May 24, 1932. R. VERMEULEN 1,859,758

LOUD SPEAKER

Filed Oct. 20, 1926

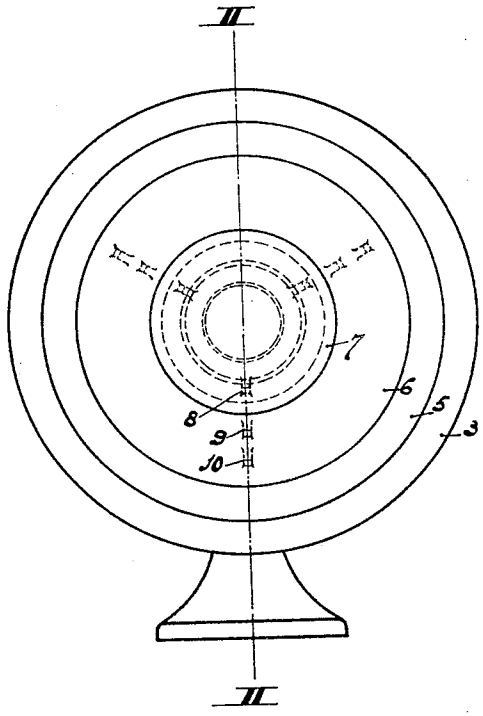

Fig. 1.

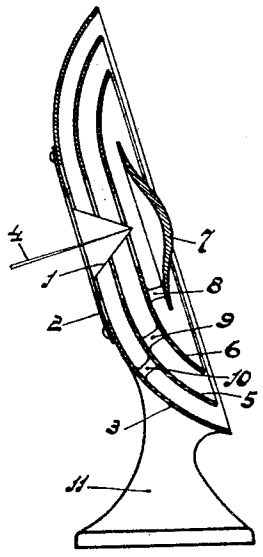

Fig. 2.

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UNITED STATES PATENT OFFICE

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LOUD SPEAKER

Application filed October 20, 1926, Serial No. 142,847, and in the Netherlands October 21, 1925.

This invention relates to apparatus of the kind used in wireless telephony, for converting electrical into mechanical vibrations. With the commonest construction of such apparatus which hereinafter will be referred to as "loudspeakers", there are provided a magnet and a diaphragm the latter of which, due to the vibrating motion imparted thereto by the magnet, causes a column of air to vibrate. This diaphragm may consist of a magnetic substance so that it can be set in vibration directly by the magnet. Also, the diaphragm may consist of a non-magnetic material, an armature being secured in that case on the said diaphragm. In both cases it is of very great importance to mount the diaphragm in such a manner that it is exactly centered relatively to the magnet and that it can freely vibrate towards both sides. According to the invention, very good results are ensured by stretching the diaphragm in a rigid frame by means of a yielding substance which is secured to the edge of the diaphragm.

When the diaphragm vibrates, sound waves are produced both before and behind the diaphragm. When the free path between the fore- and the real-side of the frame is too small, compressions and rarefactions of the air will weaken each other when their periods surpass a determined value, due to which, in general, low tones are lost. This drawback has been eliminated by arranging a kind of screen between the fore- and the real-side of the diaphragm. This screen may be differently shaped. According to the invention a very good tone production is ensured by giving it the shape of a bowl or dish. When using the screen, it is necessary that the yielding substance should entirely shut the annular aperture between the diaphragm and the screen; when such is not the case, there is a direct free path between the fore- and the rear-side of the diaphragm and the screen loses its special action.

In a construction according to the invention, the diaphragm is given the shape of a cone the apex of which extends into the concave portion of the dish-shaped screen. According to the invention in order to ensure a good tone production during the vibration of the diaphragm, there are arranged in the concave portion of the screen one or more dish-shaped bodies which together with the screen form acoustic chambers. The term "acoustic chambers" must be understood to mean spaces so shaped that the sound waves produced therein have the opportunity to emanate as favourably as possible in a determined direction so that in that direction they are most distinctly heard. Known examples of such chambers are the shapes of a funnel and a horn.

