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LOUDSPEAKER CABINETS

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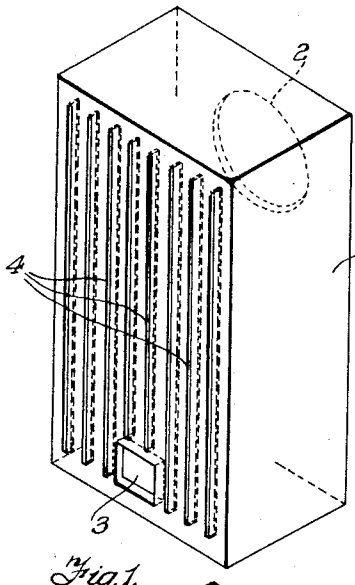


Fig. 1.

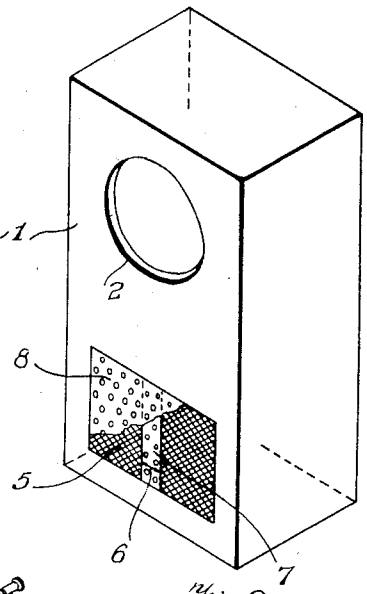


Fig. 2.

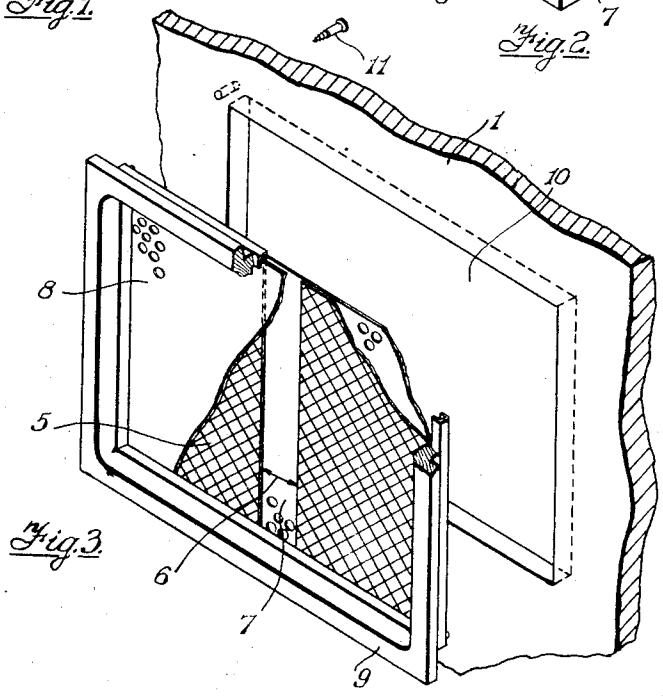


Fig. 3.

Inventor
Edward J. Jordan
By Kenway & Jenney
Attorneys

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LOUDSPEAKER CABINETS

Edward James Jordan, Sutton, England, assignor to Goodmans Industries Limited, Wembley, England, a British company

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4 Claims. (Cl. 181—31)

It is well known that when a loudspeaker unit is enclosed at the rear side thereof by a cabinet of modest dimensions, the effective speaker resonant frequency is raised so causing a reduction in or a loss of the lower frequencies. One method of obtaining a better development of the lower frequencies is to employ the so-called "reflex" or vented cabinet embodying a second radiating port of approximately the same area as the piston area of the speaker unit and facing the same direction as said unit. Such cabinets, however, are not a complete solution to the problem. Apart from the fact that they necessitate the use of a large cabinet which has to be designed in each case according to the particular speaker unit to be used, they have a resonance at a higher frequency than the effective speaker resonant frequency and so result in an irregular development over the lower frequency range.

