

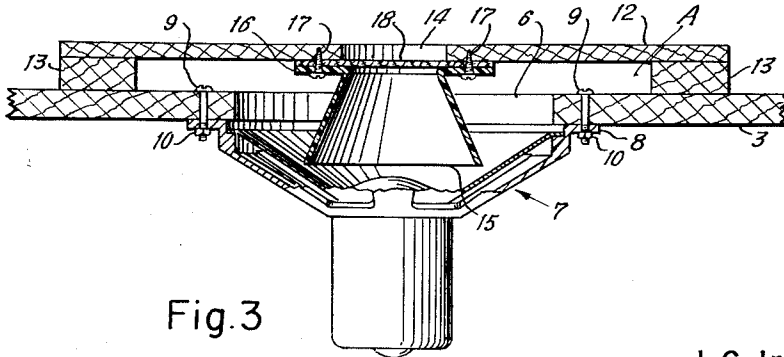
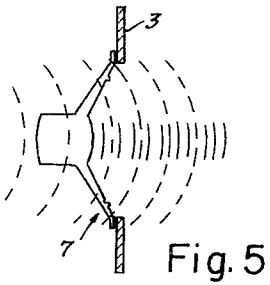
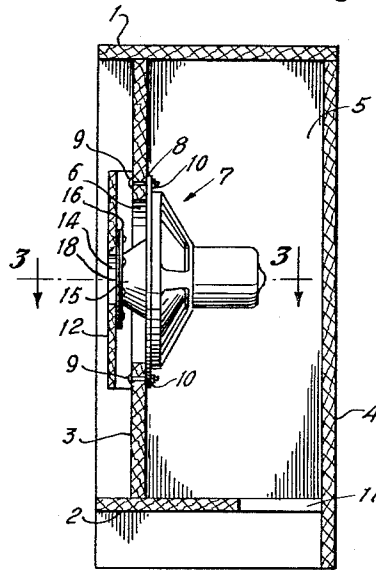
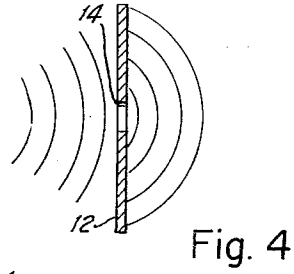
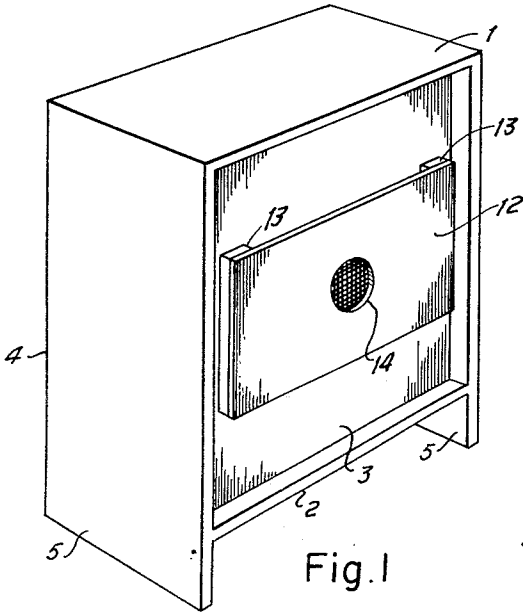
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HIGH FIDELITY LOUD SPEAKER CABINET

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HIGH FIDELITY LOUD SPEAKER CABINET

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2 Claims. (Cl. 181—31)

This invention relates to a high fidelity loud speaker cabinet, and it concerns more particularly an improved cabinet structure for a cone type sound reproducer or speaker.

It is common practice to employ two speakers simultaneously for reproducing low and high frequencies respectively, the low frequency or "woofer" being enclosed in a cabinet as described while the high frequency speaker or "tweeter" may be positioned inside or outside the cabinet.

This invention contemplates a cabinet structure which is capable of being used alone, in a single speaker system, or alternatively, in a two-speaker system in which it is capable of reproducing low frequency sounds efficiently while at the same time reproducing sounds of middle and high frequency within the range of the low frequency speaker, and provide a convenient method of controlling the balance between the low, mid-range and high frequencies.

Another object of the invention is to produce a speaker cabinet which is independent of its placement in the listening area, and tends to eliminate the harshness of the sound produced by direct radiation and to disperse the sound throughout the listening area, resulting in a more perfect reproduction of the original sound.

Another object of the invention is to provide, in combination with a cabinet providing an enclosure for a speaker and having a front opening therein opposite the front of the speaker whereby the back side of the speaker cone is loaded, to amplify the low frequencies, and means for loading the front side of the speaker cone to obtain further amplification of the low frequencies by reducing the efficiency of the speaker at the mid- and high-frequencies by a controlled amount, and also the front loading will reduce cone excursion necessary to reproduce the lower frequencies resulting in lower cone distortion, while at the same time effecting better dispersion of the middle and high frequency sounds and eliminating the directional characteristics and harshness thereof.

