July 30, 1929. E. C. WENTE 1,722,347

ACOUSTIC APPARATUS

Filed Oct. 20, 1926

Fig. 1

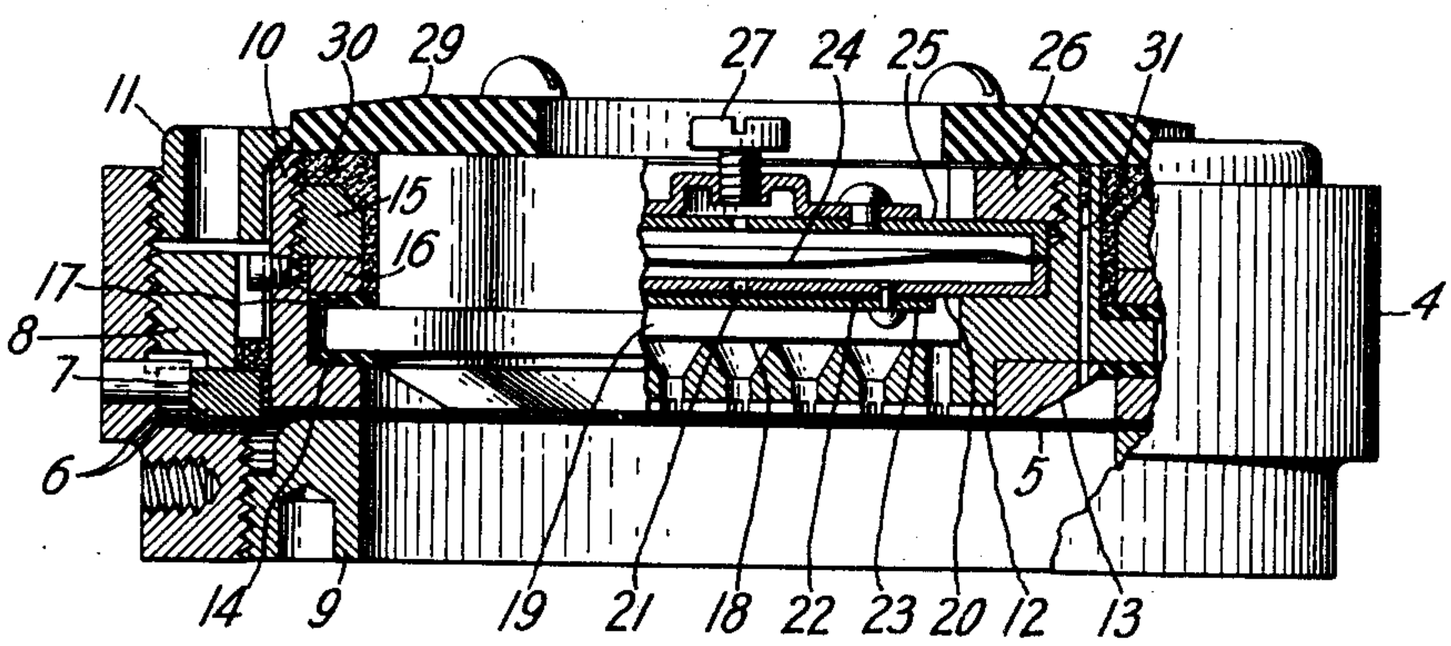


Fig. 2

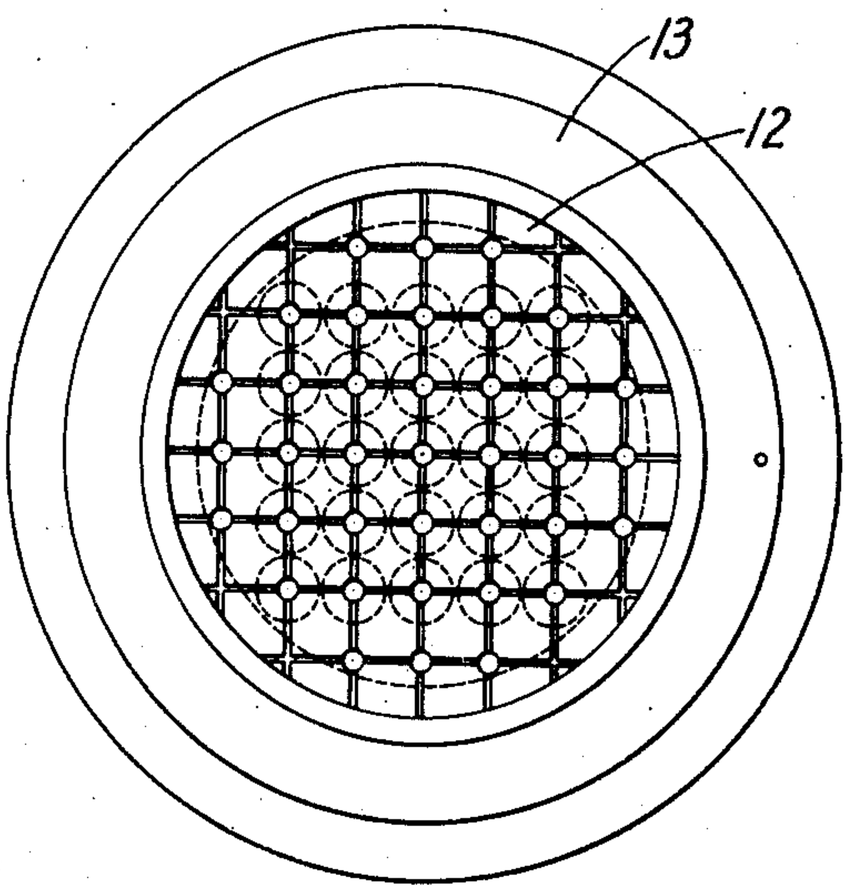
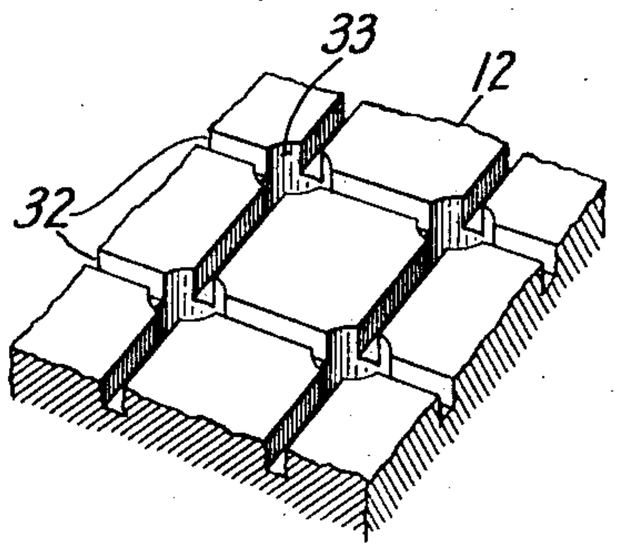


Fig. 3



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UNITED STATES PATENT OFFICE.

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ACOUSTIC APPARATUS.

Application filed October 20, 1926. Serial No. 142,790.

This invention relates to acoustic apparatus and particularly to telephone transmitters.

An object of the invention is to improve the quality of the transmission characteristic of such instruments.

