

[72] Inventor **James C. Armstrong**
4017 Springrock Drive, Cincinnati, Ohio
45239
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Primary Examiner—Stephen J. Tomskey
Attorney—Frank R. Zugelter

[54] **SPEAKER CABINET ENCLOSURE AND METHOD OF MAKING SAME**
10 Claims, 5 Drawing Figs.

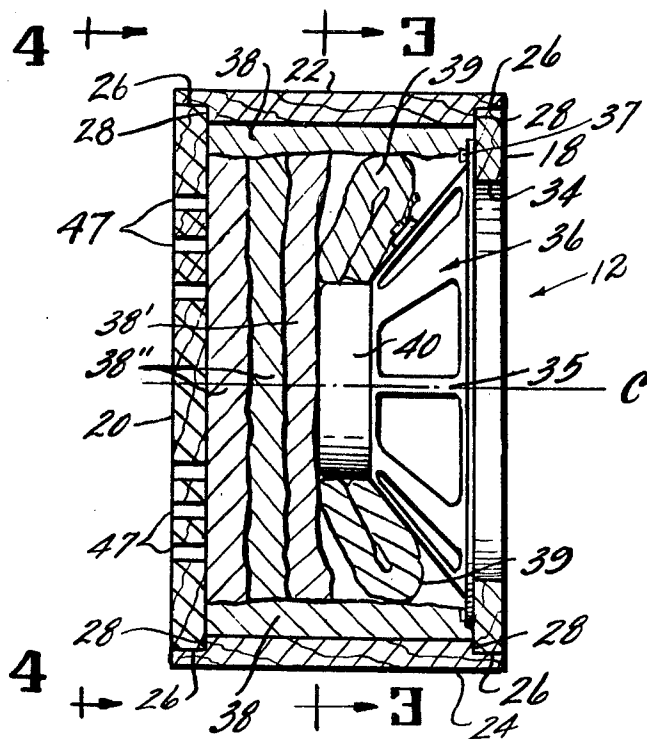
[52] U.S. Cl. 181/31
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H04r 1/28
[50] Field of Search 181/31,
31.1

