Nov. 3, 1925. 1,560,502

L. DE FOREST

SOUND REPRODUCING DEVICE

Filed Jan. 15, 1925 2 Sheets-Sheet 1

Fig. 1.

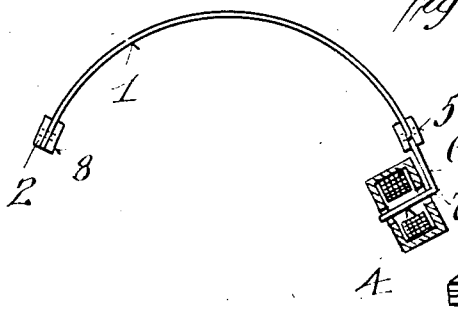


Fig. 2.

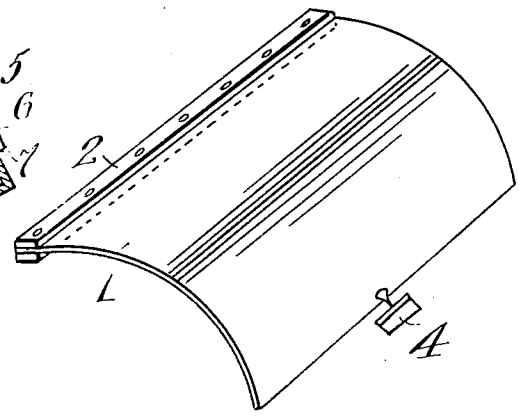


Fig. 3.

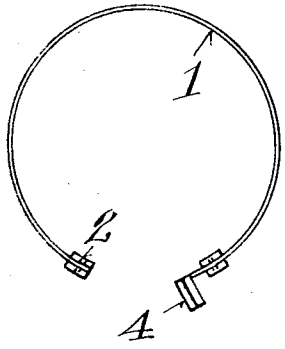


Fig. 4.

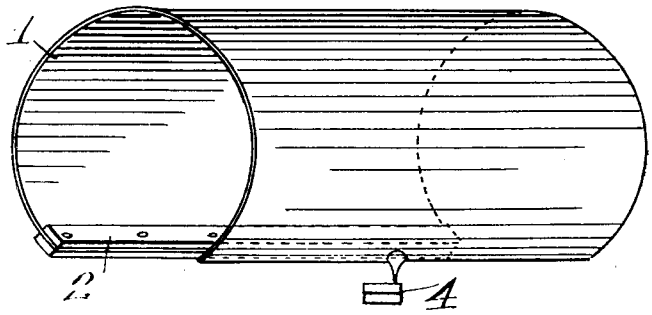


Fig. 5.

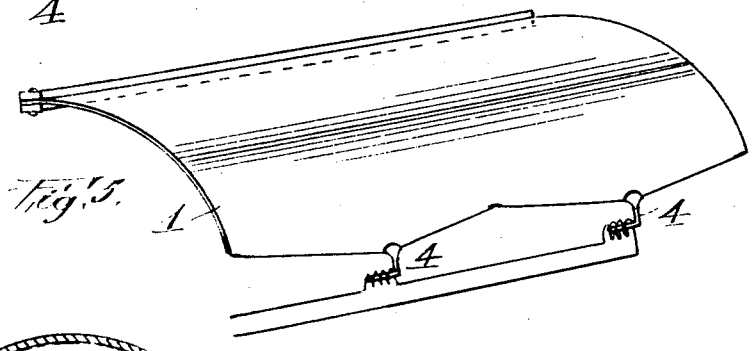
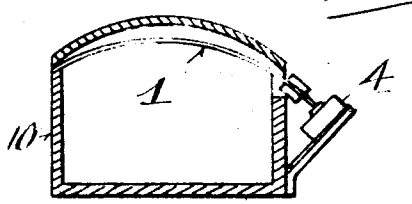


Fig. 6.



Inventor

Lee de Forest

By his Attorneys

Fraser & Fraser

Nov. 3, 1925. 1,560,502

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SOUND REPRODUCING DEVICE

Filed Jan. 15, 1925 2 Sheets-Sheet 2

Fig. 7.