Transmitters of the type to which this invention relates consist essentially of a rigid back plate and a flexible diaphragm mounted in close space relation thereto. In some transmitters the plate serves essentially to damp the motion of the diaphragm while in those of the condenser type it also serves as one electrode. In order to prevent undue damping at the high frequencies produced by friction of the thin layer of air separating the plate and the diaphragm, it has been found desirable to provide grooves in the face of the back plate and to perforate the plate as disclosed and claimed in U. S. Patent No. 1,456,538 granted to I. B. Crandall May 29, 1923. As heretofore constructed these grooves have been found to give resonance effects which in many cases impair the quality of the transmission characteristics of the instrument. It also has heretofore been found desirable to make the transmitter in the form of a gas-tight chamber having a front wall formed by the diaphragm and a rear wall formed by a sheet of flexible material on the opposite side of the perforated back plate for equalizing the pressure within and without the chamber. In addition to equalizing the pressure such a flexible wall also selectively transmits sound waves, which action is undesirable, as it causes the impedance offered to the diaphragm to vary with frequency.

In a preferred embodiment of this invention two chambers are employed. One has its front wall formed by the diaphragm, contains the back plate and includes a small space therebehind. The other has a flexible wall for equalizing the pressure within the chambers with that of the atmosphere without materially displacing the diaphragm, and is connected to the front chamber by an air passage which is opaque to waves of speech and music frequencies. The grooves in the front plate are made in a grid formation to give a maximum air passage with a minimum cutting away of material and are closed at the edges of the plate to prevent resonance in the portion of the chamber surrounding the plate. The chambers are filled with inert gas to prevent corrosion and reduction in pressure due to the consumption of the air within the chamber by the oxidation of the sealing compound.

One type of air passage which has been found very suitable for connecting the chambers consists of a pieces of silk or other fabric held in place by a metallic sheet so that the air can pass through the fabric only in a longitudinal direction under the edges of the metallic sheet.

It should be understood that the various features of this preferred embodiment may be used separately or in subcombinations without departing from the spirit of the invention as defined in the appended claims.

This invention can be more readily understood by reference to the following detailed description in connection with the drawings in which;

Fig. 1 shows an elevation partly in section of a condenser transmitter constructed according to this invention;

Fig. 2 shows the face of the back plate of the transmitter; and

Fig. 3 shows in detail the arrangement of the grooves in the face of the back plate.

There is provided a main frame member 4 in which the remaining parts of the transmitter are mounted. The flexible diaphragm 5 is made of duralium, as disclosed and claimed in Patent No. 1,611,870 to H. A. Anderson, issued Dec. 28, 1926. This diaphragm is clamped between two thin duralium rings 6, against a shoulder of the frame member 4 by means of the rings 7 and 8, the latter of which is screwed in the threads on the inner surface of the frame member 4. The diaphragm 5 is stretched by means of a threaded ring 9 which is screwed into the end of the frame member 4 opposite to that into which the ring 8 is screwed.

The back plate and associated members are assembled on a ring 10, one end of which rests against the diaphragm and the other end of which is clamped in the frame member 4 by means of a threaded ring 11. The back plate consists of a central grooved and perforated portion 12 and an outer ring 13 which is pressed thereover to close the outer ends of the grooves. The details of the grooves, which are best shown in Figs. 2 and 3, will be described hereinafter. The back plate is mounted within the ring 10, being separated therefrom by an insulating washer 14 and

being clamped therein by means of a threaded ring 15, which is clamped against a metallic washer 16 which is in turn separated from the back plate by an insulating washer 17. A piece of silk 18 covers the perforations in the back plate to prevent dust from getting into the space between the diaphragm and the back plate during assembly. The chamber 19 behind the back plate is closed by a metallic plate 20 having a hole 21 in the center thereof. This hole is covered by a piece of silk 22 clamped thereover by a second plate 23. A flexible duralium diaphragm 24 is clamped between the plate 20 and a ring 25 by means of a threaded ring 26 which screws into the threads on the inside of the back plate member 12. A terminal 27 is provided for making connection to the back plate and sealing compound 30 is provided for making the entire assembly gas tight. The edges of the rear diaphragm 24 are also painted with sealing compound before assembly. A back insulating plate 29 is secured to the ring 26 to enclose the insulated parts. Before the insulating plate 29 is put in place, the air behind the diaphragm 5 is pumped out through a hole 31 extending through the members 12 and 13, the space is filled with an inert gas such as nitrogen and the outer end of the hole 31 is sealed.