Another object of the invention is to produce a speaker cabinet of comparatively small size without sacrificing efficiency of the speaker at the lower frequencies. To reproduce sound waves in the lower frequencies that are equal in amplitude to the middle and high frequencies ordinarily requires a very large horn or cabinet. This invention contemplates reducing the efficiency of the speaker at the middle and high frequencies without affecting its efficiency at the lower frequencies. Since a cabinet of the type described is more efficient at low frequencies when driven at higher input levels, the device of the invention is so constructed as to attenuate the middle and high frequencies by a controlled amount.

Another object of the invention is to produce a loud speaker cabinet as described which is of simple, rugged construction, of comparatively small size, may be manufactured inexpensively, and is efficient in operation and durable in use.

The invention will be readily understood by referring

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to the following description and the accompanying drawing, in which:

Figure 1 is a perspective view of a speaker cabinet embodying the invention;

Figure 2 is a sectional elevational view taken on a median line;

Figure 3 is a sectional plan view taken on the lines 3—3 of Figure 2;

Figure 4 is a diagrammatic view illustrating the dispersion of sound waves on the opposite side of a barrier having a restricted orifice therein, upon impingement of the sound waves against the barrier, and

Figure 5 is a diagrammatic view illustrating the pattern of low and high frequency sound waves produced by a cone-type speaker, showing the directional characteristics of the high frequency sound waves.

Referring to the drawing, the loud speaker cabinet of the invention comprises an upright rectangular box, relatively narrow from front to back, having a top 1, a bottom 2, a front wall 3, a back wall 4, and a pair of side walls 5. The bottom 2 is spaced above the lower ends of the back wall 4 and the side walls 5. The front wall 3 extends from the top 1 to the bottom 2, and is spaced inwardly from the forward edges of the side walls 5.

A circular opening 6 is formed in the front wall 3 at its center. A cone type speaker 7 is positioned within the cabinet with its front side facing the opening 6. The speaker 7 has a circumferential flange 8 which is secured to the front wall 3, about the opening 6, by a plurality of circumferentially spaced bolts 9 having nuts 10 applied thereto.

A longitudinal slot 11 is formed in the bottom 2. The slot 11 communicates with the enclosed space below the bottom 2, which is open at the front of the cabinet whereby sound waves from the back side of the speaker 7 are passed through the slot 11 and outwardly through the front of the cabinet, below the bottom 2 thereof. The slot 11 is of proper dimension to tune the cabinet cavity to the desired frequency.

A rectangular board 12, which has a width corresponding approximately to the diameter of the circumferential flange 8 of the speaker 7, is arranged parallel to the front wall 3 of the cabinet, forwardly thereof and in spaced relation thereto, with its longitudinal edges parallel to the top 1 and the bottom 2. The ends of the board 12 are attached to vertically disposed strips 13 secured to the outer face of the front wall 3 whereby the board 12 is secured in spaced relation to the front wall 3.

An opening 14, which has a diameter approaching the diameter of speaker cone 7 at its center and is arranged concentrically relative thereto, is formed in the board 12. A funnel-shaped cone 15, which is formed of non-resonant material, has a radially outwardly extending flange 16 on its smaller end which is attached to the board 12 about the opening 14 by a plurality of circumferentially spaced screws 17.

The smaller end of the cone 15 has a diameter corresponding to that of the opening 14. The larger end of the cone 15, which is of smaller diameter than the larger end of the speaker cone 7, faces the speaker cone 7 and is positioned in close proximity thereto. A low frequency pass acoustic filter 18 extends across the opening 14 and is secured between the board 12 and the flange 16 of the cone 15 by the screws 17.

Figure 4 illustrates the dispersion of sound waves, indicated by the curved lines, on the opposite side of a barrier, such as the board 12, having a restricted orifice such as the opening 14 therein, upon impingement of the sound waves against the barrier.

Figure 5 illustrates the pattern of low and high frequency sound waves, indicated by the broken and solid curved lines, respectively, produced by a cone type speak-

er such as the speaker 7, showing the directional characteristics of the high frequency sound waves. The high frequency sound waves originate near the center of the speaker, while the lower frequency sound waves originate nearer the circumference thereof, and the extreme low frequencies are developed by the mass of the speaker cone moving as a piston action.

In the operation of the device, high frequency sound waves originating near the center of the speaker 7 are collected in the cone 15 and passed through the opening 14 and the low frequency pass acoustic filter 18, whereby the high frequency sound waves are attenuated and at the same time dispersed in atmospheric air.