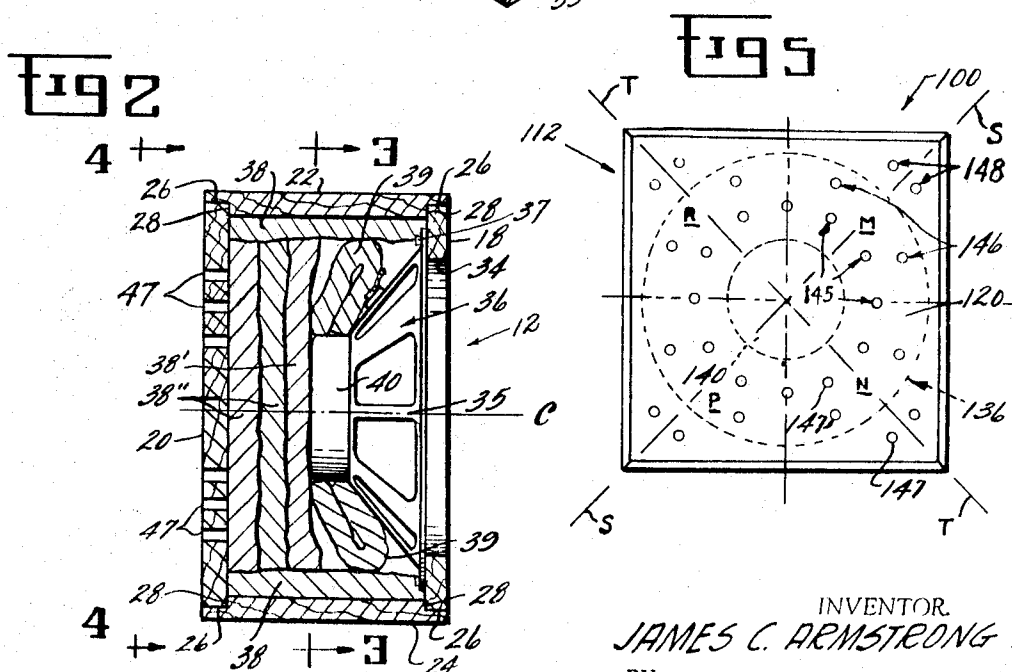
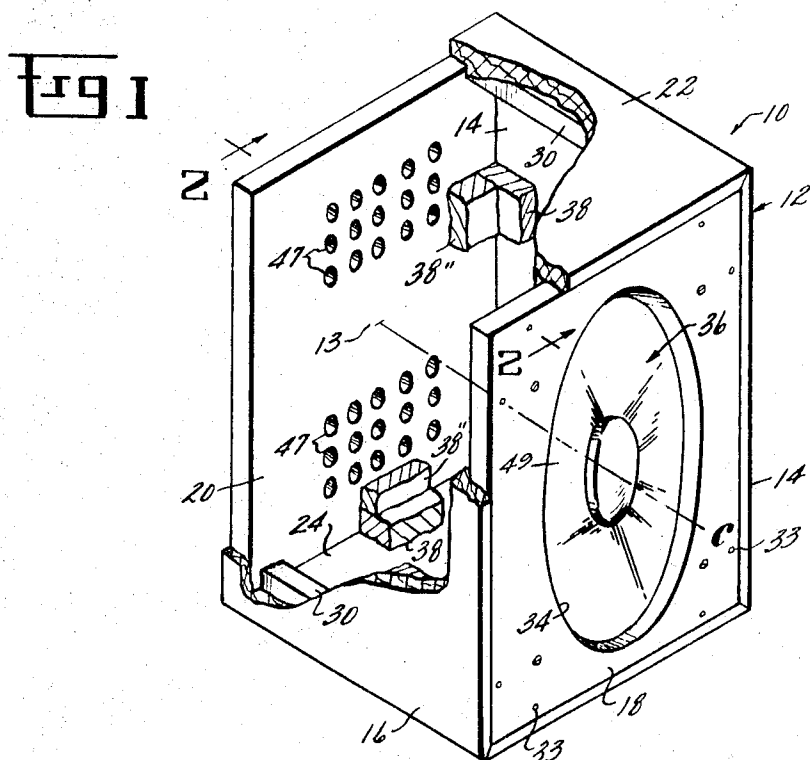
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ABSTRACT: A speaker cabinet enclosure comprising a rectangular parallelepiped having a speaker unit in its front wall, a layer of insulation on each of its top, base and sidewalls, and a rear wall in which two sets of a plurality of apertures are disposed, each such set being a mirror image of the other in nature and disposition. Insulation is provided against the speaker unit frame above and below its magnet. A layer of insulation is provided directly behind the magnet of the speaker unit, and additional layers of insulation may be provided therebehind.





INVENTOR
JAMES C. ARMSTRONG
 BY
Pearce and Schaeperclaus
 ATTORNEYS

Fig 3

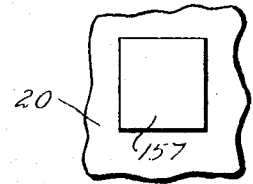
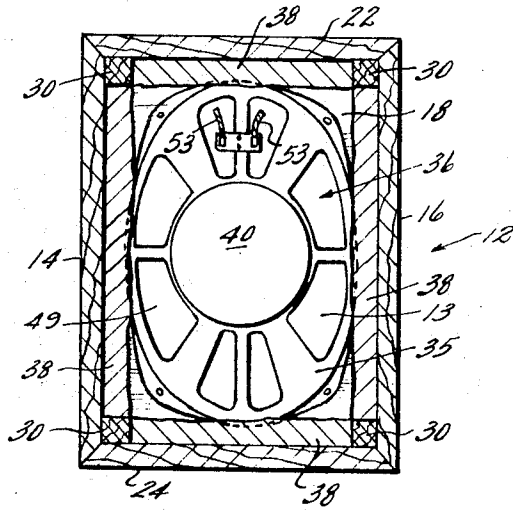


