Nov. 8, 1938. A. PFISTER 2,135,840

SOUND PROPAGATING DEVICE

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Fig. 1.

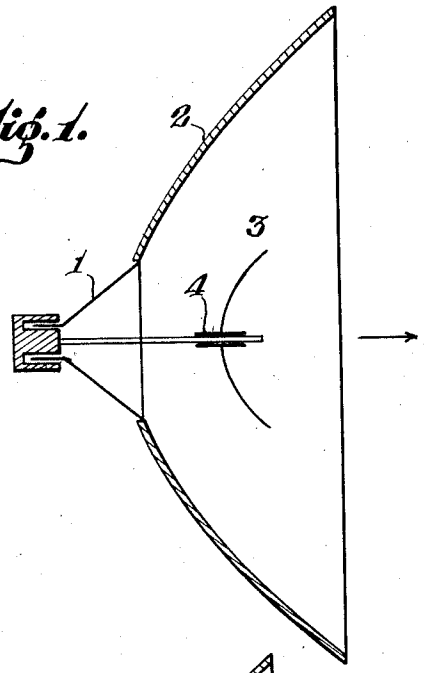
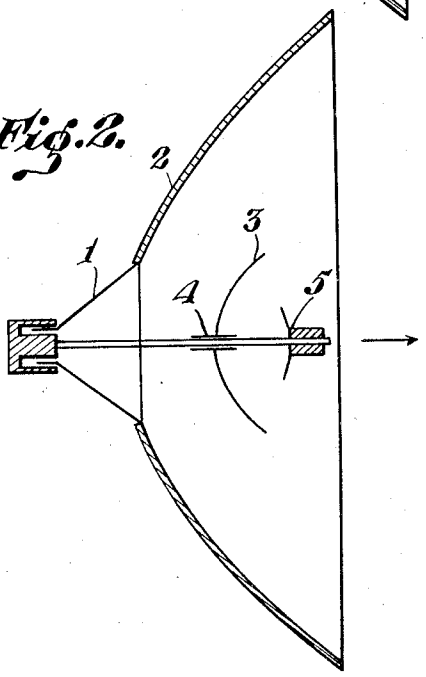


Fig. 2.



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SOUND PROPAGATING DEVICE

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4 Claims. (Cl. 181—31)

This invention relates to sound propagating devices and has for an object the provision of a device capable of radiating the high and low frequency tones in a realistic manner and diffused over a substantial angle to the axis of the device.

Efforts to obtain a true and realistic reproduction of sounds having a substantial frequency range have heretofore been confined largely to improvements in the tonal response of the propagating device. This has been achieved, for example, by means of a plurality of reproducers so designed and proportioned that each unit responds to a comparatively narrow portion of the sound spectrum. In unison, such units may extend their response over practically the entire range of audible frequencies. Such systems, however, have been unsatisfactory because of the peculiar directive properties of the higher frequency tones by reason of which they tend to be propagated in the form of a beam about the axis of the propagating device. This characteristic is inherent in any known type of propagator which may be employed.

Recognizing the availability of reproducers, especially of the dynamic type, which are capable of responding over substantially the entire audible spectrum, the present invention provides a method and means for effecting a uniform distribution of all of the emitted frequencies over a desired angle of radiation and without regard to the number of propagating devices employed.

The invention also consists in the various combinations of parts and details of construction hereinafter more fully set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the broader aspects of the invention may be better understood by referring to the following description taken in connection with the accompanying drawing in which certain preferred embodiments thereof are set forth for purposes of illustration.

In the drawing:

Fig. 1 is a diagrammatic sectional view of a sound propagator embodying the present invention; and

Fig. 2 is a similar view illustrating a different embodiment of the invention.

In the following description and in the claims certain specific terms are used for convenience in referring to various details of the invention. It is to be understood, however, that these terms are to be given as broad an interpretation as the state of the art will permit.

Referring more particularly to Fig. 1, the invention is shown as applied to a loud speaker diaphragm 1 of any standard type such, for example, as the diaphragm of a dynamic speaker which is capable of emitting sounds over the entire audible spectrum with equal intensity. While the response characteristics of the diaphragm 1 are assumed to be satisfactory for the different tonal frequencies of the audible spectrum, nevertheless, it is subject to the disadvantage that the higher frequencies are radiated in a beam more or less concentrated about the axis of the speaker and are not diffused equally with the lower frequencies. This difficulty is avoided in acordance with the present invention by providing a baffle reflector 2 which surrounds the diaphragm 1 of the speaker and is formed with a central opening in which the speaker diaphragm is inserted. The baffle reflector 2 is preferably made in the form of a paraboloid of revolution with its axis coinciding with the axis of the diaphragm 1 and its focus extending in the direction of sound propagation.

A second reflector 3 is mounted concentric with the first reflector and is adjustably mounted as on a carriage 4 for movement along the axis thereof. The second reflector 3 is also preferably formed as a paraboloid of revolution, is substantially smaller than the first reflector 2, and also faces in the direction of sound propagation.