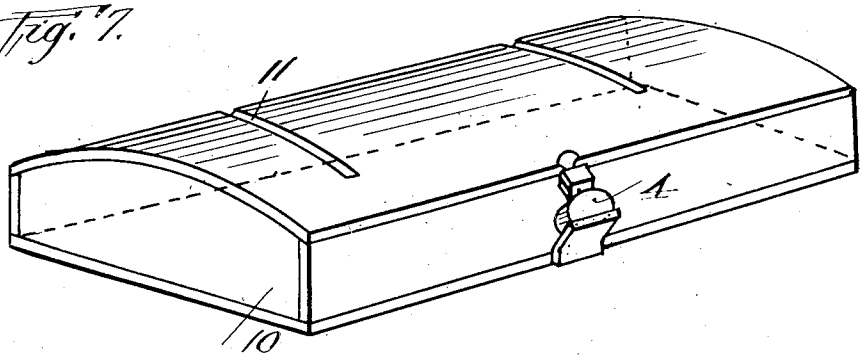


Fig. 8.

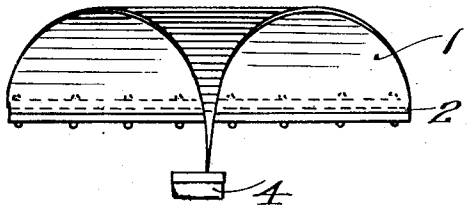
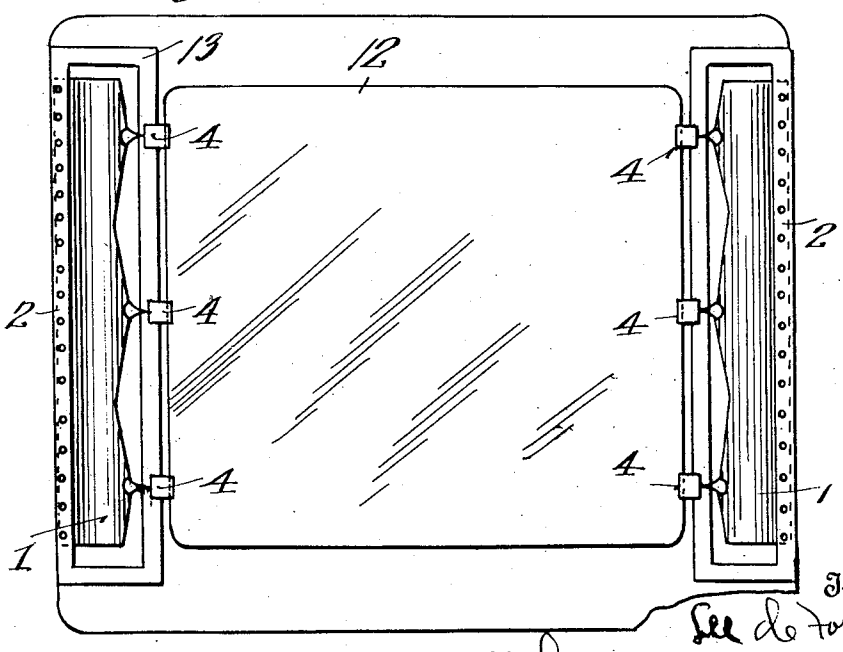


Fig. 9.



Inventor
Lee de Forest
By his Attorneys
Darby & Darby

Patented Nov. 3, 1925. 1,560,502

UNITED STATES PATENT OFFICE.

LEE DE FOREST, OF NEW YORK, N. Y.

SOUND-REPRODUCING DEVICE.

Application filed January 15, 1925. Serial No. 2,548.

To all whom it may concern:

Be it known that I, LEE DE FOREST, a citizen of the United States, residing at New York, in the county and State of New York, have made a certain new and useful Invention in Sound-Reproducing Devices, of which the following is a specification.

This invention relates to sound reproducing devices, such as are employed in phonographs, talking motion pictures, loud speakers, radio receiving sets, etc., and has for its principal object the production of a simple, efficient and economical unit for the reproduction of sound waves from an electrical or similar type of source.

A further object of the invention is to provide a unit of this character which, due to its simplicity of construction, affords an exceptionally advantageous commercial device for the uses hereinabove set forth.

A further object of the invention is to provide a device of this character wherein faithful reproduction of speech, music or other sounds, is secured with maximum volume and clarity and minimum distortion.

Further objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown by the accompanying drawings and finally pointed out in the appended claims.