The lower frequency sound waves which originate nearer the circumference of the speaker 7 are passed around the cone 15 and above and below the board 12. Low frequency sound waves which originate on the back side of the speaker 7 are passed through the slot 11 and outwardly through the front of the cabinet, below the bottom 2 thereof, as above described. This is a modified Helmholtz resonator.

With reference to Figure 1, when the speaker is mounted in the cabinet, which may be of the base reflex type, the back side of the speaker cone is loaded. To accomplish front loading and better coupling to the atmospheric air in the listening area, loading board 12 is placed a critical distance in front of the speaker creating the space "A." The space "A" creates an acoustical resistance at the lower audio frequencies which tends to reduce cone excursion necessary to reproduce the lower frequencies which reduces cone distortion, and at the same time, when the air is exhausted along the front baffle board of the speaker cabinet, the greater area of the front baffle board tends to enhance the coupling of the air moved by the speaker cone to the air in the listening area.

The purpose of the collector cone 15 is to direct the high and mid-frequencies generated near the center of the speaker cone through the opening 14. When the frequencies collected by the cone 15 are passed through the opening 14 they are dispersed over the entire front surface of loading board 12 which couples these frequencies to the air in the listening area. Since the higher frequencies are radiated directly from the center of the cone and the mid frequencies are radiated from near the mid-part of the speaker cone, the size of the mouth of the collector cone will determine what frequencies will be passed through the opening 14. The diameter of the opening 14 will determine to what extent the frequencies passing through the opening 14 will be attenuated. Thus by adjusting the size of the mouth of collector cone 15 and the diameter of the opening 14 the speaker may be adjusted to obtain the desired response.

Since the low frequencies are enhanced by the cabinet and the efficiency of the speaker at the mid- and high-frequencies may be controlled, it is possible to adjust the overall speaker response to the frequency balance desired and at the same time obtain better coupling to the air in the listening area and eliminate beaming of the higher frequencies which results in a speaker that has a smoother response and less directional characteristics.

In most instances the unit described will be used as the "woofer" or low- and mid-range reproducer in conjunction with a "tweeter" or extreme high frequency reproducer, to form a two-speaker reproducer, since it is desirable to attenuate the frequencies produced by the "woofer" section at the point the "tweeter" begins to operate, or at the cross-over frequency, the filter 18, as shown in Figures 2 and 3, may be added to the opening 14 to attenuate the higher frequencies generated by the speaker 7. The frequencies and the amount of attenuation depend upon the material, density and/or

thickness making up the low frequency pass acoustic filter 18. Since the cut-off frequency of the "woofer" section can be accomplished acoustically, as described above, the remaining element of the cross-over network can be a simple condenser of the proper value placed in series with the "tweeter" or high frequency speaker.

The invention may be modified in various ways without departing from the spirit and scope thereof.

What is claimed is:

1. In a loud speaker cabinet, the combination of a resonant box providing a chamber having a front wall, a circular opening in the front wall, a cone-type speaker in the chamber facing the opening and having a circumferential flange secured to the front wall about the opening, an elongated rectangular board, having a width corresponding substantially to the diameter of the speaker flange, arranged parallel to the front wall, in spaced apart relation thereto, exteriorly of the box, with its longitudinal edges disposed horizontally, spacer members connecting the ends of the board to the front wall and defining a passage between the board and the front wall, the board providing a front baffle for the speaker and having a circular opening therein arranged concentrically of the speaker, a funnel shaped non-resonant collecting cone facing the speaker and having its smaller end secured to the board about the opening therein, and a low frequency pass acoustic filter extending across the opening of the board and secured between the board and the collecting cone.

2. In a loud speaker cabinet, the combination of a resonant box having a top, a bottom, a front wall, a rear wall, and a pair of side walls, the bottom of the box being spaced above the lower ends of the rear wall and the side walls, the front wall extending from the top of the box to the bottom thereof and being spaced rearwardly from the forward edges of the top, bottom, and side walls of the box, the box providing an enclosed chamber therein and defining an enclosed space, open at the front thereof, below the bottom of the box, the bottom of the box having an elongated opening therein, rearwardly thereof, communicating with the enclosed chamber within the box and the enclosed space below it, a circular opening in the front wall, a cone-type speaker in the chamber facing the opening and having a circumferential flange secured to the front wall about the opening, an elongated rectangular board, having a width corresponding substantially to the diameter of the speaker flange, arranged parallel to the front wall, in spaced apart relation thereto, exteriorly of the box, with its longitudinal edges disposed horizontally, spacer members connecting the ends of the board to the front wall and defining a passage between the board and the front wall, the board providing a front baffle for the speaker and having a circular opening therein arranged concentrically of the speaker, a funnel shaped non-resonant collecting cone facing the speaker and having its smaller end secured to the board about the opening therein, and a low frequency pass acoustic filter extending across the opening of the board and secured between the board and the collecting cone.

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