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ACOUSTIC ENCLOSURE FOR LOUDSPEAKERS

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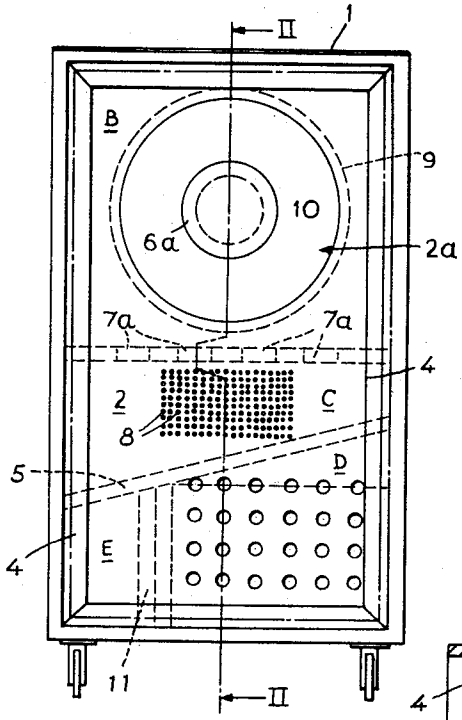


Fig. 1.

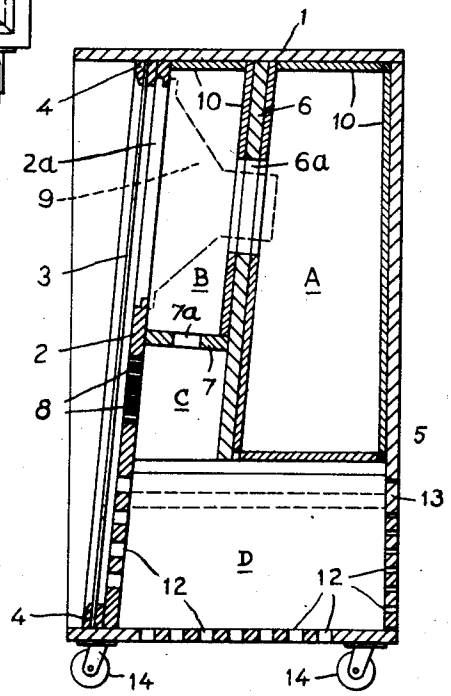


Fig. 2.

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ACOUSTIC ENCLOSURE FOR LOUDSPEAKERS

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3 Claims. (Cl. 181—31)

The use of an enclosure in the form of a Helmholtz resonator tuned to the "free air resonance" of a loudspeaker unit is well known in the art. Such enclosures are generally known as "bass-reflex" or "phase inverter" cabinets.

A disadvantage of such a system is that although the main resonance of the speaker is effectively damped and the bass response extended, two subsidiary resonances are formed. In one the mass and air loading of the moving parts of the loudspeaker unit resonate with the acoustic capacitance of the air enclosed by the cabinet and in the other the mechanical stiffness of the unit resonates with the acoustic inductance of the port aperture of the resonator. As a result the frequency response of the system is non-linear in the region of these unwanted resonances.

It is an object of the present invention to reduce the amplitude of these unwanted resonances with a resulting smoother frequency response and consequent reduction in distortion of the reproduced sounds.

According to the invention, one or more internal Helmholtz resonators are introduced into a reflex enclosure adapted to contain a loudspeaker unit and are tuned to the resonance frequency of the loudspeaker unit with the acoustic capacitance of the air enclosed by the enclosure or to frequencies in a band including that resonance.

According to a feature of the invention, a further subsidiary reflex system or systems are arranged to be coupled acoustically to the main port aperture or apertures of the main reflex system constituted by the enclosure and are tuned to the resonance of the loudspeaker unit with the acoustic inductance of the main port aperture or apertures or to frequencies in a band including that resonance.

The enclosure is constructed so as to be mechanically rigid and lined with suitable sound absorbing material. If necessary membranes of a sound absorbing material such as felt are mounted across one or all of the internal chambers to absorb standing waves formed by reflections between the walls or partitions in the enclosure.

The frequency response of the system is considerably smoother and is extended further towards the lowest acoustic frequencies than that of a conventional reflex system occupying the same volume and fitted with a similar loudspeaker unit.

In order that the invention may be more fully understood reference will now be made to the accompanying drawing in which:

Figure 1 is a front elevation of a loudspeaker enclosure according to the invention with the decorative fret removed, and

Figure 2 is a section taken on the line II—II in Figure 1.

Referring to the drawing, the enclosure comprises an outer casing 1 of generally rectangular form and preferably made of wood, for example plywood and constructed so that it is mechanically rigid. The side of the casing 1 which is intended to form the front, is closed by a loudspeaker board 2, in front on which is arranged a decorative fret 3 which may be a sheet of expanded metal, and is retained in position by means of a detachable framework or beading 4. The interior of the cabinet is divided horizontally by means of a sloping shelf 5, which extends between the two opposite side walls of the casing 1. By making the shelf 5 sloping, the possibility of producing standing waves within the cabinet is reduced. The space above the shelf 5 is divided vertically by a partition 6 extending between the upper surface of the shelf and the top of the casing 1 in order to form two compartments, namely a rear compartment A and a front compartment B. The bottom of the front compartment B is formed by a horizontal shelf 7, which defines, with the shelf 5, a third compartment C below the compartment B. The shelf 7 is provided with a plurality of apertures 7*a* which provide communication between the compartment B and the compartment C. The speaker board 2 is also formed with a plurality of holes 8 opposite the compartment C.

