May 6, 1930. L. E. BALTZLEY 1,757,107

SOUND REPRODUCER

Filed March 24, 1926 3 Sheets-Sheet 1

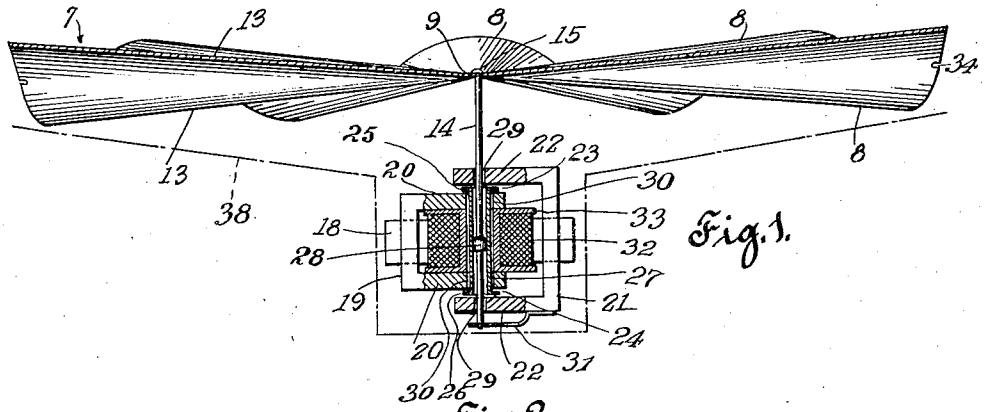


Fig. 1.

Fig. 2.

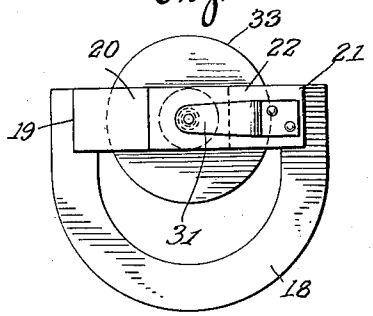


Fig. 3.

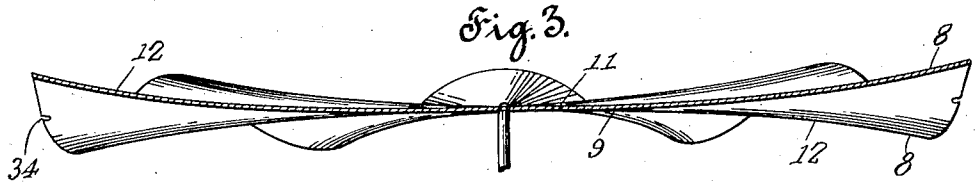
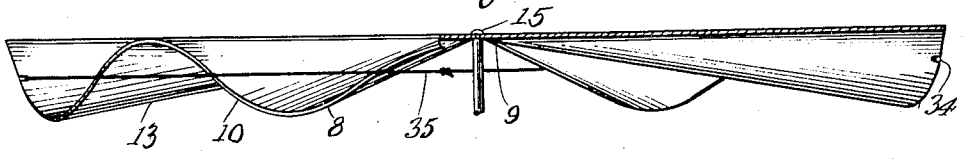


Fig. 4.



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SOUND REPRODUCER

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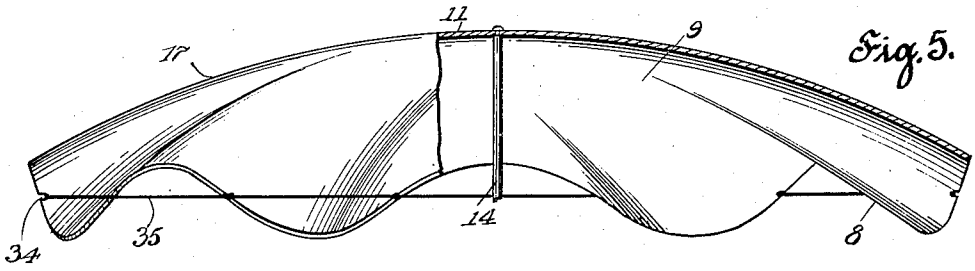

Fig. 5.

