March 12, 1935. G. E. ATKINS 1,993,768

ACOUSTIC DEVICE

Filed Sept. 29, 1933 2 Sheets-Sheet 1

FIG. 1

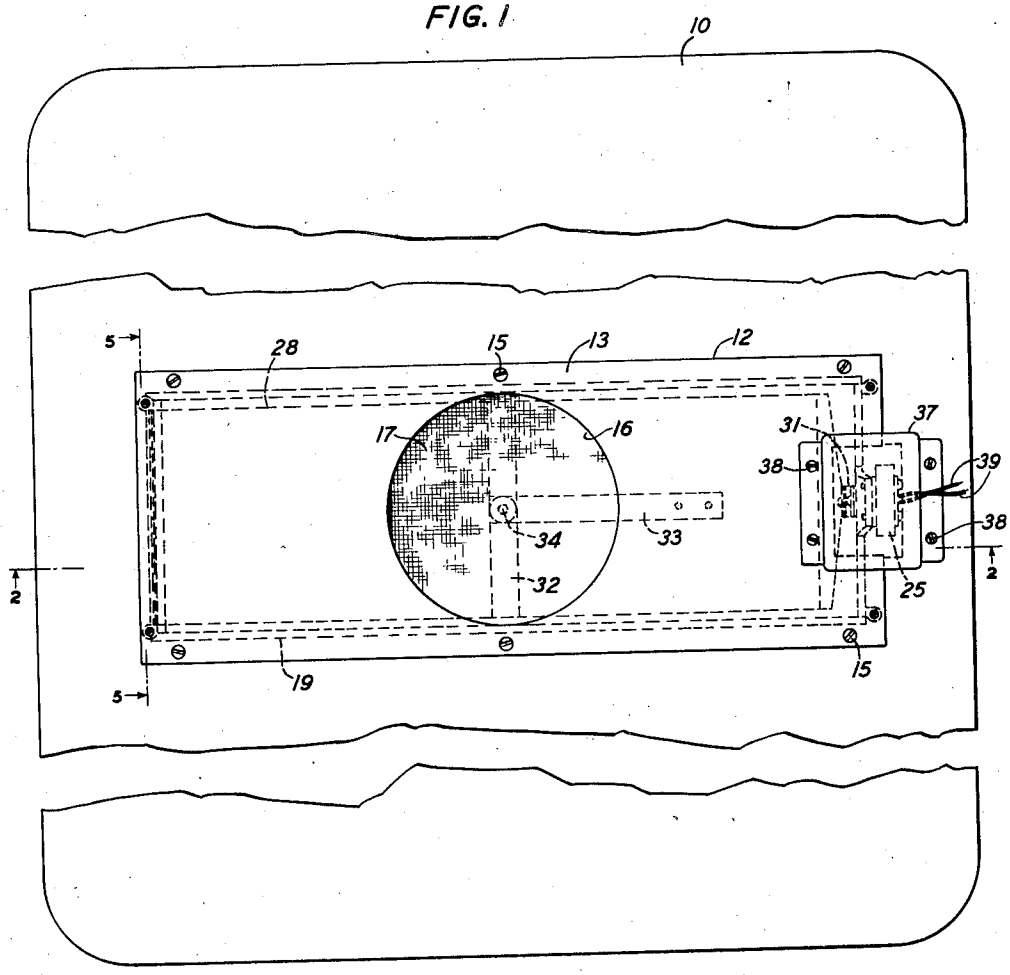

FIG. 2

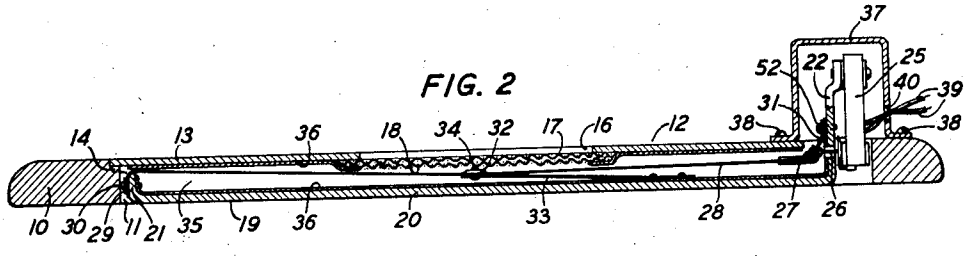

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FIG. 3

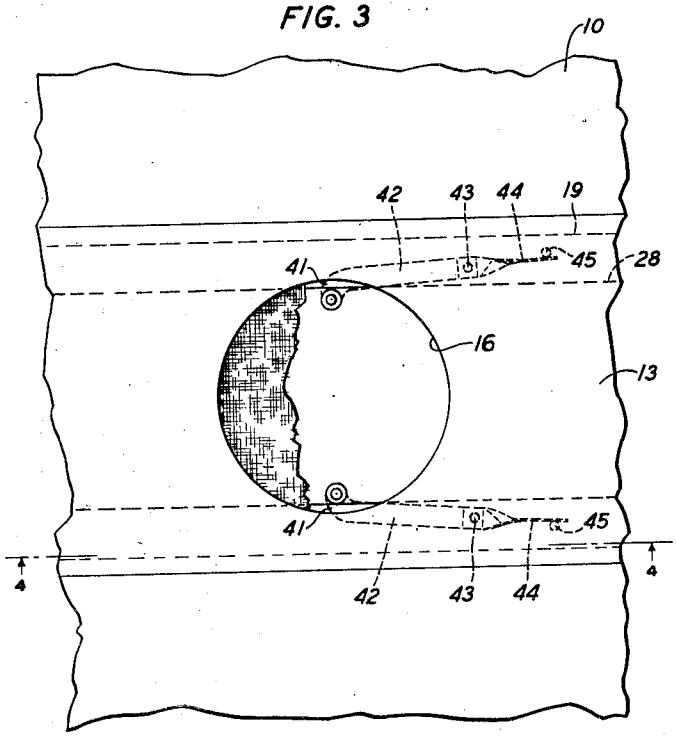


FIG. 4

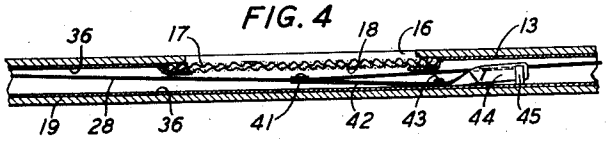
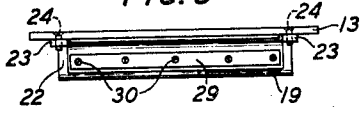


FIG. 5



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1,993,768

UNITED STATES PATENT OFFICE

1,993,768

ACOUSTIC DEVICE

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Application September 29, 1933, Serial No. 691,501

18 Claims. (Cl. 181—31)

This invention relates to acoustic devices and, more particularly, to loudspeakers especially suitable for use in hospital beds, Pullman car berths, easy chairs and the like, and commonly designated as pillow type receivers.

An object of this invention is to enable the fabrication of a loudspeaker of small thickness which may be inserted readily under a pillow, and having a limited field of audibility and a good quality of reproduction.

Another object of this invention is to simplify the construction and to reduce the cost of loudspeakers.

In one embodiment of this invention, a loudspeaker comprises a thin frame or support suitable for placement under a pillow or other support for the head, and provided with a diaphragm chamber having an aperture for allowing egress of sound waves. An actuating unit of any suitable type is mounted adjacent one end of the support. A sheet diaphragm, which may be rectangular in form, is disposed within the diaphragm chamber and is rigidly secured at one edge to the support. The opposite edge of the diaphragm is secured to a spring member which is attached to the support and is coupled to the actuating unit. A rigid stiffening member or cross-piece is secured to the diaphragm at substantially the center thereof and extends across the diaphragm substantially parallel