Fig 6

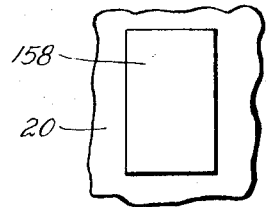


Fig 7

Fig 4

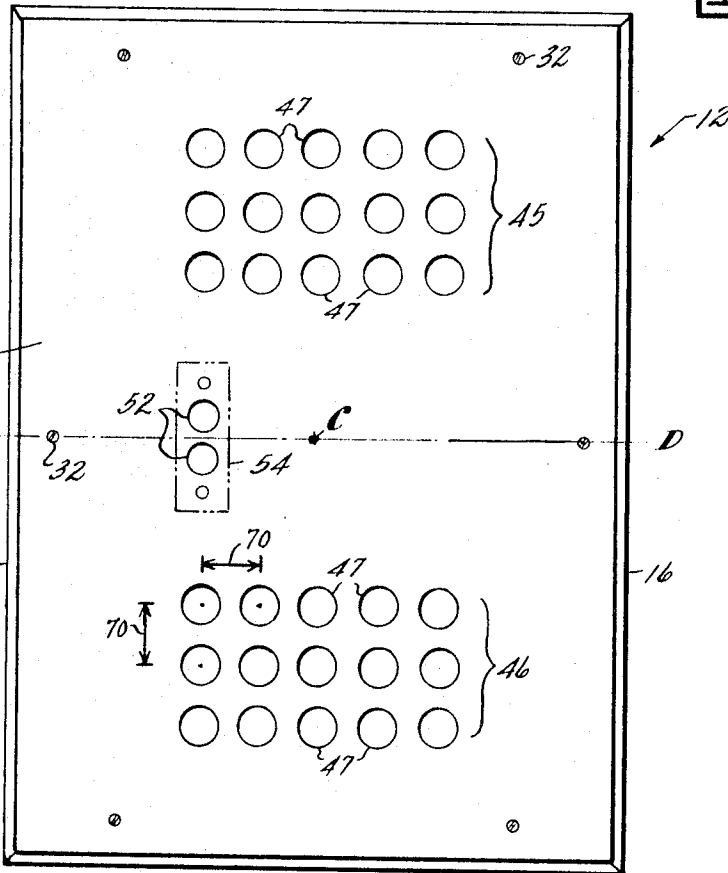


Fig 8

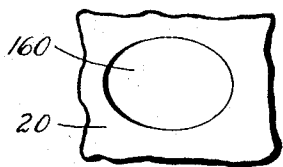
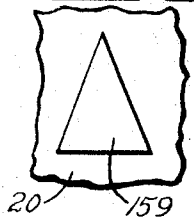


Fig 9

INVENTOR.
JAMES C. ARMSTRONG
BY
Pearce and Schaefer & Klus
ATTORNEYS-

SPEAKER CABINET ENCLOSURE AND METHOD OF MAKING SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The field of art to which the invention is most likely to pertain is generally located in the class of apparatus relating to speakers. Class 181, Acoustics, U.S. Patent Office classification, appears to be the applicable general area of art in which the claimed subject matter of the type involved here has been classified in the past.

2. Description of the Prior Art

Loud speaker apparatuses, of the type involved here, are disclosed in U.S. patents classified in said Class 181.

SUMMARY

An object of this invention is to provide for a novel speaker cabinet enclosure.

Another object of this invention is to provide for sound propagation of desired frequencies from within its chamber to the exterior of the cabinet, the desired frequencies being those of which the response curves of sound propagated forwardly from a speaker cone are shown to be weak.