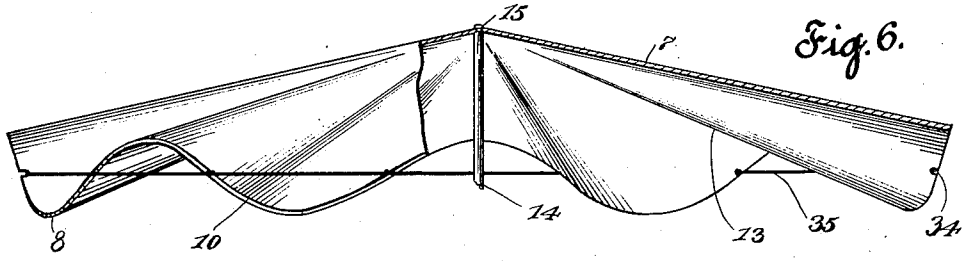

Fig. 6.

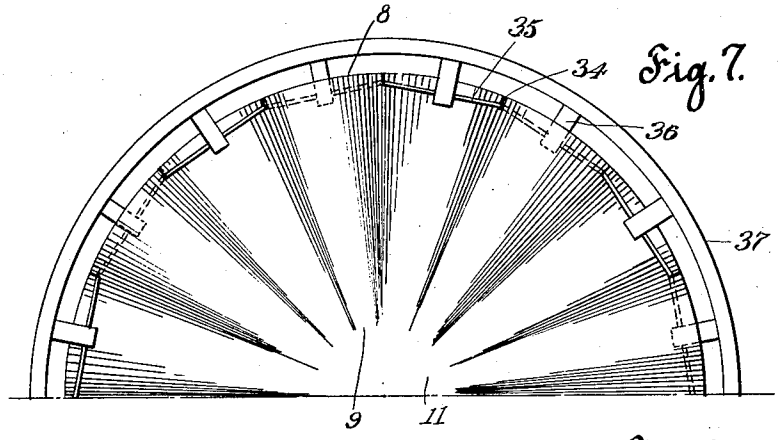

Fig. 7.

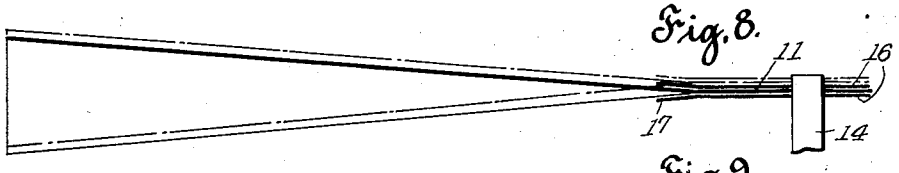

Fig. 8.

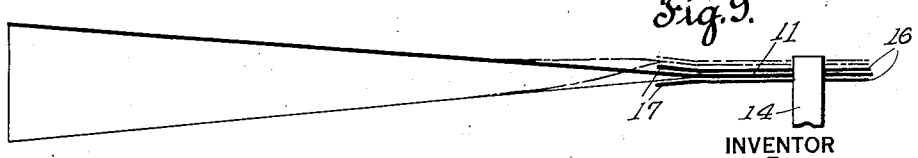

Fig. 9.

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Fig. 10.

