the form of lateral undulations. Since there is so little drag on the record the needle is easily driven and I am able to play music on relatively small records even down to a sound groove of about one and one-half inch diameter with the speed as low as seven lineal inches per second.

I have found that if the needle is so mounted that the leverage ratio is about two or two and one-half to one, excellent results are obtained. The device is therefore suitable for standard, inexpensive phonograph needles which are usually tapered for a little more than one-third of their length. Thus the hole 45 in bracket 44 can be made the right size to hold the needle at approximately the right position to give the required ratio.

In use, waves of compression set up by the diaphragm within the pick-up head or tone head are wedged toward the neck 28 of the horn intensifying them in this region. The waves then enter the main resonance section 25 of the horn where they expand and move outwardly until they reach the end portion 26 where they are again to some extent compressed. This latter action gives a feeling of depth to the tone, increasing the tonal quality and rendering the horn substantially equivalent to a much larger conventional horn.

In Fig. 8 I show a modified form of sound pick-up head 61. This is generally similar to the head 17 previously described in that it provides three edges, indicated by 62, 63, and 64, respectively, which are in a common plane and against which a diaphragm 65 is cemented. A fourth edge 66 is recessed from the plane containing the edges 62, 63, and 64 and the diaphragm is secured to the upper wall 67 of the tone head by being cemented thereto in a manner similar to the way the diaphragm 18 is cemented to the upper wall of the pick-up head 17. This provides a space between the diaphragm and the recessed edge 66, the diaphragm having a partial bend 68 opposite the edge 66.

It is contemplated that a needle-holding bracket similar to bracket 46 would be provided on the diaphragm although none has been shown on the drawing. This diaphragm operates in the same manner as the diaphragm previously described.

In Fig. 9 I show another type of diaphragm wherein the sound pick-up head, generally indicated by 71, provides an opening 72 bounded by a continuous wall 73. This wall 73 may be of any configuration desired, such as rectangular or circular, it being rectangular in the view shown. I mount a diaphragm 74 on this tone head by cementing the diaphragm around the periphery of the wall 73. This is accomplished by providing a diaphragm with a main or flat diaphragm section 75 and a tubular extension thereon 76 which receives the wall 73. In this form of the invention the diaphragm main section 75 is not in contact with any portion of the edge 78 of the wall 73. The diaphragm-tone head construction shown in Fig. 9 may be used in the same manner as the diaphragm-tone head constructions previously described.

In the forms of the invention thus far described, the devices shown have been designed particularly for use with records having lateral undulations. In Figs. 10, 11, and 12 I show how the invention may be adapted for use with the so-called "hill and dale" type of records where the sound vibrations appear in the record in the form of vertical undulations. Referring first to Figs. 10 and 11, 91 generally indicates a phonograph device upon which is shown a record 92. Mounted on the phonograph in the same manner as the horn previously described is a combined horn and tone head 93. This includes the horn section 94 and sound pick-up head 95. The latter is shown laterally offset but as an integral part of the horn section and with a needle 97 which rests upon the record groove. Here the diaphragm 100 is at about right angles to the position it occupies in the prior-described forms of the invention. The angle of the needle with the record can be about 60° although quite a bit of latitude is permissible.

In Fig. 12 I show another modification of the invention wherein a horn 102 is provided with a sound pick-up head 103. This head has a diaphragm 104 mounted thereon in any of the various ways previously described. The head 103, however, is characterized by the fact that the outlet opening 106 thereof which communicates with the horn is located substantially centrally of the tone head and opposite the diaphragm center and the ends of the tone head are relatively narrow, tapering to a reduced cross section. I contemplate that this general type of tone head may be used in place of those previously described, although of course if used for records with lateral undulations, it would be turned at right angles to the position of Fig. 12.

I contemplate that various changes and modifications can be made in the forms of the invention disclosed without departing from the scope of the invention as defined by the claims. For example, while I prefer to make the tone head and horn integral or unitary, I contemplate that these parts can be separate and detachably secured by any conventional means. Also, these parts may be made of different material if desired.

I claim:

1. In sound reproducing means a sound pick-up head comprising wall means defining an outlet opening and a diaphragm opening, said wall means presenting a continuous diaphragm mounting edge about said diaphragm opening, said edge having a major portion in a common plane and having a minor portion recessed from said plane, a diaphragm mounted against said major portion of said edge and overlying said minor portion in spaced relation thereto, means sealing said diaphragm to said wall means and diaphragm cooperate to form a chamber, and means for actuating said diaphragm.
2. In sound reproducing means, a sound pick-up head,

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comprising wall means defining an outlet opening and a diaphragm mounting opening, said wall means presenting a continuous diaphragm mounting edge about said diaphragm opening, said edge defining an elongated figure with long sides and relatively shorter connecting ends, said edge at one of said sides and both ends being in a common plane, said edge at the other of said sides being recessed, a diaphragm overlying said edge in spaced relation thereto, means sealing said diaphragm to said wall means to close said diaphragm opening with the diaphragm against the portions of said edge lying in a common plane, and means for actuating said diaphragm.

3. Sound reproducing means as set forth in claim 2 in which said diaphragm has a bend in the region opposite said recessed portion of said edge and is attached to said wall means beyond said bend.

4. Sound reproducing means as set forth in claim 2 in which said figure is substantially rectangular.

5. Sound reproducing means as set forth in claim 2 in which the means for actuating the diaphragm comprises a needle, means securing the inner end of the needle opposite and operatively connected to the central portion of the diaphragm, and means located adjacent a long side of said edge for supporting the needle intermediate its ends.

6. In sound reproducing means, a sound pick-up head comprising wall means defining a chamber with an outlet opening, said wall means including a diaphragm, a flexible bracket mounted substantially at the center of

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said diaphragm projecting outwardly of the plane thereof and providing a recess facing an edge portion of the diaphragm, a second bracket mounted on said head beyond the margin of said diaphragm, providing an aperture having an axis passing through said recess, and a needle having a tapered end portion supported between its ends at the tapered end portion in said second bracket and having its inner end received in said recess and supported by said first-mentioned bracket.

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