Referring to the drawings:

Figure 1 is a view in side elevation of a sound reproducing device embodying my invention.

Fig. 2 is a view in perspective of the same.

Fig. 3 is a view in side elevation of a slightly modified arrangement.

Fig. 4 is a view in perspective of the same.

Fig. 5 is a perspective view of a slightly modified arrangement.

Fig. 6 is a sectional view of a modified arrangement shown in Fig. 7, which, in turn, is a perspective view thereof.

Fig. 8 is a front view of a still further modified arrangement.

Fig. 9 is a view in perspective of a further modification as applied to a motion picture screen.

The same part is designated by the same reference character wherever it occurs throughout the several views.

I have discovered that if vibrations occasioned by sound are imparted to the marginal edges or corner of a substantially rigid membrane and in the direction of the plane thereof, exceptionally clear, loud, distortionless and accurate sound wave reproduction is obtained and, in essence, this is what constitutes, in its broadest scope, the subject-matter of my present invention.

While I have shown and will now describe my invention as applied to an electrically actuated sound reproduction device, I do not wish it to be limited or restricted thereto as this form of sound reproducer has been selected solely for the purpose of illustration. The principle may be equally advantageously applied to phonograph reproduction.

In the arrangement shown, however, in Fig. 2, I show a membrane 1 which may be rigidly or flexibly fastened at one edge thereof in any suitable manner; for example, by means of a clamp 2. The membrane is flexed and preferably maintained under tension. A sound reproducing device—in the form shown, an electrical telephone receiver of the balanced armature type—is diagrammatically illustrated at 4, with the armature thereof adapted to bear against the marginal edge of the membrane 1 in any suitable manner. In the arrangement selected for illustration, I employ a yoke 5 adapted to fit on opposite sides of the marginal edge of the membrane 1, which affords a connection between the mechanical link 6 and the end of the armature 7 of the reproducer. The opposite edge of the device may be secured in any desired manner; e. g., and as shown, by means of two clamping members 2 and 8, or it may be flexibly supported on rubber or string lacings, or held between soft clamps of rubber, felt, or other yielding material.

I do not desire to be limited or restricted to any particular material employed for the membrane 1, as it may consist of cardboard, parchment, fiber board, paper, sheet metal, and in fact, may be of any material which is of a vibratory nature. Likewise, I do not desire to be limited or restricted to any particular size or shape of the membrane. For example, and as shown in Fig. 2, the membrane is rectangular; or as shown in Figs. 5 and 9, it may be of modified rectangular shape; or as shown in Fig. 8 it may be of triangular shape. I therefore wish it to be understood that the shape of the membrane may be of any geometrical shape,

regular or irregular, as desired. Similarly, I do not desire to be limited or restricted to any particular thickness of the membrane, as it may be of constant thickness, or gradually increasing or decreasing thickness, or of irregular thickness; all in accordance with the particular design and the use to which the device is to be put. Also, it may be ribbed or corrugated. Likewise, I do not desire to be limited or restricted to the degree of flexure or the geometrical degree of curvature imparted to the membrane. For example, it may be slightly flexed, as shown in Figs. 1 and 2; or it may be substantially cylindrical, as shown in Figs. 3 and 4; or it may be flexed as shown in Figs. 5, 6 and 7; or in a spiral formation, the fundamental feature being that the mechanical sound reproducing vibration is imparted to the marginal edge of the membrane, preferably in the plane of the membrane at that point, or tangentially thereto.

Likewise, I do not desire to be limited or restricted to the point of application of the sound record reproductions on the membrane. As shown in Figs. 1 and 2, these may be imparted at the approximate center thereof; or they may be imparted, as in the case of Fig. 8, at the apex of the triangle; or a plurality of sound reproducing devices may be connected, either in series or parallel, and applied at different points on the marginal edge of the membrane 1, as shown in Figs. 5 and 9.

Likewise, if desired, the membrane may be encased, as illustrated in Figs. 6 and 7, with the sound reproducing device 4 applied to the marginal edge thereof, as shown. In such instance, I prefer to provide the case 10 with one or more slots 11 to allow the sound waves caused by the vibration of the membrane 1 to escape therefrom. The casing acts like a sounding box or board, to enhance the vibrations of the air therein contained.

