

G. B. BURCH,
ACOUSTIC DEVICE.
APPLICATION FILED SEPT. 15, 1919.

1,414,801.

Patented May 2, 1922.
2 SHEETS—SHEET 1.

Fig. 1.

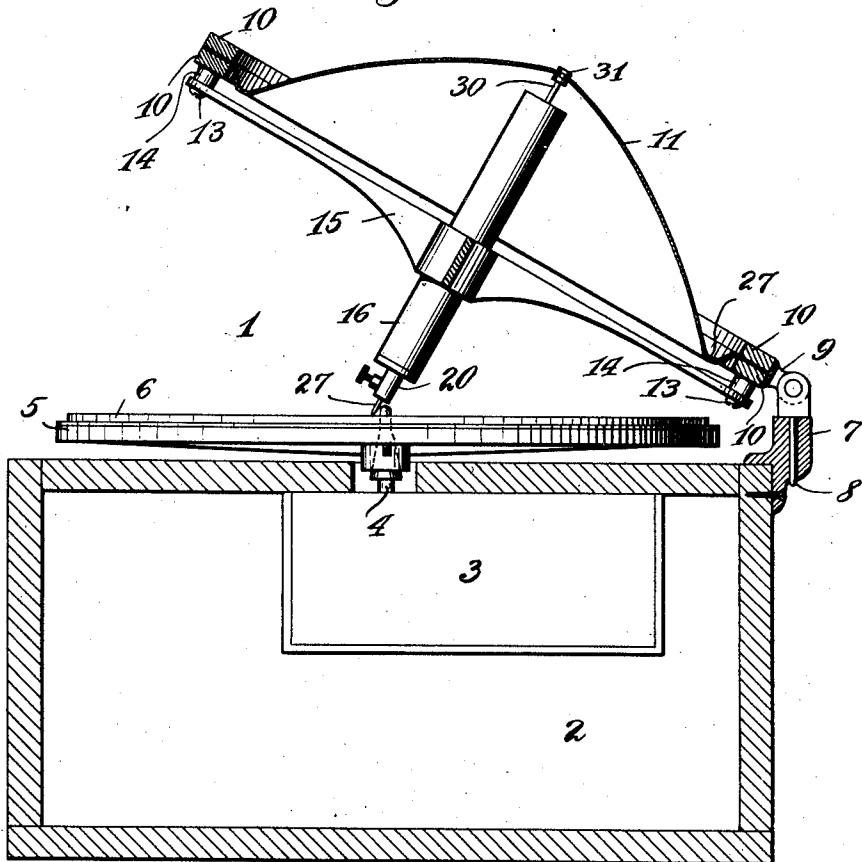
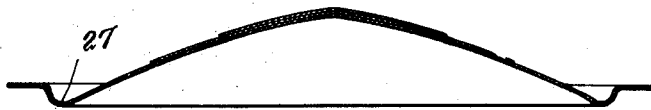


Fig. 5



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2 SHEETS—SHEET 2.

Fig. 2.