to the fixed edge thereof. A resilient member, which may be a leaf spring secured at one end to the base of the support, is secured to the stiffening member or cross piece and exerts a tensioning force upon the diaphragm at substantially right angles to the tensioning force produced by the spring member coupled to the actuating unit. The spring and resilient members preferably are balanced so that a substantially constant resultant tension is maintained in the diaphragm as it vibrates.

A more complete understanding of this invention will be obtained from the detailed description which follows, read with reference to the accompanying drawings, wherein:

Fig. 1 is a plan view of an acoustic device embodying this invention;

Fig. 2 is a sectional view of the device of Fig. 1 along the line 2—2 thereof;

Fig. 3 is a plan view of a fragment of an acoustic device showing a modification of the device of Fig. 1;

Fig. 4 is a sectional view of the modification shown in Fig. 3 along the line 4—4 thereof; and

Fig. 5 is a sectional view of the device of Fig. 1 along the line 5—5 thereof.

The acoustic device of Figs. 1 and 2 is a loudspeaking telephone comprising a thin flat plate, board or other member 10, preferably of wood, and of the order of a square foot or more in area. It contains an elongated, rectangular shaped slot or opening 11 in its central portion to receive a similarly shaped receiver unit designated generally as 12. The unit 12 comprises a supporting plate or carrier member 13 adapted to be supported at its peripheral portion on the shoulder portion 14 of the board 10, being secured to the board by suitable fastening means, such as the screws 15, such that its upper surface is in the same plane as that of the upper surface of the board. The member 13 has a central aperture or opening 16. A wire gauze protective screen 17 and a cloth screen 18 extend across aperture 15, being supported from the under surface of the carrier member.