The compartment B is intended to accommodate a loudspeaker unit 9, which is indicated in broken lines, and which is mounted with its cone over the aperture 2*a* in the speaker board 2 and, the rear of the loudspeaker extending through an aperture 6*a* in the partition 6.

The enclosure A and part of the enclosure B are lined with a sound-absorbing material 10, for example a layer of cotton waste covered with thick felt.

In operation, the main port apertures 7*a* resonate with the volumes of the compartments A and B at "free air resonance" of the loudspeaker unit as in a conventional reflex system. According to the invention, the aperture 6*a* forms an annular air gap between the rear of the loudspeaker and the side walls of the partition 6 which resonates with the volume of compartment A as a Helmholtz resonator and reduces the amplitude of the resonance of the speaker unit with the volumes A and B. Thus this internal Helmholtz resonator is tuned to the resonance frequency of the loudspeaker unit with the acoustic capacitance of the air enclosed by the cabinet or to frequencies in a band including that resonance.

Furthermore, the apertures 8 resonate with the volume of air in the compartment C as a subsidiary reflex system and reduces the amplitude of resonance of the speaker unit with the main port apertures 7*a*. Thus this subsidiary reflex system is coupled acoustically to the port apertures 7*a* of the main reflex system and is tuned to the resonance of the loudspeaker unit with the acoustic inductance of the main port apertures 7*a* or to frequencies in a band including that resonance. The size and spacing of the holes 8 is important to give the desired resonance frequency.

In this embodiment of the invention, the space beneath the shelf 5 forms a compartment D which may be employed to house an amplifier to be used in conjunction with the loudspeaker. One end of this space may be divided by means of a wall 11, to form a subsidiary compartment E which may house an electrical cross-over unit. Ventilation holes 12 are formed in the front, rear and bottom of the amplifier compartment D, and preferably the rear of the compartment is provided with a removable door 13, in order to give access to the interior of the compartment. The loudspeaker enclosure may be mounted on castors 14 so that it can be readily moved from place to place.

Whilst a particular embodiment has been described, it will be understood that various modifications may be made without departing from the scope of this invention. For example the cabinet may be constructed without the bottom compartments intended to house the amplifier and cross-over unit.

I claim:

1. An acoustic enclosure comprising a substantially

rectangular casing having a front wall, a rear wall, two side walls, a top and a bottom which slopes from one side to the other across the enclosure, an internal substantially vertical partition extending from side to side across the casing and dividing the internal space into a front compartment and a rear compartment which together form a bass-reflex system, a loudspeaker unit arranged in said front compartment, an aperture in said front wall for the egress of sound from the loudspeaker unit, an aperture in said partition through which the rear of the loudspeaker projects, and a space between the rear of said loudspeaker and the side wall of said aperture forming an air gap around the rear portion of the loudspeaker unit which is arranged to resonate with the volume of air in the rear compartment as a Helmholtz resonator and thereby reduce the amplitude of the resonance of the loudspeaker unit with the volume of air enclosed in the casing.

2. An acoustic enclosure comprising a substantially rectangular casing having a front wall, a rear wall, two side walls, a top and a bottom which slopes from one side to the other across the enclosure, an internal substantially vertical partition extending from side to side across the casing and dividing the internal space into a front compartment and a rear compartment which together form a bass-reflex system, a loudspeaker unit arranged in said front compartment, an aperture in said front wall for the egress of sound from the loudspeaker unit, an aperture in said partition through which the rear of the loudspeaker projects, and a space between the rear of said loudspeaker and the side wall of said aperture forming an air gap around the rear portion of the loudspeaker unit which is arranged to resonate with the volume of air in the rear compartment as a Helmholtz resonator and thereby reduce the amplitude of the resonance of the loudspeaker unit with the volume of air enclosed in the casing, and a membrane of sound absorbing material mounted across at least one of the compartments to absorb standing waves.

3. An acoustic enclosure comprising a substantially rectangular casing having a front wall, a rear wall, two side walls, a top and a bottom, an internal substantially vertical partition extending from side to side across the casing and dividing the internal space into a front compartment and a rear compartment which together form a bass-reflex system, a loudspeaker unit arranged in said front compartment, an aperture in said front wall for the egress of sound from the loudspeaker unit, an aperture in said partition through which the rear of the loudspeaker projects, and a space between the rear of said loudspeaker and the side wall of said aperture forming an air gap around the rear portion of the loudspeaker unit which is arranged to resonate with the volume of air in the rear compartment as a Helmholtz resonator and thereby reduce the amplitude of the resonance of the loudspeaker unit with the volume of air enclosed in the casing, a horizontal partition arranged below said loudspeaker unit and forming the bottom of said front compartment, a lower compartment beneath said horizontal partition, at least one aperture between said lower compartment and the outside of the cabinet, at least one aperture in the horizontal partition connecting the front and lower compartments, said at least one aperture between said lower compartment and the outside of the cabinet resonating with the volume of air in the lower compartment as a subsidiary reflex system and reducing the amplitude of resonance of the speaker unit with the at least one aperture in the horizontal partition.

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