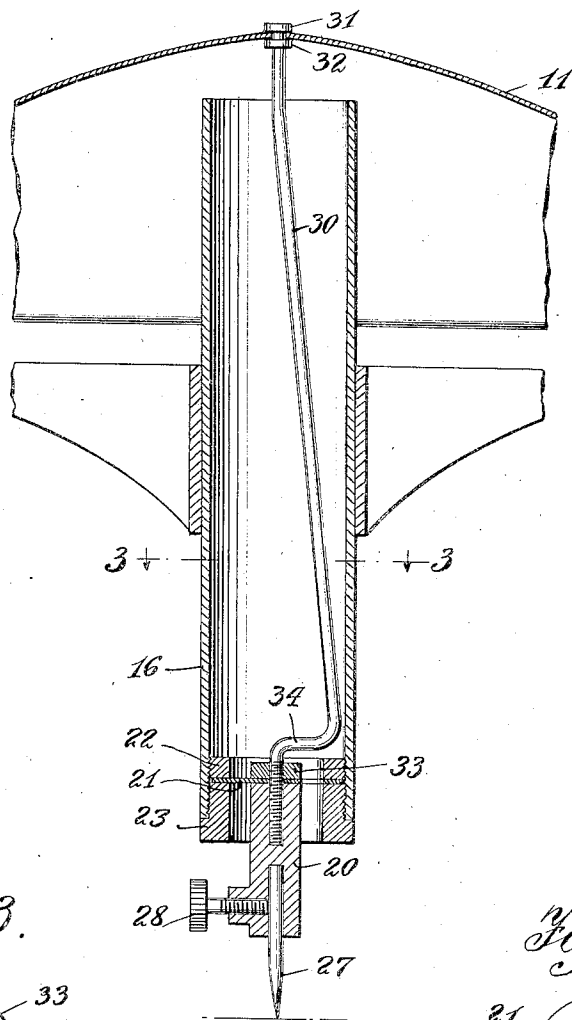


Fig. 3.

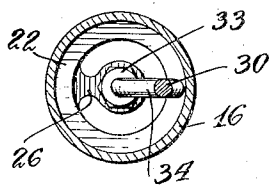
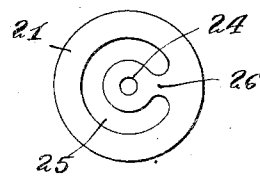


Fig. 4.



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ACOUSTIC DEVICE.

1,414,801.

Specification of Letters Patent.

Patented May 2, 1922.

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To all whom it may concern:

Be it known that I, GEORGE B. BURCH, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Acoustic Devices, fully described and represented in the following specification and the accompanying drawing, forming a part of the same.

The invention relates to acoustic diaphragms and cooperating means therefor, and has been made more particularly with the idea of producing a large direct-acting phonograph diaphragm which shall not require any sound amplifying or intensifying horn, although diaphragms made according to the invention may obviously be used in other ways for sound reproduction and recording. The invention aims to provide a diaphragm of this kind which shall be highly sensitive and responsive to sound vibrations, and particularly adapted, when used as a phonograph reproducer, for reproducing very perfectly as to quality and in the desired volume sounds recorded on a phonograph record, by setting up sound waves directly in the surrounding atmosphere. This and other objects are accomplished by my invention, one embodiment of which is hereinafter more particularly set forth.

An understanding of the invention can best be given by a description of an embodiment of all the features of the invention, and such a description will now be given in connection with the accompanying drawings, and the invention will then be particularly pointed out in the claims. In said drawings:—

Fig. 1 is a sectional view of a phonograph having a reproducer embodying my invention;

Fig. 2 is an enlarged sectional view of a portion of the diaphragm, stylus holder, transmission rod and connected parts;

Fig. 3 is a sectional view, taken on the line 3-3 of Fig. 2, looking in the direction of the arrows;

Fig. 4 is a plan view of a disk, which supports one end of the transmission rod; and

Fig. 5 is a sectional view of a modified form of diaphragm.

The drawings show a phonograph 1 provided with a casing 2 in which is mounted a motor 3 from which rises a shaft 4 which

carries the turn-table 5 for supporting a record 6 in the usual manner. A bracket 7 on the casing 2 at one side of the turn-table receives a swivel pin 8 which turns freely therein and carries a hinge member 9 secured to a pair of rings 10 between which is secured the edge flange of a diaphragm 11. These rings also carry a spider 15 the arms of which are secured to the rings 10 by screws 13 on which are sleeved washers 14, as shown. The spider 15 carries a tube 16.