The operation of the speaker may be best understood by considering the audible frequency spectrum as divided at about 1000 cycles into a lower and upper band. The lower band is radiated in the direction of the arrow from an angle largely determined by the opening in the baffle reflector 2. Reflector 3 offers no substantial impediment to these frequencies due to the fact that they are capable of bending around the edges of the reflector 3. The lower frequencies are, accordingly diffused over the entire angle of propagation and are suitably distributed in space. The upper band, however, is increasingly concentrated in a beam around the axis of propagation as the higher frequencies are approached, thereby tending to distort the sound pattern for any position removed from the axis of propagation. The upper band, however, impinges upon the second reflector 3 and is reflected thereby on to the first baffle reflector 2 by which it is again reflected and diffused outwardly in the direction of sound propagation. The reflector 3 is preferably set at a distance from the apex of the speaker less than the focal length of the baffle reflector 2, the particular point being determined by adjustment so that the various frequencies are reflected on to the baffle reflector 2 at an angle such that they will be re-radiated by said reflector over substantially the same angle as the low frequency band. The upper frequencies are thus reflected and diffused and are so combined with the lower frequencies that realism is pro-

duced over the entire angle of propagation of the device.

A means for further increasing the volume and range of the upper frequency band is illustrated in Fig. 2. In this figure the various parts above described are identical with those in Fig. 1 and have been given the same reference characters.

In Fig. 2, however, a second sound reproducing device **5** is mounted at substantially the focus of the second reflector **3** and is adjustable along the axis thereof. The second sound reproducing device **5** is preferably responsive to the higher frequencies and is so positioned that these frequencies are reflected by the second reflector **3** and diffused with the sound waves produced by the first reproducer. Although the adjustment of the second reproducer **5** with respect to the second reflector **3** permits a wide range in the control of the angular distribution of the reflected sound, an optimum response is usually obtained when the angle of reflection of the baffle reflector **2** equals that of the second reflector **3**.

This invention is particularly useful where faithfulness of reproduction over a substantial angle of distribution is required as, for example, in theatre reproduction and radio broadcasting and in such cases may eliminate the necessity for using a plurality of speakers facing in different directions. The reproducer and its components are not limited to any particular size, angle of radiation or material of construction, all of which may be varied in accordance with the requirements of any particular case. Obviously, the baffle reflector **2** and the second reflector **3** should be formed and mounted so as to be substantially free from vibration.

Although certain specific embodiments of the invention have been disclosed for purposes of illustration, the invention is not to be limited thereto, but is only to be limited in accordance with the scope of the following claims when interpreted in view of the prior art.

What I claim is:

1. A sound propagating device comprising a first sound reproducer, a first paraboloid reflector surrounding said reproducer to control the angle of propagation of the sound waves produced thereby, a second reflector disposed in the path of the more concentrated sound waves and shaped to reflect and diffuse the same over substantially the entire area of said first reflector and a second reproducer responsive to the upper portions of the audible spectrum, said second reproducer being positioned at about the focal axis of the second reflector and being adapted to direct the higher frequencies toward said second reflector whereby they are diffused over the area corresponding to the diffusion of the low frequency waves by said first reflector for distributing and reinforcing the waves in the higher frequency portion of the sound spectrum.

2. In a sound reproducing device, a dynamic speaker having a cone shaped diaphragm for producing compressional waves of equal intensity over the entire audible spectrum and radiating the higher frequencies in a beam concentrated about the axis of the speaker to a greater extent than the lower frequencies, a first reflector surrounding said diaphragm, said first reflector being bowl shaped and facing in the direction of wave propagation to diffuse and radiate the lower frequencies of the audible spectrum over a substantial angle of radiation, a second reflector smaller than said first reflector and concentric therewith, said second reflector being positioned to intercept only the higher frequencies which are propagated by the diaphragm as a concentrated beam and to permit propagation of the lower frequencies around the edges thereof without substantial change in direction, said second reflector being bowl shaped with its convex side toward said first reflector and being positioned to reflect said higher frequencies onto parts of said first reflector beyond the edges of said second reflector and to diffuse the same over the surface of said first reflector in a position to be reflected and re-radiated thereby over substantially the same angle of dispersion as the lower frequencies.

3. In a sound reproducing device, a dynamic speaker having a cone shaped diaphragm for producing compressional waves of equal intensity over the entire audible spectrum and radiating the higher frequencies in a beam concentrated about the axis of the speaker to a greater extent than the lower frequencies, a first reflector in the form of a paraboloid of revolution surrounding said diaphragm and facing in the direction of wave propagation to diffuse and radiate the lower frequencies of the audible spectrum over a substantial angle of radiation, a second similar reflector smaller than said first reflector and concentric therewith, said second reflector being positioned to intercept only the higher frequencies which are propagated by the diaphragm as a concentrated beam and to permit propagation of the lower frequencies around the edges thereof without substantial change in direction, said second reflector having its convex side toward said first reflector and being positioned to reflect said higher frequencies onto parts of said first reflector beyond the edges of said second reflector and to diffuse the same over the surface of said first reflector in a position to be reflected and re-radiated thereby over substantially the same angle of dispersion as the lower frequencies.

4. In a sound reproducing device, a dynamic speaker having a cone shaped diaphragm for producing compressional waves of equal intensity over the entire audible spectrum and radiating the higher frequencies in a beam concentrated about the axis of the speaker to a greater extent than the lower frequencies, a first reflector in the form of a paraboloid of revolution surrounding said diaphragm and facing in the direction of wave propagation to diffuse and radiate the lower frequencies of the audible spectrum over a substantial angle of radiation, a second similar reflector smaller than said first reflector and concentric therewith, said second reflector having a diameter to intercept only the higher frequencies which are propagated by the diaphragm as a concentrated beam and to permit propagation of the lower frequencies around the edges thereof without substantial change in direction, said second reflector being located between said diaphragm and the focus of said first reflector so as to reflect said higher frequencies onto parts of said first reflector beyond the edges of said second reflector and to diffuse the same over the surface of said first reflector in a position to be reflected and re-radiated thereby over substantially the same angle of dispersion as the lower frequencies.

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