Another object of this invention is to provide for optimum evenness of backloading on the speaker cone resulting in optimum clarity of sound reproduction (transient response).

A further object of the invention is to provide for evenness of backloading of a speaker cone which will permit its operation at higher volume (watts) without corresponding increase in distortion or destruction of the speaker unit.

A further object of the invention is to provide for a novel speaker cabinet enclosure having an uncomplicated structure and in which a maximum evenness of backloading of the speaker cone is established, the result of which is excellent transient response.

Another object of the invention is to provide for the flattest possible frequency response by controlling the frequencies or frequency ranges propagated from the chamber of the cabinet to the exterior of the cabinet by means of novel structure in the rear wall of the cabinet. The frequencies or their ranges propagated through the rear wall are those frequencies which the response curves of the sound propagated from the forward direction of the speaker cone are shown to be weak.

Another object of this invention is to provide for a cabinet of relatively inexpensive, simplified and efficient construction.

Another object of this invention is to provide for faithful and clear reproduction of sound.

Another object of this invention is to provide a novel method for establishing clear and faithful reproduction of sound in and from a cabinet enclosure constructed on a bass reflex principle.

Another object of this invention is to provide for the reduction in size of a bass reflex cabinet over the sizes normally associated with such type cabinets, by application of two features involving the cabinet port, namely, the distribution of apertures to obtain even backloading of the speaker cone and choice of diameters of apertures to control frequency response of the sound propagated in the interior of the cabinet through the rear wall to the exterior of the cabinet.

These and other objects and advantages of this invention will become more apparent by a full reading of the following description, claims appended thereto and drawings comprising two sheets.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a speaker cabinet enclosure, broken away to show elements of the device embodied in the invention.

FIG. 2 is a view taken on line 2-2 of FIG. 1.

FIG. 3 is a view taken on line 3-3 of FIG. 2, but with folded-over layers of insulation removed.

FIG. 4 is a view taken on line 4-4 of FIG. 2, and drawn to scale for the preferred embodiment.

FIG. 5 is a modification of a novel rear wall embodying the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing in which reference characters correspond to like numerals in the following description, 10 (FIG. 1) represents generally a speaker cabinet enclosure embodying my invention. Enclosure 10 comprises a cabinet 12 of rectangular parallelepiped construction forming an acoustical cavity or chamber 13. Cabinet 12 comprises a pair of opposing spaced sidewalls 14 and 16, a front wall 18, a rear wall 20, a top wall 22, and a bottom or base wall 24. Cabinet 12 is formed from thin boards, plywood or other suitable material known for its utility in the production of speaker enclosure cabinets. Each of the sidewalls 14, 16, top wall 22 and base 24 is recessed as at 26 FIGS. 1 and 2) along their vertically and horizontally disposed edges, as the case may be, adjacent front wall 18 and rear wall 20, so as to produce shoulders 28 against which front and rear walls 18, 20 abut upon assembly of cabinet 12, thereby providing for a flush juncture of the exterior faces of walls 18, 20 with such edges of sidewalls 14, 16, top wall 22 and base 24. A grille cloth (not shown) may be mounted upon front wall 18 and molding (not shown) applied to the front wall thereafter for providing an artistic or stylish appearance to cabinet 12 as a whole.

A wooden bar or strip 30 or the like is mounted along each interior juncture of top and bottom walls 22, 24 with sidewalls 14 and 16, as shown in FIGS. 1 and 3. Means, such as nails (not shown), secure each of bars 30 to walls 14, 16, 22, 24, as the case may be. Means, such as a plurality of screw holes, are provided in rear wall 20 for registering upon shoulders 28 whereby wood screws 32 secure rear wall 20 to the side, top and base walls of cabinet 12. Means, such as ring shank nails 33, tack and secure front wall 18 to such walls.