The stylus holder 20 is mounted in the lower end of the tube 16 so as to be capable of vibratory oscillation, being for this purpose in the construction shown carried by a disk 21 which is held between rings 22 and 23 screwed into the lower end of the tube 16. The disk 21 is best made from suitable metal of a thickness of from 12 to 25 thousandths of an inch according to the size and weight of the cooperating parts. It is formed with a central perforation 24 and with a horseshoe opening 25 extending about its central portion, leaving the central portion connected with the peripheral portion by means of a neck 26, the width of which neck will depend upon the thickness of the disk and the size and weight of the cooperating parts. The stylus holder 20 is formed to carry at its lower end a needle or stylus 27 which may be removably secured by a set screw 28 in the usual manner. A transmission rod 30 extends from the stylus holder to the center of the diaphragm to which it is firmly secured, as by means of clamping collars or nuts 31 and 32 on the threaded end of the rod. The lower end of the transmission rod is threaded and screwed into a threaded axial opening in the upper end of the stylus holder. The lower end of the rod also extends through the central perforation of the supporting disk 21, and a nut 33 serves to clamp the disk tightly against the end of the holder. The transmission rod most desirably has a sharp lateral bend closely adjacent the stylus holder and extends substantially straight from such laterally bent portion to the diaphragm. The bent portion 34 of the rod should extend from the holder in the direction away from the neck 26 as shown. Such bend in the transmission rod, or any equivalent offset connection of the rod to the stylus holder, will not always be necessary especially when the holder is mounted to oscillate.

late about an axis laterally offset from the longitudinal axis of the holder, as with the mounting shown, but even with the holder so mounted, this bend may be in some cases 5 desirable for causing vibrations of the desired amplitude to be transmitted to the diaphragm when the lower end of the rod is connected centrally to the holder. The point with regard to this bend is, that, while 10 the transmission rod, because of its being relatively very long and very slender is quite flexible, its short laterally bent portion adjacent the stylus holder will be sufficiently rigid so that, because of the rigidity of this 15 laterally bent part and the flexibility of the main part of the rod, vibrations of the stylus holder will be transmitted to the diaphragm in the direction of the length of the rod. The use of pivot pin connections with the 20 possibility of lost motion is thus avoided, and the resulting transmission of the vibrations in the direction of the length of the connection between the stylus holder and the diaphragm is the same as though the connection were to a rigid part of the stylus 25 holder offset laterally from its pivotal axis.

When the reproducer is used with a record having a laterally cut groove, the neck 26 and bent portion 34 at the lower end of the 30 transmission rod must be placed in a plane at right angles to the direction of the groove, that is, with the pivotal axis provided in effect by the neck 26, will be in such position with relation to the record as to 35 permit the stylus holder to oscillate under the action of the laterally cut groove. If the record be one having a hill and dale, or vertically cut groove, these parts are placed at right angles to the position just described. 40 This may result from turning the diaphragm structure 90° about its axis so as to bring the pivotal axis of the stylus holder parallel to the surface of the record.

The diaphragm 11 may be made from any 45 suitable material. I have used with excellent results thin sheet celluloid of .01 inch thickness, cloth treated with suitable stiffening material to give the diaphragm the necessary resiliency, and also paper. It is 50 made large, say nine inches to a foot in diameter, and is shaped in what may be termed a convex or dished or bulging form, curved from its center outward in all radial directions, and it may be of uniform thick- 55 ness throughout, or it may have a thickened central portion as shown in Fig. 5. Such thickened central portion may be formed by one or more added plies or layers of the sheet material, one layer extending only a 60 short distance from the center and another extending a further distance outward. Most desirably, the diaphragm is of convex conoidal form, as shown, continuously curved in one direction from its center outward in all 65 radial directions to a circumferentially ex-

