

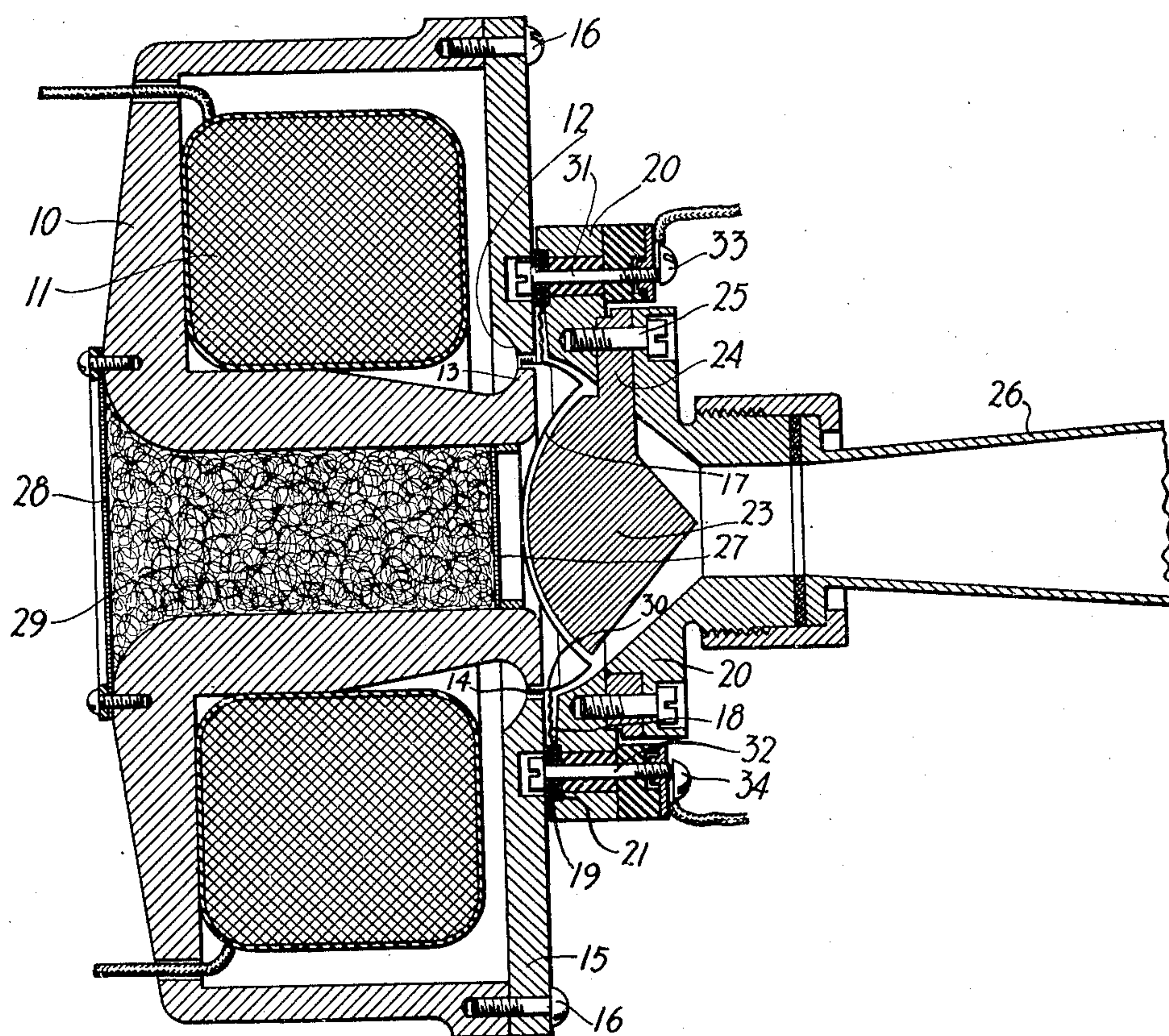
April 2, 1929.

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1,707,545

ACOUSTIC DEVICE

Filed Aug. 4, 1926



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UNITED STATES PATENT OFFICE.

