Dec. 23, 1930. I. WOLFF 1,786,279

REFLECTOR

Filed March 31, 1927

Fig. 1

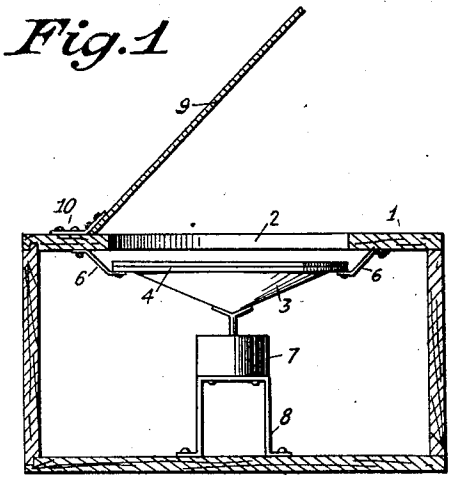


Fig. 3

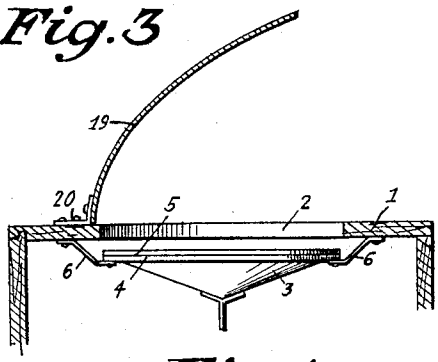


Fig. 4

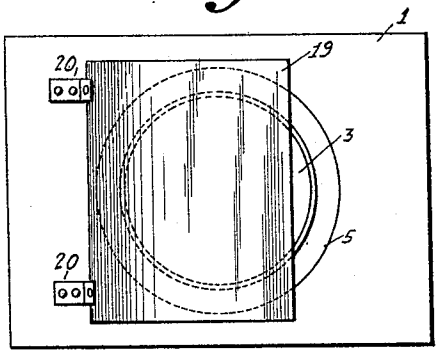


Fig. 2

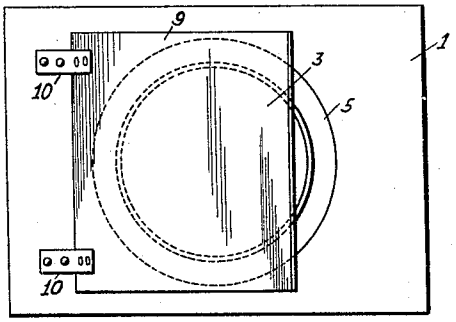


Fig. 6

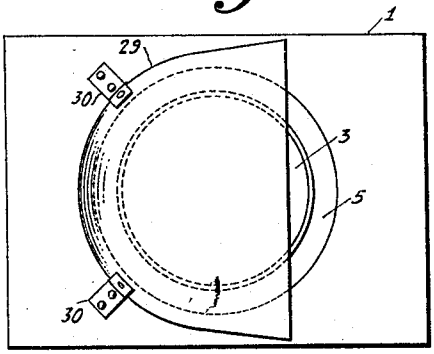
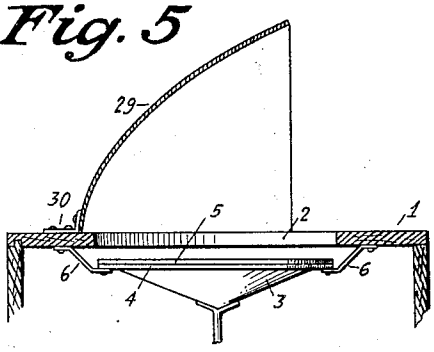


Fig. 5



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UNITED STATES PATENT OFFICE

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REFLECTOR

Application filed March 31, 1927. Serial No. 179,744.

The invention concerns acoustic devices of the type generally known as loud speakers and has for its principal object to provide a sound reflector in connection with such a device

A more specific object of the invention is to provide a sound reflector in combination with a loud speaker for reflecting the sound waves therefrom in order to modify the direction of the sound or to decrease or amplify certain frequency ranges.

In the construction of loud speakers it is often necessary for structural purposes or other reasons to so locate the sound emitting element that the direction of maximum sound intensity or of more nearly perfect transmission is not in the direction of the audience. It may be necessary for example to locate the vibratile element so that the sound waves emitted from it will be directed in a vertical direction whereas the listener usually will be located in a horizontal direction from the loud speaker. It is known that the low frequency waves will extend with a substantially equal intensity in all directions, that is there is a tendency for the low frequency waves to change their direction of propagation readily or in other words, to spread out in all directions. The high frequency sound waves, however, have a tendency to persist only in the direction in which they start. The high frequency waves, in other words, instead of spreading out in all directions have more or less the form of a beam which in the case of a loud speaker extends directly away from it. It is obvious, therefore, that if the vibratile element were placed horizontally that the low frequency tones would probably be of sufficient intensity in all directions but the high frequency tones would extend directly upward and would have little effect in the horizontal direction in the loud speaker. The resulting sound, therefore, would have its high frequency components weakened so that the speech or music being produced would not correspond at all to that originally causing the vibration of the vibratile element. I propose to overcome this defect by providing a sound reflector in proximity to the vibratile element so that the high frequency waves will be directed from their original path into the direction which it is desirable that the sound from the loud speaker be heard.

