Sept. 4, 1951 F. A. MANLEY 2,566,422

SOUND DISPERSING DEVICE

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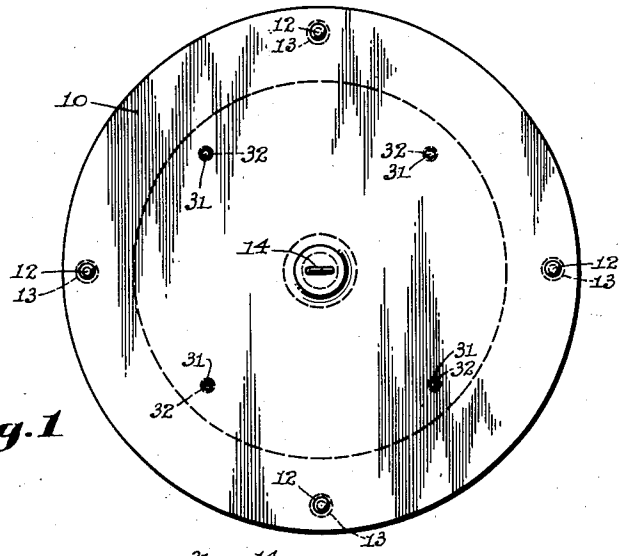


Fig. 1

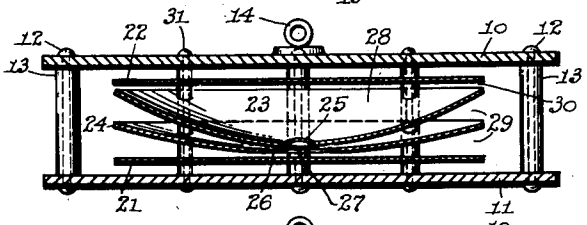


Fig. 2

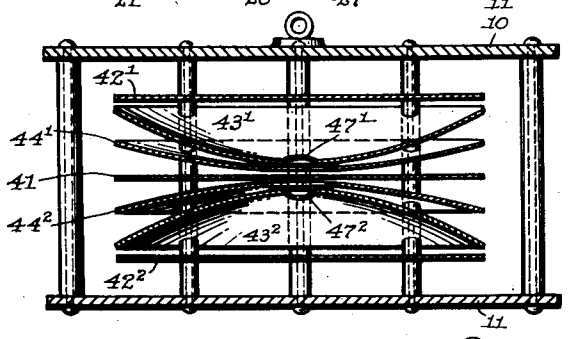


Fig. 3

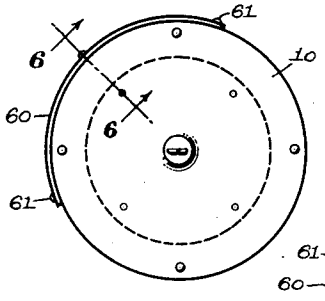


Fig. 5

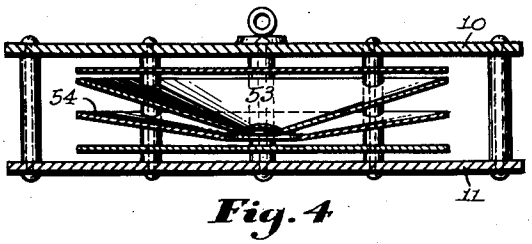


Fig. 4

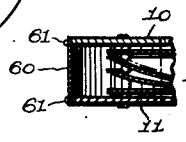


Fig. 6

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SOUND DISPERSING DEVICE

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1

The present invention relates to acoustic devices and more particularly to a sound dispersing device for amplifying and dispersing sounds emanating from a sound reproducer or electro-acoustic transducer having a vibrating diaphragm.

The primary objects of the invention are to provide an improved sound dispersing device or "loudspeaker" primarily intended for use in auditoriums, concert halls, theaters and other places of assembly, both indoor and outdoor; to provide such a device which will effectively radiate sound throughout an entire 360° directional range or portion thereof; to provide such a device which will effectively disperse tones of both high and low frequencies; and in general to provide such an improved sound dispersing device which is efficient in use, reasonably economical in manufacture, and attractive in appearance.

Illustrative embodiments of the invention are shown in the accompanying drawings, wherein:

Figure 1 is a top plan view of my new sound dispersing device;

Figure 2 is a central vertical sectional view of the same taken on a horizontal line through the center of Figure 1;

Figure 3 is a central vertical sectional view of a modified form of the device;

Figure 4 is a central vertical sectional view of another modified form of the device;

Figure 5 is a top plan view of the device, on a reduced scale, with an arcuate shield applied to a circumferential portion thereof; and

Figure 6 is a fragmentary sectional view of the same taken on line 6—6 of Figure 5.