A shallow frame member 19 depends from the member 13 and comprises an elongated, flat, rectangular shaped, central portion 20 and flanged end portions 21, 22. As shown more clearly by Fig. 5, end portion 21 is provided with ear portions 23, suitable fastening means, such as screws 24, clamping them to the carrier member 13. End portion 22, similarly, is provided with such ear portions and fastening means (not shown).

An actuating unit 25, responsive to impulses of sound wave frequency and of any suitable type, for example, of the general construction disclosed in Wegel Patent 1,704,354, granted March 5, 1929, is supported by the end portion 22, its vibratory member or reed 26 being suitably secured at one end 27 of a diaphragm 28. The diaphragm, which may be of paper, metal, or any suitable material, is elongated and substantially rectangular in shape, and has one short edge drawn over end portion 21 of the frame member and clamped thereagainst by a clamping strip 29 and screws, rivets, or the like, 30. The end 27 of the diaphragm is connected to the frame 19 by a spring member 31, one end of which is fastened to the diaphragm and the other end of which is secured to the end portion 22 by suitable fastening means 52. The diaphragm 28, reed 26, and spring member 31 are thus coupled together. The longer edges of the diaphragm are unrestrained. A light, stiff center-piece or rod 32 is secured to the central portion of the diaphragm and extends substantially across its entire width. The central portion of the diaphragm is pulled down or bowed by a spring 33, which, although shown as of the flat type, may be a coiled spring. The spring 33 is secured to

the diaphragm, for instance, by a rivet 34, and is similarly fastened at its other end to the frame 19. To dampen any reverberation from the walls of the cavity 35 in which the diaphragm is located, the walls may be lined with a suitable sound deadening material 36, for instance, of felt. The actuating unit is concealed and protected by a cover member 37, secured by suitable fastening means, such as the screws 38, to the carrier member and the board 10. The actuating unit is connected to an appropriate external electrical communication or program circuit by conductors 39 which extend through an aperture 40 in the cover.

The diaphragm is stretched under a tension exerted at its mid-portion and at one of its shorter edges and assumes a bowed condition to present the appearance of a very shallow V. It is driven at one of its shorter edges in the direction of its longer dimension and when so driven, the angle along its length is increased and decreased, the diaphragm vibrating substantially in a direction transverse to the surface of the diaphragm. If the tension of the springs is of the same order as the force ratio, the diaphragm will be maintained under substantially constant tension under operating conditions. It is apparent, of course, that the spring force tensioning the diaphragm axially or along its length, may be inherent in the actuating unit, although herein disclosed as being provided by the spring member 31.

In use, the acoustic device described is inserted under the pillow, cushion, or other member (not shown) providing the surface against which the head of the user rests. Sound waves reproduced have egress through the aperture 16. While it is not necessary for the user to maintain the head in a particular position to receive the program, the field of audibility is sufficiently limited so that others in the vicinity of the user will not be disturbed.

Figs. 3 and 4 show an alternative expedient for applying the bending or tensioning force at the central portion of the diaphragm 28. At each end of a line extending crosswise of the diaphragm midway of its length is connected one end 41 of a twisted, flat spring member 42. The spring member extends downwardly to the frame 19 and is pivotally secured thereto at a point along its length on a pin member 43. The portion 44 of the spring member beyond the pivot point engages with a movement limiting pin or stop member 45 projecting from the frame 19. The springs 42 exert a pulling force across the width of the diaphragm as well as downwardly.

While the features of this invention have been disclosed in various specific structures, it is understood, of course, that various modifications may be made in the details of construction without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A sound translating device comprising a diaphragm for actuating said diaphragm, means for exerting a tensioning force on said diaphragm along its surface, and spring means for exerting a tensioning force on said diaphragm at an angle to its surface.

2. A sound translating device comprising a diaphragm fixed at an edge, spring means secured to the opposite edge of said diaphragm for exerting a tensioning force along an axis thereof, and additional means coupled to said diaphragm intermediate said edges and exerting a tensioning force on said diaphragm at substantially right angles to said axis.

3. A sound translating device comprising a diaphragm, means for actuating said diaphragm, and a plurality of members applying tension to said diaphragm at substantially right angles, said members being proportioned so that a substantially constant tension is maintained in said diaphragm when it vibrates.

4. A loudspeaker comprising a rectangular diaphragm fixed at one edge, a spring member coupled to the opposite edge of said diaphragm and tensioning it along its surface, a resilient member coupled to said diaphragm intermediate said edges and tensioning said diaphragm at substantially right angles to its surface, and actuating means coupled to said spring member.