Front wall 18 is provided with an opening 34 about which a frame 35 of a speaker unit 36 is suitably secured to wall 18 by mounting screws 37 (FIG. 2). A layer of insulation 38, such as fiber glass, is mounted to the interior face of each of sidewalls 14, 16, top wall 22 and base 24. Each of a pair of insulating layers 39 is folded over on itself and disposed above and below a magnet 40 secured in conventional fashion to frame 35 to substantially fill the volume between the speaker frame and the plane coincident with the back of magnet 40, as clearly shown in FIG. 2. Layers 39 extend laterally to layers 38 mounted on sidewalls 14, 16. A layer of insulation 38' is vertically mounted directly behind magnet 40 of speaker unit 36 and extends coextensively with the height and width of chamber 13 as defined by layers 38 mounted on sidewalls 14, 16, top wall 22 and base 24. In this preferred embodiment having particular dimensions as set forth hereinafter, additional layers of insulation 38'', similar to layer 38', are provided behind layer 38' and extend to rear wall 20. However, it should be understood that the number of additional layers of insulation 38'' need not extend completely to rear wall 20, as it is a matter of preference as to the degree of sound reverberation one desires to hear emanating from chamber 13 of cabinet 10.

A pair of holes 52 (FIG. 4) is provided in rear wall 20 whereby lead wires 53 (FIG. 3) conventionally secured to speaker unit 36 may be secured to a barrier terminal strip 54 (shown in phantom) secured to the exterior face of rear wall 20. Suitable electrical wiring (not shown) from strip 54 to a tuner, amplifier or the like is utilized for operation of enclosure 10.

The portions of sidewalls 14, 16, top wall 22 and base wall 24 joining each other, as the case may be, are mitered, and with the described securement of front and rear walls 18, 20 to such walls, provides an efficient, snug and airtight construction.

Assembly of cabinet 12 should be apparent from the foregoing description.

Sets or patterns of apertures 45, 46 are provided in rear wall 20. FIG. 4 shows that each set or pattern of apertures 45, 46 is disposed in its corresponding half of rear wall 20 so as to be a mirror image or reflection of the other set or pattern of apertures in the other half of rear wall 20.

Each aperture 47 therein is of a diameter so that the total spatial area of these apertures is equal to the spatial area for a port or opening utilized in a cabinet enclosure constructed on the bass reflex principle. The distribution of apertures 47, which involves location, distance between and number of such apertures, are so chosen as to provide a maximum evenness of backloading on cone 49 of speaker unit 35, thereby obtaining maximum clarity of sound and consequently maximizing transient response.

Cabinet 12 is constructed on the bass reflex principle and incorporates therein the novel feature of sets or patterns of apertures 45, 46 in rear wall 20 whereby clear and faithful reproduction of sound is attained. The method for determining given sets or patterns comprises generally the following steps:

1. Establishing a spatial area of a conventional port for a bass reflex cabinet.
2. Determining the pattern(s) or distribution of apertures to obtain even backloading on the speaker cone.
3. Determining the diameters of apertures 47 which will permit the desired frequencies or frequency ranges to pass to the exterior of the cabinet via the apertures.

To effect step 1., it is first to be noted that the spatial area of the port included therein is related to the free air resonance characteristic of the speaker unit mounted in the bass reflex cabinet. First constructing a cabinet A having the estimated port spatial area and a cabinet B having a spatial area larger than that of Cabinet A, A-B listening comparisons are made to determine which cabinet decreases the free air resonance peak in the most pleasing manner. If cabinet A sounds better than Cabinet B, the port spatial area in cabinet B will be made smaller than that in cabinet A and the A-B listening comparison is repeated. Adjustments of the port spatial areas are repeated until the flattest response in the bass frequency range is obtained.