Referring now in detail to these drawings, the various modifications of my new sound dispersing device or "loudspeaker" shown in Figures 2, 3 and 4 all appear identical in top plan view, and the top plan view of the device shown in Figure 1 is therefore a true top plan view of each of said modifications.

Referring first particularly to Figures 1 and 2, the sound dispersing device is housed in a drum-shaped housing comprising a circular upper head 10 and a circular lower head 11 secured together in spaced apart parallelism as by means of rivets 12 having spacer collars 13 thereon, and the upper head 10 is desirably provided with a central eyelet 14 by means of which the device may be suspended on a rope or chain or otherwise attached to a ceiling or other suitable mooring place. Other means of mounting the device may include a pedestal secured to the underside of the lower head 11 for supporting the device from beneath.

2

The sound dispersing device shown in Figures 1 and 2 comprises a flat, circular base or disc 21, a second flat, circular sub-base plate or disc 22 disposed in spaced apart substantially parallel and substantially coaxial relation to the first disc 21, and a third circular horn-forming plate or disc 23 having a central throat opening 27 contiguous to but slightly spaced from the center of the base disc 21, said third disc 23 extending from said throat opening conoidally to an outer periphery contiguous to but slightly spaced from the outer periphery of the second disc 22. A fourth circular separator plate or disc 24 is desirably, but not necessarily, interposed between the base disc 21 and the horn-forming disc 23 and extends from a central opening 26 therein conoidally and equidistantly between the discs 21 and 23 to an outer periphery midway between the peripheries of said discs 21 and 23.

The electro-acoustic transducer which constitutes the source of sound to be amplified and dispersed by my new sound dispersing device, may be of conventional construction and is here indicated diagrammatically as a diaphragm 25 disposed in the central throat opening 27 of the third or horn-forming disc 23, which disc 23 divides the region between the base disc 21 and the sub-base disc 22 into a low frequency resonating chamber 28 and a high frequency horn 29 which may be divided into two parts by the separator disc 24. It will readily be seen that vibration of the diaphragm 25 sets up sound waves adjacent thereto which are of opposite phase in the resonating chamber 28 and in the divided horn 29 respectively, and these sound waves are amplified and dispersed from the horn 29, and from the chamber 28 through the narrow peripheral opening 30, in approximately the same phase. The horn 29 is designed to disperse sound waves of predominant higher frequencies ranging toward lesser dispersion at the lower frequencies. The separator disc 24 is provided in the horn 29 for better dispersing the sound waves, and while one such separator disc is here shown it will be understood that two or more (or none) may be provided depending upon the size of the horn and the character of the installation. The resonating chamber 28 is designed to disperse sound waves of predominant lower frequencies ranging toward lesser dispersion at the higher frequencies, said sound waves being emitted through the narrow peripheral opening 30 between the discs 22 and 23 in approximately the same phase with, and blended with, the waves emitted from the horn 29.

The discs 21, 22, 23, and 24 are secured to-

gether and to the upper and lower heads of the housing drum as by means of rivets 31 having spacer collars 32 thereon for securing the plates in properly spaced relation.

In the modified form of the invention shown in Figure 3, the sound dispersing device hereinbefore described is simply doubled for greater amplification and effectiveness, there being a common base or primary disc 41 and two sub-base or secondary discs 42^1 and 42^2, with two conoidal horn-forming or tertiary discs 43^1 and 43^2, and as shown with two conoidal separator discs 44^1 and 44^2. The operation of the device is the same as that of the device shown in Figure 2 except that the sound reproduction is doubled, it being understood that the diaphragms in the throat openings 47^1 and 47^2 are so arranged that sound is emitted from both the resonating chamber and the horn approximately in phase.

In the modification of the invention shown in Figure 4, the various parts and their arrangement and operation are identical to those shown in Figure 2 except that the third or horn-forming disc 53 and the separator disc 54 are shown conical in formation for economy of manufacture, instead of conoidal, the latter term being intended to include those forms generated by the revolution of a conic section about its axis, including spherical. In any of the modifications of the device shown in Figures 2, 3 and 4, the most desirable and effective degree of taper between the base disc and the third or horn-forming disc may be determined for a particular installation by the use of any of several well-known formulae now used for determining the taper in uni-directional horns. While the top and bottom plates or discs in all of the modifications illustrated are shown as being flat, either one or both may be somewhat conical or conoidal in formation thus increasing or decreasing the size of the horn and/or the resonant chamber.

