T. A. EDISON.

SOUND RECORDING APPARATUS.

APPLICATION FILED APR. 20, 1910.

1,019,441. Patented Mar. 5, 1912.

Fig. 1

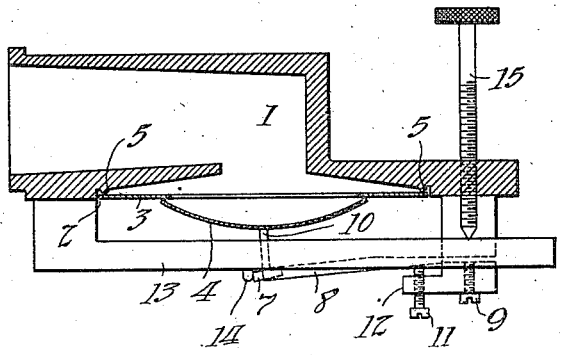


Fig. 2

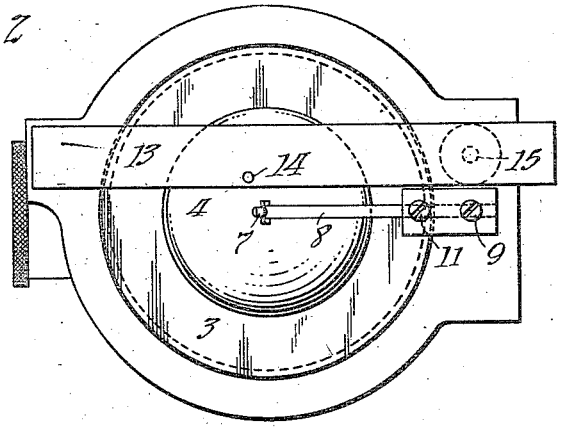


Fig. 4

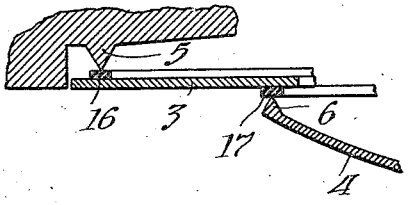
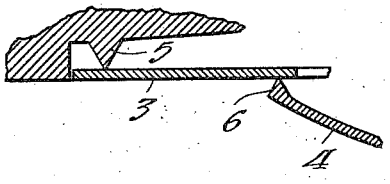


Fig. 3



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UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, WEST ORANGE, NEW JERSEY, ASSIGNOR TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

SOUND-RECORDING APPARATUS.

1,019,441. Specification of Letters Patent. Patented Mar. 5, 1912.

Application filed April 20, 1910. Serial No. 556,469.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, and a resident of Llewellyn Park, West Orange, Essex county, New Jersey, have invented certain new and useful Improvements in Sound-Recording Apparatus, of which the following is a description.

My invention relates to devices for recording sound, and my objects are the provision of a novel and efficient sound recorder of sufficient sensitiveness to respond to sound waves of little power, and at the same time so constructed as to largely prevent excessive movement of the diaphragm and recording stylus in a direction away from the recording surface under the influence of sound waves of great amplitude. My improved apparatus therefore is intended to record sounds, both weak and strong, more truly than has heretofore been possible.

In order that a full understanding of my invention may be had, attention is hereby directed to the accompanying drawings forming part of this specification, and in which—

Figure 1 represents a vertical central cross section through a sound recorder embodying one form of my invention. Fig. 2 is a bottom plan view thereof. Fig. 3 is a sectional detail view showing the preferred manner of mounting the diaphragm; and Fig. 4 is a similar view showing a modified mounting for the diaphragm.

The same reference characters will be used throughout to denote corresponding parts.

Referring to the drawings, the sound box 1 is provided with a recess 2 to receive and guide the diaphragm. The latter consists of a flexible outer portion preferably annular or ring shaped, as shown at 3 in the drawings, and an inner non-flexible portion 4. The flexible ring 3 which may consist of glass, mica, or other suitable material, is placed within recess 2 of sound box 1 without touching the sides of the same, and is supported preferably by knife edge 5 extending downwardly from sound box 1 within recess 2, said knife edge being positioned to engage the upper surface of the flexible ring 3 adjacent to the outer edge thereof. The ring 3 is not secured to the sound box by wax, rubber, or in any other way as is usual in the art. The rigid or non-flexible portion 4 of the diaphragm is given the form of an arch, as shown, or is formed in any other way so that it will not be flexed by the pulsations of the sound waves upon it. This rigid member 4 of the diaphragm is preferably circular in form with its edge bent sharply upward, as shown at 6, and forming a knife edge contacting the lower side of the flexible ring 3 near the inner edge thereof. The recording stylus 7 is carried by spring lever 8, the other end of which is flattened and secured within the sound box by screw 9.