In regard to step 2., each of two rear walls 20 is perforated throughout their areal dimensions with a plurality of apertures 47. The apertures are generally formed on a geometrical pattern, say, such as involving rectangular, square, triangular or circumferential or circular patterns, or the like. The total spatial area developed in each rear wall 20 is greater than the indicated equivalent spatial area from step 1. Different patterns of apertures 47 in each of rear walls 20 is established by filling excess apertures with corks. The effectiveness of the pattern of patterns in cabinet A is compared with the effectiveness of the pattern or patterns in cabinet B by A-B listening comparisons. The pattern is changed in the cabinet which yields the least clarity. Then another listening comparison is made. This process is repeated until the reproduction of sound is the clearest possible (transient response has been optimized) by the evenness of backloading of the speaker cone 49.

To carry out step 3., the cabinet, chosen to be the optimum construction for steps 1. and 2., is tested for overall flatness of frequency response. If the frequency response is satisfactory, no further adjustments of the diameters of the apertures are required. However, if peaks or valleys exist in the overall frequency response, then step 3. is performed. Each of two rear walls 20 of cabinets A and B, having substantially the same pattern of apertures 45, 46, but the apertures in each cabinet A, B having different diameters, are compared by A-B listening tests. The initial choice of change in diameters in cabinet A with respect to cabinet B is estimated by the following. If there is too much bass response, the diameters of the apertures in cabinet B are made larger with a corresponding decrease in number of apertures in order to maintain the same port spatial area as determined in step 1. If there is too much high frequency response, the diameters of the apertures in cabinet B are made smaller with a corresponding increase in number of apertures in order to maintain the same port spatial

area as determined in step 1. The diameters of the apertures in cabinet B are made larger or smaller, maintaining the same spatial area until the flattest possible overall frequency response is obtained. It is to be understood that the plurality of apertures 47 may include different diameters in order to satisfy the need for flat overall response.

Additional cabinets 12 which are constructed using the same dimensions in all details and speaker units 36 having the same characteristics will sound substantially identical.

An example of the dimensions and characteristics of preferred embodiment 10 is as follows:

Length: 11"

Width: 8 1/4"

Depth: 7 3/4"

(These are outside dimensions of cabinet, without molding.)

Walls: 3/4" plywood

Speaker unit: Oaktron 69FEUW, manufactured by Oaktron Industries, Inc., Highway 69 South Monroe, Wisconsin 53566. Unit centrally mounted on center line C passing through front and rear walls 18, 20 (FIG. 1).

Wiring: Conventional

Diameter of apertures: 3/16"

Number of apertures: 30, subdivided into two groups of 15 each, in a rectangular pattern 3 x 5, each pattern substantially equally spaced in respective halves of the rear wall of cabinet, divided about line D in FIG. 4 to form mirror.

Centers of apertures: 3/4 inch (see reference character 70 in FIG. 4).

Insulation: Each layer essentially 1 inch thick fiber glass, with insulation 38" comprising 2 layers.

Opening 34: an oval configuration, having 1/4 inch smaller dimensions than the maximum dimensions of the cone.

FIG. 5 illustrates a modification of the invention as believed applied to an enclosure 100 having equal dimensions of length and width and a round speaker unit 136. A cabinet 112 is constructed and assembled in accordance with the above description. Round speaker 136 having a magnet 140 is secured to its front wall (not shown). Rear wall 120 is believed to demonstrate a pattern or patterns by which even backloading of a cone of a round speaker unit 136 is obtained.

The pattern or patterns of apertures 145, 146 and 148 is duplicated in each quadrant M, N, P and R imposed upon rear wall 120 as shown. A mirror image pattern of such apertures about each half of each diagonal S, T in their respective quadrants can be established in accordance with the above outlined steps.

It should be apparent now that a change in distribution of apertures 147 in one of such quadrants M, N, P and R necessitates a corresponding change in each of the other remaining quadrants in order to maintain even backloading on the cone of speaker unit 136. The inventive concept of this invention extends to variations of the configurations of apertures 47 and 147 and such configurations are not limited to the circular configurations thereof illustrated in the drawing. Such variations include (FIGS. 6-9) squares 157, rectangles 158, triangles 159, ovals 160, and other geometrical configurations suitable for carrying out the objects and purposes of the invention.