Figures 5 and 6 show an arrangement whereby any of the modifications of the device shown and described may be provided with an arcuate shield 60 secured to the housing drum as by means of screws 61, for screening any circumferential portion of the device and thus limiting the direction of sound dispersion to less than 360°.

It will thus be seen that the invention provides a novel acoustic device for the dispersion of sound, which is capable of blending and dispersing high frequency and low frequency sound waves in approximate phase throughout a 360° directional range or less if desired, and while but several specific embodiments of the invention have been herein shown and described, it will be understood that numerous details may be altered or omitted without departing from the spirit of the invention as the same is defined by the following claims.

I claim:

1. A sound dispersing device comprising a pair of spaced apart substantially parallel plates, and a third plate disposed between said pair and having a throat opening at its center contiguous to but slightly spaced from the center of one plate of said pair and extending from said throat opening to an outer periphery contiguous to but slightly spaced from the outer periphery of the other plate of said pair, said third plate thus dividing the region between said pair of plates into a unitary outwardly divergent horn having a 360° peripheral opening from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed.

2. A sound dispersing device comprising a pair of spaced apart substantially coaxial discs, and a third disc disposed between said pair and having a throat opening at its center contiguous to but slightly spaced from the center of one disc of said pair and extending from said throat opening to an outer periphery contiguous to but slightly spaced from the outer periphery of the other disc of said pair, said third disc thus dividing the region between said pair of discs into a unitary outwardly divergent horn having a 360° peripheral opening from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed.

3. A sound dispersing device comprising a pair of spaced apart substantially coaxial discs, and a third disc disposed between said pair and having a throat opening at its center contiguous to but slightly spaced from the center of one disc of said pair and extending from said throat opening conically to an outer periphery contiguous to but slightly spaced from the outer periphery of the other disc of said pair, said third disc thus dividing the region between said pair of discs into a unitary outwardly divergent horn having a 360° peripheral opening from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed.

4. A sound dispersing device comprising a pair of spaced apart substantially coaxial discs, and a third disc disposed between said pair and having a throat opening at its center contiguous to but slightly spaced from the center of one disc of said pair and extending from said throat opening conoidally to an outer periphery contiguous to but slightly spaced from the outer periphery of the other disc of said pair, said third disc thus dividing the region between said pair of discs into a unitary outwardly divergent horn having a 360° peripheral opening from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed.

5. A sound dispersing device comprising a pair of spaced apart substantially coaxial circular discs, and a third circular disc disposed between said pair and having a throat opening at its center contiguous to but slightly spaced from the center of one disc of said pair and extending from said throat opening to an outer periphery contiguous to but slightly spaced from the outer periphery of the other disc of said pair, said third disc thus dividing the region between said pair of discs into a unitary outwardly divergent horn having a 360° peripheral opening from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed.

6. A sound dispersing device comprising a pair of spaced apart substantially coaxial circular discs, and a third circular disc disposed between said pair and having a throat opening at its center contiguous to but slightly spaced from the center of one disc of said pair and extending from said throat opening conically to an

outer periphery contiguous to but slightly spaced from the outer periphery of the other disc of said pair, said third disc thus dividing the region between said pair of discs into a unitary outwardly divergent horn having a 360° peripheral opening from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed.

7. A sound dispersing device comprising a pair of spaced apart substantially coaxial circular discs. and a third circular disc disposed between said pair and having a throat opening at its center contiguous to but slightly spaced from the center of one disc of said pair and extending from said throat opening conoidally to an outer periphery contiguous to but slightly spaced from the outer periphery of the other disc of said pair, said third disc thus dividing the region between said pair of discs into a unitary outwardly divergent horn having a 360° peripheral opening from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed.

8. A sound dispersing device comprising a first disc, a second disc spaced from and substantially coaxial with the first disc, a third disc disposed between the first and second discs and having a throat opening at its center contiguous to but slightly spaced from the center of the first disc and extending from said throat opening to an outer periphery contiguous to but slightly spaced from the outer periphery of the second disc, and a fourth disc disposed between and spacedly from the first and third discs, said fourth disc having an opening in the center thereof and extending from said opening to a periphery lying between the peripheries of the first and third discs, said third disc thus dividing the region between said first and second discs into an outwardly divergent horn from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed, and said fourth disc dividing said outwardly divergent horn into two unitary horn parts each having a 360° peripheral opening.