In assembling the recorder the ring member 3 of the diaphragm is placed upon knife edge 5, being guided and located by the edge of recess 2 of sound box 1, and the non-flexing member 4 of the diaphragm is then placed in position with its sharp peripheral edge 6 contacting the under side of ring 3 near its inner edge. A rigid connection 10 is then placed between the end of spring member 8 and the center of the rigid diaphragm member 4, the spring member 8 being given a strong inward flexure and the connecting member 10 then firmly secured, preferably by shellac, at its two ends to the diaphragm member 4 and the spring member 8. Screw 11 may be mounted as shown in shoulder 12 of the sound box with its ends contacting the under side of spring member 8, whereby the amount of flexure of spring member 8 may be adjusted.

Lever 13 carrying tracking member 14 may be used if desired, the screw 15 being mounted in the sound box with its lower end bearing upon the upper side of the free end of lever 13 to adjust the vertical position of tracking member 14 to regulate the depth of cut permissible for recording stylus 7.

In Fig. 4 I have illustrated a modification in which ring member 3 of the diaphragm is provided with a ring of rubber or similar yielding material 16 secured by cement or otherwise to its upper side adjacent the outer edge to form a bearing surface for knife edge 5 of the sound box, and a similar ring 17 is secured to the under side of ring 3 adjacent its inner edge to form a bearing surface for the sharp edge 6 of the rigid member 4 of the diaphragm. This con-

struction is to permit the use of such material for flexible ring 3 as cannot be entirely freed of buckling around the edges, but I prefer to form the ring 3 of material free from buckles and to have knife edge 5 of the sound box and edge 6 of the rigid member 4 bear directly upon the flexible ring as shown in Fig. 3. The screw 11 pressing upon spring 8 bows the latter inwardly and forces the diaphragm upwardly sufficiently to give a strong initial upward tension to the latter.

The following points may be noted in connection with the diaphragm constructed as above described:—

First: Less power is consumed in vibrating it than in the case of diaphragms secured to the sound box by wax, rubber, or similar substance attached to the outer edge of the diaphragm, as has been the common practice heretofore, since power has necessarily been lost in stressing this securing device. Accordingly, my diaphragm is more sensitive.

Second: Less strength is required in a sound wave to be recorded to move the diaphragm a given distance than in the common recorder construction, since it does not flex in the center. The ring 3 is easily flexed because of its free inner edge.

Third: The diaphragm does not buckle in segments within the limits of the deflections given by the sound waves to be recorded.

Fourth: By employing a non-flexing center and a flexible ring diaphragm free at both edges, a strong upward stress can be given the whole diaphragm, which not only serves to hold it in place, but also strongly resists excessive movement of the diaphragm in a direction away from the recording surface.

When the recording stylus is tracked for the record, the movement of the diaphragm downward or toward the recording surface requires but little power, but the outward or upper movement of the same is greatly resisted by the strong initial flexing of the diaphragm which has been described. Accordingly, the tendency of strong sound waves or waves of large amplitude to cause the recording stylus to leave the record material is strongly resisted. With the form of diaphragm heretofore used in recorders, the initial flexing necessary to attain the effect described is not practicable on account of false motions given to the diaphragm which are recorded with sufficient amplitude to be audible in the record when reproduced. In the construction which I have described and illustrated, however, no false motions of sufficient amplitude to be audible on reproduction are given to the diaphragm.

It is to be understood that my invention is not limited to the exact construction above described, but is as broad as the appended claims.

Having now described my invention, what I claim and desire to protect by Letters Patent is:

1. In sound recording apparatus, the combination with a flexible ring diaphragm and a non-flexible central member bridging the opening of the ring and in contact therewith, of a recording stylus connected to the non-flexible member, and means for applying an elastic pressure on the stylus to hold the flexible and non-flexible members in engagement, substantially as described.

