July 5, 1932. I. WOLFF 1,865,735

SOUND REPRODUCER

Filed April 1, 1929

Fig. 1

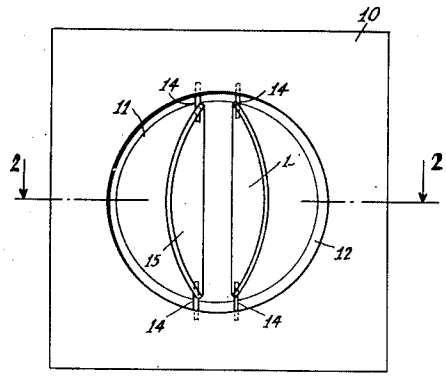


Fig. 3

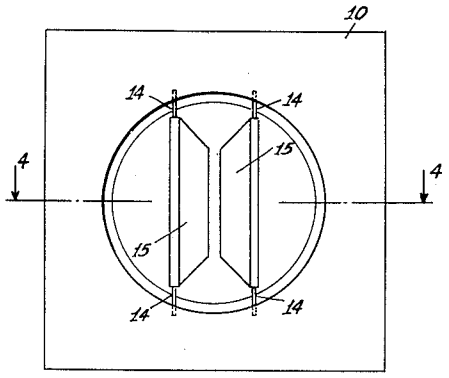


Fig. 2

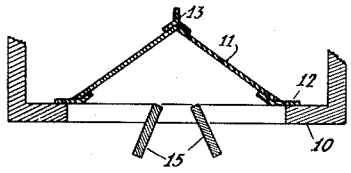


Fig. 4

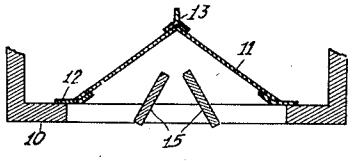
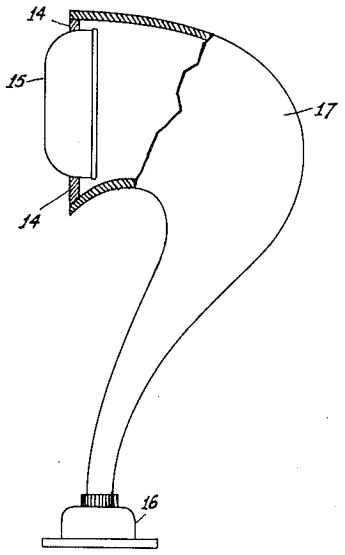


Fig. 5



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By his Attorney

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UNITED STATES PATENT OFFICE

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SOUND REPRODUCER

Application filed April 1, 1929. Serial No. 351,597.

This invention relates to sound reproducers such as loudspeakers of either the horn or cone type. More particularly this invention relates to means for diffusing or deflecting the sound waves radiated from the loudspeaker so that a more uniform response is obtained therefrom.

When a vibrating element, such as a diaphragm which radiates directly to the open air, is small in comparison with the wave length of the sound being radiated, the sound waves which are set up by the diaphragm are propagated spherically therefrom. On the other hand, when the radiating surface becomes comparable with or larger than the wave length of the sound waves being radiated, the wave propagation is substantially perpendicular to the effective moving surface and for a considerable distance from the surface, the propagation takes the form of a beam which does not spread or diffuse appreciably.

In the cone type of loudspeaker now used, the diaphragm is of such a size that the high frequency sound waves radiated therefrom are propagated substantially in a beam whereas the low frequency sound waves are propagated substantially spherically. As a result, there is an excess of high frequencies directly in front of the loudspeaker and an insufficiency of high frequencies or an excess of low frequencies to the sides of the loudspeaker. This results in an uneven response throughout the room in which the loudspeaker is located, with a predomination of either high or low frequencies according to the position of the listener relative to the speaker. The same objection is found in the horn type of loudspeaker in which the mouth of the horn has substantially the same dimensions as the diaphragm of the cone in a cone type of loudspeaker.

It is the object of this invention to provide means for obtaining a more uniform response from sound reproducers or loudspeakers of the types described, and to affect the sound waves radiated therefrom so that the proportion of high and low frequencies will depend entirely upon the sound being reproduced and not upon the relative position of the listener with respect to the sound reproducer. This object is attained according to a preferred form of the invention by positioning a plurality of deflectors in the path of the high frequency sound wave beam, preferably immediately adjacent the cone diaphragm in one case and the mouth of the horn in the other case.

For a more complete disclosure of the invention reference should be made to the following specification which should be read in connection with the accompanying drawing in which

Figure 1 is a front view of a cone type of loudspeaker to which my invention has been added;

Figure 2 is a section on line 2—2 of Figure 1;

Figure 3 is a view similar to Figure 1 in which a slightly different modification of my invention is employed;

Figure 4 is a section on line 4—4 of Figure 3; and

Figure 5 is a view, partly in section, of a horn type of loudspeaker to which my invention has been added.

Referring to the figures, reference character 10 indicates a supporting member, such as the front of a cabinet or a baffle board, to which is fastened a sound reproducer of the type that radiates directly to the open air. The vibrating member 11 which is shown as a conical diaphragm, is connected to the supporting member 10 by any suitable means such as a strip of flexible material 12. The driving force is applied to the diaphragm in any well known manner such as by means of a rod 13 connected to its apex. It is not necessary, according to the invention, that the diaphragm be conical in shape as any other form of diaphragm which is adapted to radiate directly to the open air will act in the same way.