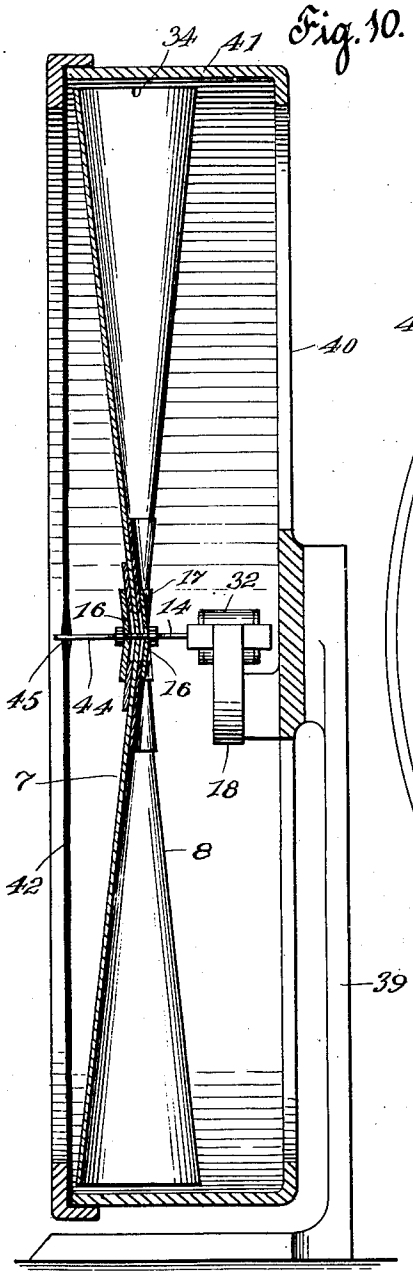
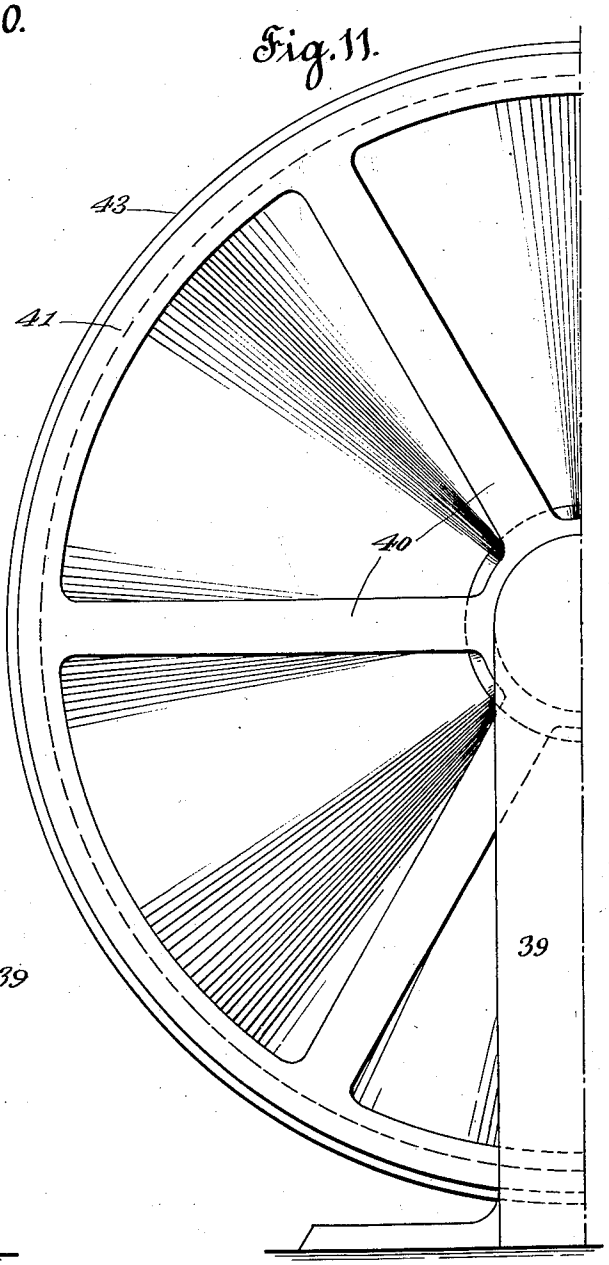


Fig. 11.



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UNITED STATES PATENT OFFICE

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SOUND REPRODUCER

Application filed March 24, 1926. Serial No. 96,967.

The objects of this invention are to reproduce or recreate the musical and vocal sounds with the greatest possible fidelity and throughout the rather wide range of audibility between the low pitched notes at one end and the high pitched notes at the opposite end of the scale of audibility.

Various forms of horns, cones and diaphragms have been designed heretofore which could reproduce well, sounds within a given range or ranges, but which because of certain inherent resonant qualities or the like, lose their ability to translate sounds properly occurring in another range or ranges. To overcome or reduce these faults or limitations, such extremes have been proposed as to provide a plurality of horns, cones or the like of different size or shapes and intended to operate in a selective sense, each in its own certain range or field.

The desired results are attained in the present invention and in a single unitary device by novel features of construction, combination and relation of parts, including in one important particular, a mechanically or electrically vibrated sound translating member of disc like form and having incorporated in its structure, circumferentially repetitious waves or undulations providing the effect of substantially radially extending ribs which are shallower toward the center and are of greatest depth toward the rim of the disc. This disc is operated by the central portion where the undulations are least or possibly entirely absent. The central portion is thus made the most highly sensitive section of the reproducer, capable of responding to the vibrations of the highest orders and the more deeply fluted rim portion becomes the less sensitive section, responding to the notes or tones of the lower scales.

The foregoing and other novel features of the invention will appear more fully as the specification proceeds.

The drawings accompanying and forming part of this specification illustrate a few of the possible embodiments of the invention and it is to be understood that the structure may be varied without departure from the spirit and scope of the invention as hereinafter defined and broadly claimed.

Figure 1 is a broken sectional side elevation of the invention embodied in a form of a speaker for radio receiving sets.

Figure 2 is an enlarged bottom plan view of the receiving unit.