The invention further contemplates the use of a reflector in connection with a loud speaker to amplify certain frequency ranges of the loud speaker or to decrease certain frequency ranges. It is well known that the usual sound emitting device has several frequency ranges that are unduly accentuated with respect to the others resulting in distortion of the original sound. On the other hand the element may respond very poorly to certain frequencies within its operating range resulting in a decided dip in its response curve. By the use of a reflector of suitable construction and material it is possible to strengthen or decrease as desired the intensity of the sound of particular frequency ranges. This may be done by so placing the vibratile element that it vibrates in a direction different from that in which it is desired that the sound be heard and then providing a reflector which will reflect the sound waves into the desired direction. By suitably choosing the reflector it can be made to reflect some frequencies and absorb others from which it will result that the sound after it leaves the reflector will have certain frequencies of substantially the same intensity as they left the vibratile element and others will be decreased in intensity. In this manner a more uniform response over the entire frequency range of the vibratile element may be obtained.

A more particular use of the reflector occurs where a vibratile element is used having a rise in its characteristic curve within the low frequency range. It is well known that the diaphragm or other vibratile element emits sound waves from its two sides simultaneously and these waves are directly out of phase with each other. This effect is of no importance with respect to the high frequencies as they tend to persist in their original direction and the wave length is too short to give interference but the low frequency waves tend to spread out in all directions and if no means were taken to prevent it those

leaving the rear face of the vibratile element would pass around to the area in front of it and lessen the intensity of the waves emitted from the front face by interference. It is proposed in the present invention to make use of these interference effects and even in certain cases accentuate them. This may be done by placing a reflector in proximity to the rear face of the element so that the low frequency waves emanated therefrom will be reflected into the area in front of the vibratory element where they will interfere with the low frequency waves emanating from the front face. This will have the effect of course of cutting down the intensity of the low frequency waves emitted by the vibratile element and thereby causing it to give a more uniform response throughout its range.

The invention will be more clearly understood from the following detailed description which should be read in connection with the accompanying drawings in which:

Figure 1 shows a view partly in section of a horizontally disposed cone type loud speaker having a reflector conforming to the invention.

Figure 2 shows a top plan view of the device in Figure 1.

Figures 3 and 4 show sectional and plan views respectively of a modification of the device shown in Figures 1 and 2.

Figures 5 and 6 show sectional and plan views of a further modification of the device.

The device shown in Figure 1 comprises a casing 1, including a loud speaker mechanism consisting of a cone 3 supported by clamping rings 4 and 5 which are attached to the casing 1 by means of brackets 6. The cone 3 is caused to vibrate by the operating mechanism 7 supported by bracket 8. The operating mechanism 7 may be of any desired type and the cone 3 may be replaced by a diaphragm or other vibratory element if desired. The casing 1 is provided with an aperture 2 directly in front of the cone 3 to permit the sounds emitted from the cone to reach the area outside of the casing. The reflector 9 shown in this figure consists of a flat plate extending at an angle of about 45° to the horizontal in front of the aperture 2. The size of the reflector is substantially equal to the size of the vibrating element such as the cone 3. The exact dimensions of the reflector are not important for the purposes of the present invention, it merely being necessary that the reflector is of such a size that its projection upon the plane of the base of the diaphragm substantially covers such diaphragm. This structure insures a proper deflection of the desired frequencies. The reflector 9 is held in place by the brackets 10 attached to the casing 1. It will be recognized that in this case the sound from the cone 3 is directed upwardly and although the low frequencies would spread out in all directions the high frequencies would be in the form of a beam extending upwardly from the cone and would not be heard to any great extent in horizontal direction. The reflector 9 serves to reflect the high frequencies so that they will be diverted from their vertical path to a horizontal one extending to the right from which it results that with a proper choice of material, size and angle of the reflector substantially undistorted sounds of desirable intensity would be heard in a horizontal direction to the right in the loud speaker as shown in Figure 1.

Figures 3 and 4 are substantially similar to Figures 1 and 2 except that a different form of reflector is used. In this case the reflector 19, fastened to the casing 1 by the angles 20. has an elliptical cross section. This type of reflector may be used to concentrate the flow of energy in the direction of the listener.

A further modification is shown in Figures 5 and 6 in which the reflector 29, fastened to the casing 1 by the angles 30, is in the form of an ellipsoid. This type will give more concentration of energy in a limited area than the other types. It will be understood of course, that reflectors of any curvature horizontally or vertically can be used to obtain the results required in any particular case.

While I have disclosed my invention in connection with certain modifications, it is clear that it is capable of many other adaptations which will readily occur to those skilled in the art and desire to be limited therefore only as indicated by the scope of the following claims.

I claim as my invention:

1. In combination a sound producing device of the cone type and reflecting means comprising a member having an elliptical cross section associated therewith for modifying the direction of the sound waves emitted therefrom.

2. In combination a sound producing device of the cone type and an elliptical reflector associated therewith for reflecting the sound waves emitted therefrom.

3. In combination a loud speaker comprising a vibratile element of the tone type and means for reflecting the sound waves emitted from said element in a direction at an angle to their original direction, said means comprising a member having a surface of an ellipsoid of revolution.

4. In combination, a loudspeaker device comprising a vibratile element, a casing enclosing said element on all sides except one, said casing having an opening in said one side, and a reflector monted over said opening and joined to said casing adjacent to an edge of said opening.

5. A loudspeaker device comprising in combination, a vibratile diaphragm, means

to actuate said diaphragm, a casing enclosing said means and said diaphragm, said casing having an opening substantially the same shape as said diaphragm, and a reflector mounted adjacent to said opening and angularly disposed with respect to the plane of said diaphragm.

6. In combination, a loudspeaker device having a vibratile element, and an ellipsoidally shaped reflector mounted adjacent to said element.

7. The combination of an acoustic device and an elliptical reflector associated therewith.

8. The combination of an acoustic device and a reflector therefor, said reflector having a surface at least a part of which is an ellipsoid of revolution.

9. The combination of means forming a reflecting surface having the form of an ellipsoid of revolution and an acoustic device positioned substantially at the focal point of said ellipsoid.

IRVING WOLFF.