9. A sound dispersing device comprising a first disc, a second disc spaced from and substantially coaxial with the first disc, a third disc disposed between the first and second discs and having a throat opening at its center contiguous to but slightly spaced from the center of the first disc and extending from said throat opening to an outer periphery contiguous to but slightly spaced from the outer periphery of the second disc, and a fourth disc disposed equidistantly between the first and third discs, said fourth disc having an opening in the center thereof and extending from said opening to a periphery lying equidistantly between the peripheries of the first and third discs, said third disc thus dividing the region between said first and second discs into an outwardly divergent horn from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed, and said fourth disc dividing said outwardly divergent horn into two unitary horn parts each having a 360° peripheral opening.

10. A sound dispersing device comprising a first disc, a second disc spaced from and substantially coaxial with the first disc, a third disc disposed between the first and second discs and having a throat opening at its center contiguous to but slightly spaced from the center of the first disc and extending from said throat opening conoidally to an outer periphery contiguous to but slightly spaced from the outer periphery of the second disc, and a fourth disc disposed between and spacedly from the first and third discs, said fourth disc having an opening in the center thereof and extending from said opening conoidally to a periphery lying between the peripheries of the first and third discs, said third disc thus dividing the region between said first and second discs into an outwardly divergent horn from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed, and said fourth disc dividing said outwardly divergent horn into two unitary horn parts each having a 360° peripheral opening.

11. A sound dispersing device comprising a first disc, a second disc spaced from and substantially coaxial with the first disc, a third disc disposed between the first and second discs and having a throat opening at its center contiguous to but slightly spaced from the center of the first disc and extending from said throat opening conoidally to an outer periphery contiguous to but slightly spaced from the outer periphery of the second disc, and a fourth disc disposed equidistantly between the first and third discs, said fourth disc having an opening in the center thereof and extending from said opening conoidally to a periphery lying equidistantly between the peripheries of the first and third discs, said third disc thus dividing the region between said first and second discs into an outwardly divergent horn from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed, and said fourth disc dividing said outwardly divergent horn into two unitary horn parts each having a 360° peripheral opening.

12. A sound dispersing device comprising a pair of spaced apart substantially coaxial circular discs, a third circular disc disposed between said pair and having a throat opening at its center contiguous to but slightly spaced from the center of one disc of said pair and extending from said throat opening to an outer periphery contiguous to but slightly spaced from the outer periphery of the other disc of said pair, said third disc thus dividing the region between said pair of discs into a unitary outwardly divergent horn having a 360° peripheral opening from which the higher frequency sounds are dispersed and a unitary outwardly convergent resonating chamber having a 360° peripheral opening from which the lower frequency sounds are dispersed, and an arcuate shield screening a portion of the circumferential space between the substantially coaxial pair of discs for limiting the direction of sound dispersion to less than 360°.

13. A sound dispersing device comprising: a flat circular inner primary disc; a pair of circular outer secondary discs disposed equidistantly from

and substantially coaxial with said primary disc; and a pair of circular tertiary discs, one thereof being disposed between each secondary disc and the primary disc, each of said tertiary discs having a throat opening at its center contiguous to but slightly spaced from the center of the base disc and extending from said throat opening from the primary disc to an outer periphery contiguous to but slightly spaced from the outer periphery of the adjacent secondary disc.

14. A sound dispersing device comprising: a flat circular inner primary disc; a pair of circular outer secondary discs disposed equidistantly from and substantially coaxial with said primary disc; a pair of circular tertiary discs, one thereof being disposed between each secondary disc and the primary disc, each of said tertiary discs having a throat opening at its center contiguous to but slightly spaced from the center of the base disc and extending from said throat opening from the primary disc to an outer periphery contiguous to but slightly spaced from the outer periphery of the adjacent secondary disc; and a pair of circular separator discs, one thereof being disposed between and spacedly from each tertiary disc and the primary disc, and each of said separator discs having an opening in the center thereof and extending from said opening to an outer periphery lying between the peripheries of the primary disc and the adjacent tertiary disc.

15. A sound producing device comprising a first circular disc, a second circular disc spaced from

and substantially coaxial with the first disc, a conoidal third disc disposed between the first and second discs and having a throat opening at its center contiguous to but slightly spaced from the center of the first disc and extending from said throat opening conoidally from the first disc to an outer periphery contiguous to but slightly spaced from the periphery of the second disc thus forming with the first disc a unitary 360° high frequency sound dispersing horn and forming with the second disc a unitary 360° low frequency sound dispersing resonator, and a vibratory diaphragm disposed adjacent said throat opening wherefrom sound waves are generated simultaneously in said horn and said resonator and dispersed therefrom in approximately the same phase.

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