In Fig. 9 I have shown a simple application of the invention to a motion picture screen for special adaptation to talking motion pictures. The motion picture screen is illustrated at 12, and on both sides thereof I mount a frame 13, the frame in this instance serving as a clamp 2 for one edge of the membrane, and the sound reproducing device 4 operating on the marginal edge of the membrane 1 as hereinbefore described.

Many other modifications and changes in details of construction, shape, size and material, as well as applications of the invention, will readily occur to those skilled in the art without departing from the spirit and scope of my invention as defined in the appended claims. Therefore, what I claim as new and useful, of my own invention, and desire to secure by Letters Patent is:

1. A sound reproducing device comprising a membrane and a sound reproducing member attached tangentially thereto to impart vibrations tangentially to the plane thereof.

2. A sound reproducing device comprising a membrane and a sound reproducing member attached tangentially thereto to impart vibrations to the marginal edge thereof.

3. A sound reproducing device comprising a flexed membrane and a sound reproducing member attached tangentially to the marginal edge thereof.

4. A sound reproducing device comprising a membrane flexed to form a portion of a cylinder and a sound reproducing member attached tangentially to the marginal edge thereof.

5. A sound reproducing device comprising a membrane flexed to form a portion of a cylinder and a sound reproducing member attached tangentially thereto to impart vibrations tangentially to the plane thereof.

6. A sound reproducing device comprising a membrane fixed at at least one edge thereof, and a sound reproducing member attached tangentially to the marginal edge thereof.

7. A sound reproducing device comprising a membrane fixed at at least one edge thereof, and a sound reproducing member attached tangentially thereto to impart vibrations tangentially to the plane thereof.

8. A sound reproducing device comprising a membrane fixed at at least one edge thereof and flexed to form a portion of a cylinder, and a sound reproducing member attached tangentially to the marginal edge thereof.

9. A sound reproducing device comprising a membrane fixed at at least one edge thereof and flexed to form a portion of a cylinder, and a sound reproducing member attached tangentially thereto to impart vibrations tangentially to the plane thereof.

10. A sound reproducing device comprising a membrane and an electro-magnetically operated sound reproducing member attached tangentially to the marginal edge thereof.

11. A sound reproducing device comprising a membrane and an electro-magnetically operated sound reproducing member attached tangentially thereto to impart vibrations tangentially to the plane thereof.

12. A sound reproducing device comprising a flexed membrane and an electro-magnetically operated sound reproducing member attached tangentially to the marginal edge thereof.

13. A sound reproducing device comprising a flexed membrane and an electro-magnetically operated sound reproducing member attached tangentially thereto to impart vibrations tangentially to the plane thereof.

14. A sound reproducing device comprising a membrane and a sound reproducing member attached tangentially to the marginal edge thereof, and a frame for supporting said membrane and member.

15. A sound reproducing device comprising a membrane and a sound reproducing member attached tangentially to the marginal edge thereof, and a frame for supporting said membrane and member, said frame also serving to act as a sounding board to reinforce the air vibrations set up by the membrane.

16. A sound reproducing device comprising a flexed membrane and a sound reproducing member attached tangentially thereto to impart vibrations tangentially to the plane thereof, and a frame for supporting said membrane and member.

17. A sound reproducing device comprising a flexed membrane and a sound reproducing member attached tangentially thereto to impart vibrations tangentially to the plane thereof, and a frame for supporting said membrane and member, said frame also serving to act as a sounding board to reinforce the air vibrations set up by the membrane.

18. A sound reproducing device comprising a membrane fixed at at least one edge thereof and a sound reproducing member attached tangentially to the marginal edge thereof, and a frame for supporting said membrane and member, said frame also serving to act as a sounding board to reinforce the air vibrations set up by the membrane.

19. A sound reproducing device comprising a flexed membrane fixed at at least one edge thereof, and a sound reproducing member attached tangentially to the marginal edge thereof, and a frame for supporting said membrane and member.

20. A sound reproducing device comprising a flexed membrane fixed at at least one edge thereof, and a sound reproducing member attached tangentially to the marginal edge thereof, and a frame for supporting said membrane and member, said frame also serving to act as a sounding board to reinforce the air vibrations set up by the membrane.

In testimony I have hereunto set my hand on this 12th day of January A. D., 1925.

LEE DE FOREST.