As shown in Figs. 2 and 3 the grooves 32 in the face of the back plate are arranged in grid formation being formed by straight grooves at right angles to one another, and holes 33 are bored through the plate at the intersection of the grooves. These holes are tapered to reduce the resonant effects which they tend to introduce. In order to prevent resonant effects which might be produced if the grooves communicated with the portion of chamber surrounding the back plate, the outer ends of the grooves are closed by the annular plate 13.

The rear diaphragm 24 is provided to equalize the pressure in the chamber 19, behind the main diaphragm 5, with that of the atmosphere to prevent material displacements of the main diaphragm due to changes in the atmospheric pressure. The only gas passage from the rear chamber, which is closed by the diaphragm 24, to the chamber 19 is through the hole 21 and longitudinally through the silk 22 so that no waves of speech or music frequencies can be transmitted between the chamber 19 and the diaphragm 24 while gas may slowly pass from one chamber to the other to equalize the pressure.

What is claimed is:

1. An acoustic device comprising a rigid plate, a flexible diaphragm in front of said plate, a chamber containing said plate, a second chamber, an air passage substantially opaque to waves of speech and music frequencies connecting said chambers, and a flexible wall for said second chamber.

2. An acoustic device according to the preceding claim in which the air passage comprises a piece of fabric and a solid plate mounted over said fabric whereby the air must pass longitudinally through said fabric.

3. An acoustic device comprising a pair of chambers air tight with respect to the surrounding atmosphere, an air passage substantially opaque to waves of speech and music frequencies connecting said chambers, a rigid plate in one of said chambers, a flexible acoustic diaphragm in close space relation to said plate and forming a wall of said chamber, and a flexible wall for the other of said chambers whereby the pressure within said chambers is equalized with that of the atmosphere without materially displacing said diaphragm.

4. An acoustic device comprising a rigid plate, a flexible diaphragm in front of said plate, a chamber having a wall formed by said diaphragm, and inert gas substantially filling said chamber.

5. An acoustic device comprising a diaphragm and a back plate in close space relation thereto, having grooves in the face thereof arranged in a grid pattern and perforations at the intersections of the grooves.

6. An acoustic device comprising a diaphragm, a rigid plate in close space relation thereto having grooves therein on one side of said plate, said grooves being closed at their outer ends.

7. An acoustic device comprising a flexible diaphragm, a rigid grooved plate in close space relation thereto, and means closing said grooves at the edge of the plate.

8. An acoustic device comprising a stretched metallic diaphragm and a back plate mounted in close space relation thereto and having grooves in the face thereof arranged in a grid pattern to prevent undue damping at the higher frequencies of the speech and music range.

9. An acoustic device according to the preceding claim in which the grooves are closed at the edge of the plate.

10. A transmitter comprising a stretched metallic diaphragm, a rigid back plate mounted in close space relation thereto, having grooves in the face thereof arranged in a grid pattern and perforations at the intersections of the grooves, means for closing said grooves at their outer ends, a chamber containing said back plate, a second chamber, an air passage substantially opaque to waves of speech and music frequencies connecting said chambers, and a flexible wall for said second chamber.

11. A transmitter comprising a member adapted to be vibrated by speech or music, a perforated rigid plate adjacent said member, a pair of chambers on one side of said plate, one of said chambers having a flexible wall, said chambers having a wall between them

comprising two plates, one of which has an opening therein and a fabric member between said plates.

12. A transmitter comprising a vibratable member, a plurality of chambers on one side of said member, one of which is expansible, a filling of gas in one of said chambers, and a passage between said chambers which is opaque to the passage of waves of speech or music frequencies from one chamber to another but which will permit the passage of gas from one chamber to another to equalize the pressure in the chambers.

In witness whereof, I hereunto subscribe my name this 19th day of October, A. D. 1926.

EDWARD C. WENTE.