5. An acoustic device comprising a diaphragm, means responsive to impulse of sound wave frequency attached to said diaphragm, means for exerting a tensioning force on said diaphragm along its surface, said frequency responsive means being coupled to said tensioning means, and additional means for exerting a tensioning force on said diaphragm at an angle to said surface.

6. An acoustic device comprising a rectangular diaphragm, one edge only of which is fixed against movement, tensioning means attached to the edge opposite the fixed edge, and means attached to the diaphragm intermediate said opposed edges to bow the diaphragm, said bowing means comprising a rod extending across the diaphragm between its long edges, and a spring member connected to the mid-portion of said rod.

7. An acoustic device comprising a diaphragm, means for exerting a tensioning force along the surface of said diaphragm, and means for exerting a tensioning force at an angle to the surface of the diaphragm, said means being proportioned so that the diaphragm is maintained under a constant tension when vibrated.

8. An acoustic device comprising a diaphragm, spring means for exerting tensioning forces along the surface of said diaphragm and also at an angle to the surface, and means for driving the diaphragm, the ratio of the tension of said spring means being equal to the force ratio.

9. An acoustic device comprising a rectangular diaphragm, one edge only of which is restrained against movement, a spring member attached to the edge opposite the restrained edge, and a second spring member attached to the diaphragm at a point intermediate said edges and exerting a bending force on the diaphragm.

10. An acoustic device comprising a flat, board member of an area of a square foot or more having a central aperture, and a sound wave translating unit of substantially the same thickness throughout as said board member and disposed in said aperture, said sound translating unit including a plate member for securing the unit to the board member and having a central aperture for the passage of sound waves, a frame member forming with the plate member a cavity at no point deeper than the thickness of said board, and a diaphragm mounted between said plate and frame members.

11. An acoustic device comprising a substantially flat, rectangular plate having a central aperture of substantially rectangular shape, and a sound wave translating unit enclosing a diaphragm and being of substantially the same thickness throughout as said plate and disposed in said aperture, said unit including an apertured

carrier member for securing the unit to the plate member such that the upper surfaces of the plate and carrier are in the same plane.

12. An acoustic device for use with a pillow or other support for a user's head, comprising a board member of such size as to be substantially coextensive with the head support and adapted to be concealed thereby, and a sound wave translating unit mounted in said member such that substantially all of its uppermost surface is in the plane of the upper surface of the board member.

13. A loudspeaker comprising a substantially flat, relatively thin member whose area is of the order of a square foot or more, and a sound wave translating unit mounted in said member and being substantially throughout not greater in thickness than said member.

14. An acoustic device comprising a rectangular diaphragm, means for exerting a tensioning force along one dimension of the diaphragm, and means for exerting a tensioning force in the direction of the other dimension of the diaphragm and at an angle to the surface of the diaphragm.

15. An acoustic device comprising an apertured plate member, a second plate in spaced relation to the apertured member, a diaphragm disposed between said plate members and having a plurality of edge portions one of which is secured to said second plate member, means responsive to impulses of sound wave frequency attached to another edge of said diaphragm opposite the secured edge, resilient means attached to said diaphragm intermediate said opposed edges for bending the diaphragm, and means attached to said opposite edge opposing said bending action.

16. An acoustic device comprising a support, a rectangular diaphragm, one edge of said diaphragm being fixed to said support, means attached to the edge opposite said fixed edge to tension said diaphragm, and means attached to an intermediate portion of said diaphragm for bending said diaphragm, said last mentioned means comprising an elongated resilient member.

17. An acoustic device comprising an elongated, flat rectangular plate member, another elongated rectangular plate member depending from and spaced from the first plate member to form a cavity therewith, a diaphragm actuating unit, an elongated diaphragm in said cavity and having a pair of oppositely disposed edges, one of which is fastened to the second mentioned plate and the other to the actuating means, the remaining edge portions of the diaphragm being unrestrained, and a pair of elongated resilient strips attached to said diaphragm for exerting tensioning forces along and at substantially right angles to the diaphragm surface.

18. A sound reproducing device comprising a diaphragm, a casing of small depth enclosing said diaphragm and having an opening in one face for the egress of sound waves, means attached to one edge of the diaphragm for tensioning it, means coupled to one edge of said diaphragm for actuating it, and means attached to the center of the diaphragm for tensioning it.

GEORGE E. ATKINS.

CERTIFICATE OF CORRECTION.

Patent No. 1,993,768. March 12, 1935.

GEORGE E. ATKINS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 65, claim 1, before "for" insert the comma and word , means; 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 11th day of June, A. D. 1935.

Leslie Frazer
Acting Commissioner of Patents.

(Seal)

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