It is to be understood that the diaphragm 11 is of such a size that the low frequency sound waves are propagated spherically therefrom and that the high frequency sound waves are propagated therefrom substantially in the form of a beam. This beam is perpendicular to the effective moving surface, or,

in the modifications shown, substantially perpendicular to the plane of the supporting member 10. It is not absolutely necessary for the plane of the supporting member to be substantially parallel with the effective moving surface of the vibrating member but this condition will be found to exist in practically all of the sound reproducers employing a conical diaphragm.

My invention is applied to a sound reproducer of this type by positioning a pair of deflecting members 15 in the path of the high frequency beam preferably adjacent the vibrating member. In an approved form of the invention, the deflectors 15 are maintained in position by pins 14 which are set in the deflectors 15 and are pivotally mounted in the supporting member 10. By using such a mounting, the deflectors can be manually set at any desired angle with the supporting member.

The deflectors may be of any desired shape or size as long as they are sufficiently large to break up the beam of high frequency sound waves and they may be made of wood, metal or any other sound reflecting material. It is preferable, however, that the surface of the deflectors be relatively smooth.

They may be positioned to form any desired angle with the plane of the supporting member and with each other. It has been found that when the deflectors form approximately 45° angles with each other that good results are obtained. However, the angle at which the deflectors should be positioned to obtain the best results may be found to vary according to the room or enclosure in which the loudspeaker is located and in actual operation the angle of the deflectors should be varied, so as to obtain the best results for that particular room. In some cases it may be found desirable to arrange the deflectors substantially parallel with each other but forming a desired angle with the supporting member so that the high frequency beam is deflected in a desired direction instead of being diffused generally throughout the room in which the sound reproducer is located.

In the modification illustrated by Figures 1 and 2 the deflectors are positioned to extend out past the plane of the supporting member 10, and, if desired, the deflectors may be made of such a size that they can be moved to close the entire opening in the supporting member when the sound reproducer is not in use. In such a case the deflectors can be used as a form of volume control by nearly closing the opening when it is desired to decrease the volume of the sound without making an adjustment to the radio receiver or phonograph to which the sound reproducer is connected.

In the modification illustrated by Figures 3 and 4 the deflectors are positioned so as to extend into the cone diaphragm. Due to this arrangement the shape and size of the deflectors are limited by the diameter and the depth of the cone and the angle which the deflectors can form with the plane of the supporting member is also limited. However, this modification has an advantage over the modification illustrated in Figures 1 and 2 of not having the deflectors protruding past the plane of the supporting member.

By properly designing and positioning the deflectors the high frequency beam can be diffused so as to attain uniform response throughout the room in which the sound reproducer is located, or, if desired, the high frequency beam can be deflected toward some particular spot so as to get a desired response at that spot.

In Figure 5 a loudspeaker 16 having a horn 17 is provided with deflectors 15 according to my invention. In this arrangement the pins 14 are set in the horn adjacent its mouth instead of in a separate supporting member as in Figures 1 to 4. The deflectors 15 function the same as when used with a cone type of loudspeaker.

It is to be understood that various other arrangements may be provided for attaining the objects of my invention and accordingly I do not desire to be limited by the modifications shown but only by the scope of the appended claims.

I claim:

1. A sound reproducer comprising means for radiating sound waves to the open air and means positioned adjacent the first mentioned means and interposed in the path of said sound waves for diffusing said sound waves, said means having deflecting surfaces lying in different, nonparallel planes.

2. A sound reproducer including a diaphragm adapted to radiate directly to the open air, said diaphragm being of such a size that the low frequency sound waves are radiated spherically and the high frequency sound waves are radiated substantially as a beam, and means positioned adjacent said diaphragm and interposed in the path of said beam of said high frequency sound waves for diffusing the same.

3. A loudspeaker including a diaphragm adapted to radiate directly to the open air and a plurality of deflectors positioned to diffuse the sound waves radiated from said diaphragm.

4. A sound reproducer comprising means for radiating sound waves to the open air, and a plurality of members positioned to diffuse said sound waves by deflecting them in different directions, said members having deflecting surfaces arranged so that their planes intersect.

5. A sound reproducer comprising a diaphragm adapted to radiate directly to the open air and a plurality of deflecting members positioned in front of said diaphragm and arranged at different angles to the plane of said diaphragm.

6. A sound reproducer comprising, a supporting member, a diaphragm connected to said supporting member and a plurality of deflecting members supported by said supporting member in front of said diaphragm.

7. A sound reproducer comprising, a supporting member, an opening in said supporting member, a diaphragm of the type adapted to radiate directly to the open air connected to said supporting member adjacent said opening, and a plurality of deflecting members positioned in said opening and pivotally mounted in said supporting member to form a desired angle smaller than a straight angle with each other.

8. A sound reproducer comprising a supporting member, an opening in said supporting member, a diaphragm connected to said supporting member and positioned adjacent said opening, and a pair of deflecting members pivoted to said supporting member in said opening, said deflecting members being arranged to form approximately 45° angles with each other.

9. A sound reproducer comprising a conical diaphragm adapted to radiate sound waves directly to the open air, and means positioned immediately adjacent said diaphragm and interposed in the path of the sound waves set up by said diaphragm to diffuse said sound waves, said means consisting of a plurality of plane surfaces arranged to form angles with each other.

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