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ACOUSTIC DEVICE.

Application filed August 4, 1926. Serial No. 127,023.

This invention relates to acoustic devices such as are used for receiving and transmitting sound.

An object of the invention is to receive or transmit sound with high and substantially uniform efficiency over a wide frequency range.

A specific object is to improve the transmission characteristics of loud speaking receivers at the upper portion of the sound frequency range.

In accordance with a preferred embodiment of the invention, a piston diaphragm is provided to radiate into a sound chamber having a plug secured therein which decreases the area of a portion of the sound passage therethrough. The diaphragm and plug are so shaped and arranged that converging sound passages are formed thereby extending from the center of the diaphragm and from its peripheral portion to a common sound passage. The cross sectional areas of the converging sound passages preferably increase as the common sound passage is approached and these areas are such, moreover, that the air displaced by the diaphragm flows from each of the converging sound passages into the common sound passage with substantially the same velocity. The meeting point of the converging sound passages is effectually the throat of the horn since the volume of the sound passage beyond this point is not appreciably affected by the displacement of the diaphragm. Extending from this throat portion to the mouth of the horn, it is preferable to have the cross-sectional area of the sound passage such that the area of the wave front of the transmitted sound progressively increases exponentially with respect to the distance travelled.

The invention may be readily understood by referring to the accompanying drawing in conjunction with the following detailed description.

The drawing is a sectional view of a loud speaking receiver employing the features of the present invention. An electromagnet having a hollow annular core 10, a winding 11, and annular pole pieces 12 and 13 provides a magnetic field in which the coil 14

is positioned. The top portion 15 of the magnetic core 10 is detachable to permit the assembling of the winding 11 on the core structure and is secured to the lower portion of the core by the screws 16. The diaphragm to which the coil 14 is attached comprises a stiff, dish-shaped, piston portion 17, a flexible corrugated portion 18 and a flat portion 19 which is clamped between the housing structure 20 and the upper portion 15 of the core structure. The diaphragm is separated from the portion 15 of the magnetic structure and the housing 20 by the clamping rings 21 and is held in a clamped position by screws (not shown) which pass through the flanged portion of the housing 20, washers 21 and the flat portion 19 of the diaphragm and which are threaded into the upper portion 15 of the magnetic structure. The light rigid coil 14 is connected to the stiff, piston portion 17 of the diaphragm, which is also made of light material, by means of a strip 30 of stiffened fabric material such as oiled silk coated with bakelite or shellac, or a strip of thin, lightweight metal. When assembled the coil 14 is positioned approximately equidistantly from the pole pieces 12 and 13. The ends of the conductor of which the coil 14 is wound may be brought out in any suitable manner to the screws 31 and 32 which are electrically connected to the terminals 33 and 34 respectively. The housing structure 20 is connected to a suitable sound projector such as the exponentially tapered horn 26.

The metallic plug 23 in the form of a spherical sector is secured to the housing 20 by the projecting lugs 24 and the screws 25, thus forming converging sound passages which extend from the center of the diaphragm and from its peripheral portion to a common annular sound passage, formed between the plug 23 and the housing 20. There are preferably three projecting lugs on the plug equally spaced about its periphery, although a greater or lesser number of lugs may be used if desired. The radius of the plug 23 is slightly smaller than that of the adjacent surface of the dish-shaped portion 17 of the diaphragm and the housing structure is likewise suitably shaped so that

the cross-sectional areas of the sound passages formed between these surfaces progressively increase from the center of the diaphragm and from its peripheral portion toward the common sound passage. The cross-sectional areas of these sound passages, moreover, are such that the air displaced from each of the converging passages flows into the common sound passage at substantially the same velocity. The meeting point between the converging sound passages and the common sound passage is effectively the throat portion of the sound projector since the volume of the sound passage beyond this point is not affected appreciably by the displacement of the diaphragm.

The space at the mid-portion of the magnetic structure 10 is closed at each end by some material having series acoustic resistance, such as the fine mesh wire gauze members 27 and 28, and a sound absorbing material 29 such as wool is employed to fill the space between these gauze members. Such an arrangement substantially eliminates acoustic resonance at this portion of the structure.