An embodiment of the invention is illustrated in the accompanying drawings in which

Figure 1 is an elevation of a loudspeaker according to the invention and

Figure 2 is a section taken on the line II—II in Figure 1.

In the drawings, a cone-shaped diaphragm 1 is secured to a dish-shaped body 3 by means of a yielding substance 2 for example leather, rubber or a similar material, the diaphragm being built up of a non-magnetic material, for example, of paper or cardboard. The diaphragm is set in vibration by a style 4 which is moved by a magnet not shown in the drawings. Owing to the conical shape of the diaphragm 1 the sound waves emanate sideways. In order to ensure a satisfactory tone production, dish-shaped bodies 5, 6 and 7 are arranged in the concave portion of the body 3 so as to form with each other acoustic chambers. These various bodies are secured by means of ridges 8, 9 and 10 to the body 3 which is supported by a foot 11 and which is preferably given a sloping position.

What I claim is:—

1. A loudspeaker comprising a diaphragm and a plurality of acoustic chambers in front of said diaphragm and immediately adjacent thereto, each of said chambers having a separate opening to the free air.

2. A loudspeaker comprising a conical diaphragm and a plurality of acoustic chambers, the said diaphragm extending into the said chambers.

3. A loudspeaker comprising a conical

diaphragm, a plurality of spaced dish-shaped members arranged about the axis of the cone of the diaphragm, the spaces between the said dish-shaped members serving as acoustic chambers, and a reflector placed within the concave portion of the outermost dish-shaped member.

4. A loudspeaker comprising a conical, non-magnetic diaphragm, a plurality of concave members arranged about the axis of the cone of the diaphragm, the said members being apertured and the said cone extending through the apertures, the said members being spaced from each other to provide air pockets which serve as acoustic chambers, and a reflector placed within the outermost concave member and over the aperture of said outermost concave member.

5. A loudspeaker comprising a diaphragm, and a plurality of acoustic chambers, at least a portion of said diaphragm extending into each of said acoustic chambers.

6. A device of the class described comprising a conical diaphragm, the axis of the cone being tilted upwardly, and a plurality of air chambers arranged about the axis of the cone.

7. A device of the character described comprising a plurality of acoustic chambers, a diaphragm positioned in a wall of one of said chambers for setting up sound vibrations therein, an opening from each of said chambers to the free air, and an additional opening in each chamber to an adjacent chamber.

8. A loudspeaker comprising a conical diaphragm, a dish-shaped frame for supporting said diaphragm, and a reflector positioned within said dish-shaped frame.

9. A loudspeaker comprising a diaphragm, a concave frame support for said diaphragm, and a convex reflector positioned within said concave frame.

10. A loudspeaker comprising a base, a conical diaphragm, a concave frame, and a convex reflector, the diaphragm, the frame, and the reflector being arranged about the same axis and in operative relationship to each other.

11. An acoustic device comprising a rigid concave frame, a diaphragm supported by said frame and a plurality of dish-shaped bodies arranged in the concave portion of said frame for forming a plurality of acoustic chambers.

12. An acoustic device comprising a concave frame, a diaphragm supported in the central portion of said frame, a plurality of dish-shaped bodies positioned in the concave portion of said frame and a convex body positioned within one of said dish-shaped bodies, said dish-shaped bodies forming with said concave frame and said convex body a plurality of acoustic chambers.

13. An acoustic device comprising a frame, a vibratile surface, yielding means connected between said frame and said vibratile surface, said yielding means being placed under tension for stretching said vibratile surface in said frame, and means for causing vibration of said vibratile surface.

14. An acoustic device comprising a vibratile diaphragm, and a dish shaped screen surrounding said diaphragm for materially increasing the length of the path of the sound waves between the front and the rear of the diaphragm.

In testimony whereof I affix my signature at the city of Eindhoven, this 21st day of September, 1926.

ROELOF VERMEULEN.