Figures 3, 4, 5 and 6 are broken part sectional views of different forms of the air vibrating sound wave creating member.

Figure 7 is a broken top plan illustrating one method of guiding or positioning the free edge of the sound wave member.

Figures 8 and 9 are diagrammatic representations indicative of the operation under different conditions.

Figure 10 is a vertical sectional view of a form of the invention embodied in a special vertical mount.

Figure 11 is a rear elevation of the same.

The tympanum by which electrical vibrations in the receiving unit are converted into sound vibrations in the air is designated 7 and is shown in the form of a disc corrugated radially to form radially extending flutes or ribs 8, said ribs being of a minimum height, starting from or near the center of the disc at 9 and increasing in height and width toward the rim where they form a wavy outline at 10 with the successive undulations extending to opposite sides or to one side only of the general plane of the disc. The effect or result is a series of undulations extending completely about the disc, which undulations increase in transverse dimensions or in depth and width radially toward the rim, where they are deepest and widest.

In the structures illustrated in Figures 3, 5, 7, 8, 9, 10, the radial flutes or ribs start a little distance outward from the center, leaving a plain or flat portion 11 at the center of the disc, whereas in the structures shown in the other figures, the flutes start substantially at the center of the disc. These two sets of views serve to illustrate further how the ribs may be curved longitudinally of their extent so as to produce more or less of a flare, as indicated at 12 in Figure 3, be drawn on continuous straight longitudinal lines, as shown at 13 in Figures 1 and 4, be curved following

the lines of a dome as in Figure 5 or be otherwise shaped.

The actuating connection comprises in the present disclosure, a relatively stiff rod 14 connected usually with the center or central portion of the tympanum, for instance, by riveting as at 15 in Figure 1.

Another method of connection is to secure the transmitting rod to the center of the tympanum by means of a washer or washers 16 at one or both sides of the central portion, said washers being flat at their central portions and fluted at their edge portions at 17 to fit over or embrace the inner ends of the flutes in the tympanum. In this way the inner ends of the flutes are gripped solidly so as to impart a bodily movement to the tympanum if the vibrations are of a sufficiently low order and so that if on the other hand, the vibrations are of a sufficiently high order, the inner ends of the flutes will be shifted while possibly the outer ends of the flutes may remain at rest or "lag", as indicated respectively in diagrammatic fashion in Figures 8 and 9. This structure and method of connection thus enables the tympanum to respond and recreate both the lower and the higher tone sound waves as well as those falling within the intermediate ranges.

To secure the selective or fully responsive action described, it is desirable to have an actuating unit which will respond powerfully throughout the range of audibility. A unit answering these requirements is illustrated in Figures 1 and 3 and as there shown, consist of a single powerful horse shoe magnet 18 having attached to one polar extremity, a substantially U-shaped pole piece 19 with side arms 20 projecting toward the other pole of the magnet and having attached to said other pole, a similar but larger pole piece 21 with side arms 22 extending over the pole pieces 20. Within the gaps 23, 24 between these extensions of opposite polarity are located the magnetic armature heads 25, 26, which are shown connected by a hollow core 27 in the center of which is secured at 28, the transmission rod 14. This rod projects freely through openings 29 in the outer polar projections and similarly, the armature core projects freely through the openings 30 provided in the inner polar projections 20. The lower end of the transmission rod is shown tensioned by a spring 31 to hold the armature heads normally floated free of contact in the magnetic gaps. The actuating winding for the unit is shown as a single coil 32 mounted on a hollow spool 33 supported and positioned between the inner polar projections 20.

It will be seen that the unit described acts with a combined push-pull effect at each of the two gaps and that a solenoid effect is exerted upon the armature core lying within the coil and hence the unit is responsive to feeble impulses, and is positive in its action. These features, in conjunction with the structure disclosed enabling the tympanum to respond either partially, that is, in the central portion to the more rapid vibrations, or bodily as a unit for the slower vibrations, effects a true reproduction of sound, from the lower ranges of audibility, up through the intermediate ranges to the higher ranges.

The tympanum may be made of different materials and of the same thickness throughout or of varying thickness. Thin sheet celluloid and impregnated pressed buckram of the same thickness throughout have been found very satisfactory materials.

The tympanum may be supported entirely by the transmission link but in the larger sizes may be supported or guided at the edges with freedom for bodily vibration after the manner illustrated in Figure 7 where it is shown as having notches 34 in the undulated edge of the same receiving a flexible cord 35 which is engaged in the free spaces in the hollows of the undulations by supports 36. These supports are shown as inwardly extending lugs carried by a ring 37 supported by a casing or the like indicated at 38 in Figure 1.