When employed in conjunction with a horn having no inherent losses, a loud speaker constructed in accordance with the above description has an efficiency of approximately 30%, measured from the electrical energy input to the acoustic energy output, over a wide range of frequencies. Measurements made on a loud speaker of this type, from which the plug 23 has been removed from the sound chamber, and which employs a diaphragm about 2.75" in diameter, show that the frequency response falls off at frequencies above about 3,000 cycles per second at such a rate that practically no radiation takes place at a frequency of about 6,300 cycles. By inserting the plug into the sound chamber the frequency response characteristic of the loud speaker is improved to such an extent that the point of low radiation is moved up to a frequency of about 14,000 cycles per second and the efficiency of the loud speaker is practically uniform up to a frequency above 5,000 cycles.

Although in the preferred form of this invention a plunger type diaphragm is employed, the advantages of this invention are also obtained with diaphragms of other forms.

What is claimed is:

1. An acoustic device comprising a sound chamber, a diaphragm therefor, and a plug in said sound chamber, said parts cooperating to form converging sound passages leading from the center of the vibrating portion of said diaphragm and from its peripheral portion, respectively, to a common sound passage.

2. An acoustic device comprising a sound chamber, a diaphragm therefor, and a plug in

said sound chamber, said parts cooperating to form converging sound passages leading from the center of the vibrating portion of said diaphragm and from its peripheral portion respectively to a common sound passage, a substantially equal volume of air being displaced in each of said converging sound passages by the displacement of the diaphragm.

3. An acoustic device comprising a sound chamber, a diaphragm therefor, and a plug in said sound chamber, all of said parts cooperating to form converging sound passages leading from the center of the vibrating portion of said diaphragm and from its peripheral portion, respectively, to a common sound passage, the cross-sectional area of the converging sound passages being such that the air displaced by the diaphragm flows from each of the converging passages into the common sound passage with substantially the same velocity.

4. An acoustic device comprising a piston diaphragm having a flexible peripheral portion and a substantially dish-shaped central portion, means for driving said diaphragm at the periphery of its central portion, a horn, a sound chamber between said diaphragm and said horn, and a plug in said sound chamber for decreasing the cross-sectional area of a portion of the sound passage there-through.

5. An acoustic device comprising a diaphragm, a horn, a sound chamber between said diaphragm and said horn, and a plug in said sound chamber, said diaphragm, said plug and a portion of the inner surface of said sound chamber forming two paths for the transmission of sound waves, one of said paths leading from the edge of said diaphragm and the other leading from the center of the vibrating portion of said diaphragm, said two paths merging into one path before the sound passes into the throat of said horn.

6. An acoustic device comprising a diaphragm, a horn, a sound chamber between said diaphragm and said horn, and a plug in said sound chamber, said diaphragm, said plug and a portion of the inner surface of said sound chamber forming two paths for the transmission of sound waves, one of said paths leading from the edge of said diaphragm and the other leading from the center of the vibrating portion of said diaphragm, said two paths merging into one path before the sound passes into the throat of said horn, each of said paths being of gradually increasing area.

7. An acoustic device comprising a diaphragm having a stiffened inner portion and a flexible portion, means for driving the stiffened portion of said diaphragm, a sound chamber at one side of said diaphragm, and a plug in said chamber providing paths of gradually increasing area from the center and periphery of the diaphragm to a point

intermediate the center and the periphery, said paths merging into an annular passage of gradually increasing area.

5 8. An acoustic device comprising a diaphragm having a dish-shaped portion and a flexible portion, means attached to said dish-shaped portion for driving said diaphragm, and means juxtaposed to one face of said diaphragm for directing sound waves from the

center of the diaphragm outwardly and from 10 the outer edge of said diaphragm inwardly to an annular passage, the face of said means conforming substantially to the face of the diaphragm juxtaposed thereto.

In witness whereof, I hereunto subscribe 15 my name this 3d day of August A. D., 1926.

EDWARD C. WENTE.