Pursuant to the requirements of the patent statutes, the principle of this invention has been explained and exemplified in a manner so that it can be readily practiced by those skilled in the art to which it pertains, such exemplification including what is presently considered to represent the best embodiment of the invention.

Therefore, what I claim as patentably novel is:

1. A speaker cabinet enclosure including front, rear, side, base and top walls comprising in combination
 - a bass reflex cabinet having an acoustic chamber and including a full range speaker unit and magnet therewith centrally mounted on the front wall,
 - a layer of insulation mounted on the interior face of each sidewall, top wall and base of said cabinet,

layers of insulation disposed above and below said speaker unit and filling substantially the volume of the chamber between the frame of the speaker unit and a plane coincident to the back end of said magnet,
 at least one layer of insulation abutting the rear end of said unit and extending substantially laterally and vertically of the chamber of said cabinet, and
 at least two patterns of apertures in said rear wall, the distribution of which is generally geometrically formed about the central axis of said speaker unit but without substantially a cylinder generated by the areal dimensions of the magnet of said speaker unit,
 whereby even backloading upon the cone of said speaker unit is achieved for all frequencies reproduced by said full range speaker unit.

2. The improvement of claim 1 in which said apertures are circular.

3. The improvement of claim 2 in which each of said apertures is of the same diameter as the other apertures.

4. The improvement of claim 1 in which said apertures are rectangular in nature.

5. The improvement of claim 1 in which said apertures are oval in nature.

6. The improvement of claim 1 in which said apertures are triangular in nature.

7. The improvement of claim 1 in which said apertures are square in nature.

8. An improved speaker cabinet enclosure of relatively small size and which forms a bass reflex cabinet type of enclosure, such enclosure including the combination of
 a full-range oval speaker unit and magnet therewith centrally mounted on the front wall of said cabinet,
 a layer of insulation mounted on the interior face of each wall of said cabinet,
 layers of insulation filling substantially the volume in the chamber above and below said magnet, such filling being limited between a plane coincident to the back end of said magnet and the frame of said speaker unit,
 at least one layer of insulation abutting the rear end of said unit and extending substantially laterally and vertically in

the chamber of said cabinet, and
 patterns of apertures formed in the rear wall substantially in the upper and lower areas in said wall,
 the distribution of which is geometrically formed about the central axis of said speaker unit but substantially without a cylinder generated by the areal dimension of the said magnet,
 whereby even backloading upon the cone of said speaker unit is achieved for all frequencies reproduced by said full-range speaker unit.

9. A method for providing clarity of sound by evenly backloading the cone of a full-range speaker unit centrally mounted on the front wall of a bass reflex cabinet enclosure of a given size comprising the steps of

1. forming a port opening having the required spatial area in a rear wall of an enclosure of the same size, such opening producing the flattest overall response in the bass frequency range for the enclosure, and
2. perforating a rear wall of another enclosure of the same size with a pattern and distribution of a plurality of apertures whose total spatial area is equivalent to the required spatial area in the first mentioned enclosure.

10. A method for providing clarity of sound by evenly backloading the cone of a full-range speaker unit centrally mounted on the front wall of a bass reflex cabinet enclosure of a given size and for providing the widest and flattest response for said full-range speaker unit, comprising the steps of

1. forming a port opening having the required spatial area in a rear wall of an enclosure of the same size, such opening producing the flattest overall response in the bass frequency range for the enclosure,
2. perforating a rear wall of another enclosure of the same size with a pattern and distribution of a plurality of apertures whose total spatial area is equivalent to the required spatial area in the first mentioned enclosure, and
3. changing the areal size of one or more of the apertures in said plurality by which the flattest and widest possible frequency response is obtained, a corresponding change in number of apertures being made to maintain the required spatial area developed in said forming step.

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