The flexible cord 35 which encircles the rim of the tympanum may be used as a means for bracing the tympanum and making it a more or less rigid unit. By tightening this cord in the several figures it will be seen that the overall diameter of the tympanum can be reduced and that this action forces the central portion into a conical or arched formation, increasing the rigidity of the device proportionately. Extra bracing effect can be obtained by increasing the height of the ribs and by extending the same clear to or entirely across the center of the disc. Also if desirable, laminations may be applied to the central or other portions of the disc to increase the stiffness or body of the same. The central securing washers such as shown in Figures 9 and 10 have this effect. While usually the tympanum is of circular form, the same may be made in various other shapes and the claims should be read with this and the various other considerations above in mind.

Figures 10 and 11 illustrate one of the practical methods of mounting the device. In these views the tympanum is disposed vertically and supported so by a stand 39. This stand carries the actuating unit and also carries by means of a series of radiating spokes 40, a guard rim 41 enclosing the rim of the tympanum but spaced therefrom. A screen 42 is shown stretched over the front of this frame, held in place by an angular sectioned ring 43 which fits tightly over the rim and the intervening screen material. To prevent the transmission link from sagging, said link is shown as extended at 44 past the tympanum and guided by a bushing 45 affixed

to the screen material. The transmission rod may slide in this bushing or be fixed thereto, the flexibility of the screen permitting the latter construction. In this case as in the preceding, the tympanum forms a sound wave creating member which is non-rigid to the more rapid, higher tone vibrations and may be substantially rigid so as to follow bodily the slower lower tone vibrations, the extent of bodily movement varying with the rapidity of the sound vibrations.

What is claimed is:

1. In a sound generator, a tympanum having undulations extending from the central portion to the rim of the tympanum and gradually increasing in depth and width from such central portion outwardly toward the rim portion of the same and a connection for bodily vibrating said tympanum, said connection being rigidly engaged with an intermediate portion of the tympanum and supporting the tympanum for vibration in free air responsive to the movements of said connection.

2. In sound reproduction, a tympanum in the form of a disc like structure having an undulatory surface with the undulations thereof gradually increasing in width and depth from the central portion toward the rim portion of the structure, said tympanum being supported for free bodily movement and an actuating connection rigidly engaged with the central portion of the tympanum.

3. In sound reproduction, a tympanum in the form of a disc like structure having an undulatory surface with the undulations thereof gradually increasing in width and depth from the central portion toward the rim portion of the structure, said tympanum being supported for free bodily movement and an actuating connection rigidly engaged with the central portion of the tympanum and comprising a flat washer with fluted edges engaged with the central portion of the tympanum and a transmission link rigidly engaging with said washer.

4. In sound reproduction, a tympanum of thin disc like form having radially extending flutes starting from the original flat central portion of the disc and rising gradually on curved lines to the points of greatest magnitude at the rim of the disc.

5. In sound reproduction, a tympanum having an undulatory edge with notches therein, a flexible supporting connection entered in said notches and supports engaged with said connection at points within the hollows of the undulations.

6. In sound reproduction, a tympanum operating in free unconfined air to create self-sustaining sound waves, said tympanum being corrugated to form substantially radial stiffening ribs, the central portion of said tympanum being more flexible than the rim portion thereof and an actuating connection rigidly secured to said more flexible inner portion of the tympanum.

7. In sound reproduction, a tympanum operating in free unconfined air to create self-sustaining sound waves, said tympanum being corrugated to form substantially radial stiffening ribs, the central portion of said tympanum being more flexible than the rim portion thereof, an actuating connection rigidly secured to said more flexible inner portion of the tympanum and a flexible connection engaged about the rim of said tympanum contracting the same and rendering the body of the tympanum more nearly rigid.

8. In sound reproduction, a tympanum for operation in free unconfined air, said tympanum having an undulatory rim and a tympanum contracting member engaged with said undulations in the rim.

9. In sound reproduction, a tympanum for operation in free unconfined air, said tympanum having an undulatory rim, a tympanum contracting member engaged with said undulations in the rim and positioning members engaged with portions of said contractible member which span the undulations.

10. In sound reproduction, a tympanum having a rigidly held central non-rigid portion and ribs extending substantially radially therefrom toward the rim portion, said ribs increasing in width and depth toward the rim of the tympanum.

In witness whereof, I have hereunto set my hand this 28th day of February, 1926.

LOUIS E. BALTZLEY.