tending undulation or reverse curve forming a gutter or trough 27 adjacent its edge between the main portion of the diaphragm and an edge flange by which in the construction shown it is secured to the supporting rings 10. 70 The main portion of the diaphragm will thus be of such form that the intersection between either surface of the diaphragm and any intersecting plane will be a continuously curved line. The diaphragm will thus be 75 very resilient and sensitive and highly responsive to sound vibrations. The guttered edge, forming a resilient support for the main vibratory part of the diaphragm, prevents or largely reduces the damping of 80 vibrations in the outer portion of the diaphragm which might otherwise occur with the edge of the diaphragm secured directly to the rings 10 in the manner shown. Sound vibrations being transmitted to the dia- 85 phragm will thus set the whole main or vibratory part of the diaphragm in vibration, and because of the large surface of the diaphragm, sound waves will be set up directly in the surrounding atmosphere, pro- 90 ducing the desired volume of sound without the use of any horn or other amplifying device. Moreover, all the tones recorded in the record, including the overtones characteriz- 95 ing the recorded sounds, will be faithfully reproduced, so that both volume and quality are secured in the reproduction without the characteristic phonograph sounds of the small diaphragm and amplifying horn re- 100 producers. The terms "vibration" and "vibratory" as applied to the diaphragm are used in the usual sense of implying the so-called wave-like vibration with the forma- 105 tion of nodes, and not as meaning a movement of the diaphragm as a whole, such as is the case with certain rigid small diaphragms heretofore used in sound boxes and with amplifying horns, and which are made so as not to vibrate locally or sectionally with the formation of nodes. 110

As stated, my diaphragm is most desirably from nine inches to a foot in diameter, that is, it is a large direct-acting diaphragm requiring no amplifying or intensifying horn, but co-acting directly with the sur- 115 rounding air, and acting, when used for reproduction of speed or music, to set up directly in the surrounding atmosphere sound waves producing sounds of the desired volume and quality; as distinguished from the 120 small sound-box diaphragms, the practical limit of size of which is about 2½ inches in diameter and which require the use of a horn or ear tubes.

For best results in reproducing sound, it 125 is desirable that the diaphragm be under a slight tension, and in the construction shown the transmission rod is most desirably made or adjusted to such effective length, as by adjusting the nuts 31 and 32, that the rod 130

shall be under tension to pull slightly on both the diaphragm and the stylus holder. The holder supporting spring or neck 26 will thus be put under a slight tension, and the slight tension exerted on the diaphragm will, because of its radially curved form, be distributed throughout its radially curved vibratory portion to increase its resiliency and responsiveness to the vibrations imparted to it.

In the operation of the apparatus shown in reproducing from a record, the stylus easily follows the record groove because of the pivotal mounting of the reproducer, and the recorded vibrations are taken up by the stylus and imparted to the stylus holder 20 from which they are transmitted to the diaphragm by the transmission rod 30.

While I have shown and described one embodiment of my invention, it is obvious that the invention is not restricted thereto but is broad enough to cover all structures which come within the scope of the annexed claims.

What is claimed is:

1. An acoustic device, comprising a large, direct, acting, vibratory diaphragm of conoidal form and continuously curved from its axial center outward in all radial directions.
2. An acoustic device, comprising a large, direct-acting, vibratory diaphragm of convex conoidal form and continuously curved in one direction from its axial center outward in all radial directions.
3. An acoustic device, comprising a large, direct-acting, vibratory diaphragm of outwardly bulging form continuously curved in one direction from its center outward in all radial directions.

4. An acoustic device, comprising a large, direct-acting, vibratory diaphragm of outwardly bulging form continuously curved in one direction from its center outward in all radial directions, and having an edge flange.

5. An acoustic device, comprising a large, direct-acting, vibratory diaphragm of bulging form continuously curved from its center outward in all radial directions.

6. A phonograph reproducer having a large direct acting vibratory diaphragm of convex conoidal form continuously curved from its axial center outward in all radial directions.

7. A sound recording or reproducing instrument having a large direct-acting vibratory diaphragm of bulging form continuously curved from its center outward in all radial directions.

8. A sound recording or reproducing instrument having a large direct-acting vibratory diaphragm of convex conoidal form continuously curved from its axial center outward in all radial directions.

9. A sound reproducer, comprising a large direct-acting vibratory diaphragm of bulging form continuously curved from its center outward in all radial directions, and means for transmitting vibrations to the diaphragm said means being tensioned to exert a slight tensioning force on the diaphragm.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

GEORGE B. BURCH.

Witnesses:

WM. H. O'BRIEN,
A. L. KENT.