2. In sound recording apparatus, the combination of a knife edge support, a two-part diaphragm, comprising a flexible ring member freely mounted on said support with the latter contacting the same adjacent to one edge thereof, and a non-flexible member bridging the opening of said ring and making contact therewith near the other edge thereof, a recording stylus, and a spring arm carrying the stylus and by its tension imposing an initial flexure on the diaphragm to keep the parts thereof in engagement and the ring member seated on said knife edge, substantially as described.

3. In sound recording apparatus, the combination with a sound box, of a flexible ring diaphragm mounted therein, a non-flexible member mounted to contact the inner edge of said ring but not attached thereto, and a recording stylus connected to said non-flexible member, substantially as described.

4. In sound recording apparatus, the combination with a sound box, of a diaphragm mounted therein comprising a flexible outer portion and a rigid inner portion, the outer edge of which contacts the inner edge of the flexible outer portion but is not attached thereto, and a recording stylus rigidly connected to said rigid inner portion of the diaphragm, substantially as described.

5. In sound recording apparatus, the combination with a supporting knife edge, of a diaphragm comprising a flexible ring mounted with its surface adjacent its outer edge contacting said knife edge, a non-flexible member mounted with its outer edge contacting the free inner edge of said ring but not attached thereto, and a recording stylus connected to said non-flexible member, substantially as described.

6. In sound recording apparatus, the combination with a knife-edge support, of a flexible annular diaphragm contacting said support near the outer edge of the annulus, and free at both edges, a non-flexible member the outer edge of which contacts the inner edge of said annulus on the side opposite to said support, a recording stylus connected to said non-flexible member, and means for holding said member in firm con-

tact with said annulus and placing the latter under initial upward stress, substantially as described.

7. In a device of the class described, the combination with a stylus, of a diaphragm connected thereto and comprising a rigid inner portion and a flexible outer portion adapted to vibrate with said inner portion but not secured thereto and maintained under an initial upward tension, substantially as described.

8. In a device of the class described, the combination with a stylus of a diaphragm connected thereto comprising a rigid inner portion and a flexible outer portion mounted to vibrate therewith and having a free inner edge and maintained under initial upward tension, substantially as described.

9. In a device of the class described the combination with a stylus, of a diaphragm connected thereto and comprising a rigid inner portion and a flexible outer portion adapted to vibrate with said inner portion but not secured thereto, a knife edge contacting the outer upper surface of the said outer portion, and means for placing the diaphragm under initial upward stress, substantially as described.

10. In sound recording apparatus, the combination with a recording stylus of a diaphragm connected thereto comprising a rigid inner portion and a flexible outer portion, a knife edge contacting the outer upper surface of the latter and constituting the only support therefor, said inner portion having a sharp outer edge contacting the under side of the outer portion near the inner edge thereof but not joined thereto, and elastic means for holding the inner portion in contact with the outer portion of the diaphragm, substantially as described.

11. In a device of the class described, the combination with a sound box of a flexible diaphragm member mounted therein but not secured thereto, and having free edges, a non-flexible diaphragm member mounted to vibrate therewith, and a stylus connected thereto, substantially as described.

12. In a device of the class described, the combination with a sound box of a flexible annular diaphragm member mounted therein but not secured thereto, and having free edges, a support for said flexible member adjacent its edge, and a stylus connected to vibrate with said diaphragm member, substantially as described.

13. As a new article of manufacture, an inner non-flexible diaphragm member, provided with a sharpened edge for contact with a flexible annular diaphragm member, substantially as described.

This specification signed and witnessed this 14th day of April 1910.

THOMAS A. EDISON.

Witnesses:
PURSELL EGGLESTON,
A. N. PIERMAN.

Correction in Letters Patent No. 1,019,441.

It is hereby certified that in Letters Patent No. 1,019,441, granted March 5, 1912, upon the application of Thomas A. Edison, of Llewellyn Park, West Orange, New Jersey, for an improvement in "Sound-Recording Apparatus," an error appears in the printed specification requiring correction as follows: Page 1, line 85, for the word "ends" read *end;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of April, A. D., 1912.

[SEAL.]

C. C. BILLINGS,
Acting Commissioner of Patents.