The main object of the present invention is to provide an improved loudspeaker cabinet which gives a proper and balanced development of the lower frequencies.

More particularly, it is an object of the invention to provide a loudspeaker cabinet incorporating an improved method of loading the speaker diaphragm which results in an overall improvement in the acoustic properties and in particular a damping and lowering of the effective speaker resonance together with better frequency response and transient response, such advantages being achieved with a cabinet of relatively smaller dimensions and imposing less critical conditions as to size and form and of the initial speaker resonance.

According to the invention there is provided in or for a cabinet enclosing the rear side of a loudspeaker, an acoustic impedance unit comprising an area of the cabinet wall or walls in which are provided a port or vent of a size sufficient to produce a lowering and damping of the effective speaker resonance but small enough to have negligible radiation, together with a number of small openings providing a resistive relief to air compression and rarefaction.

With this construction and at low frequencies, the concentrated air mass in the port or vent is added to the diaphragm mass and so in known manner lowers the effective resonance thereof. The frequency of this resonance may be predetermined and can be regarded as the fundamental resonance of the system and it is substantially independent of cabinet size. Above this frequency, the air mass in the vent is too inert to vibrate readily and the system begins to behave as though the rear side of the unit is enclosed completely and consequently has a second resonance at a higher frequency, the value of which depends upon the stiffness of the air in the enclosure and the mass and compliance of the speaker diaphragm. However, the stiffness of the enclosed air is modified by a "flow" in the multiplicity of slits or openings in the enclosure wall, and the shape and size of these openings are such that they cause an impedance to the air movement which is principally resistive (frictional)

and so have a considerable damping action upon the upper resonance.

Considering the equivalent electrical circuit, the slits or like openings may be regarded as a resistance connected in parallel with the acoustic capacitance of the enclosure and the inductance representing the mass or inertance of the port at low frequencies, these being in series with the radiation resistance, and it will be noted that the improved construction results in a decrease in the impedance of the parallel section and therefore increases the power dissipated in the radiation resistance. Moreover, taking the equivalent impedance curve, it will be found that the improved construction not only results in a lowering of the second peak but also in a raising of the trough between the two peaks and thus by the invention there is obtained a more regular development of the low frequency range.

Two embodiments of the invention together with a modified form thereof will now be described with reference to the accompanying drawings of which:

Fig. 1 is a rear view in perspective of a loudspeaker cabinet showing one method of providing an acoustic impedance in accordance with the invention,

Fig. 2 is a front view in perspective of a loudspeaker cabinet showing a second method of providing an acoustic impedance in accordance with the invention, and

Fig. 3 is a fragmentary perspective view of the acoustic impedance unit shown in Fig. 2 but modified so as to permit it to be removed or installed as a separate assembly.

Referring to Fig. 1, the loudspeaker cabinet **1** has an aperture **2** in its front wall to receive the loudspeaker (not shown). In its rear wall are provided a port or vent **3**, together with a plurality of slits **4**, these openings co-operating to provide an acoustic impedance in the manner already described.

In carrying the invention into effect, the small additional openings **4** may conveniently take the form of a series of saw cuts or equivalent slits of about one tenth of an inch wide and be formed in one or more cabinet walls defining the speaker enclosure and not merely in the rear wall as shown. The wall in which the slits are formed needs to be rigid and a timber panel of say one inch thickness will be found particularly suitable for this purpose as the depth of the slit relative to its width will provide a large wall area, that is, high frictional resistance to air movement, in relation to the air mass enclosed by the slit. The slits or openings may of course be formed by other methods and in walls of other material and need not occupy the full length of the wall as shown in Fig. 1. The port or vent **3** preferably has a cross sectional area in the region of sixteen square inches when used with a speaker having an effective diameter of ten inches and may be extended inwardly by a peripheral wall to increase the loading applied to the speaker diaphragm.

The interior of the enclosure **1** may be lined with sound absorbent material to absorb H.F. reflections but as such material could not be applied to the wall containing the slits without masking the slits, reflection from this wall can be avoided by suspending a curtain of sound absorbent material between said wall and the speaker unit.

Turning to Fig. 2, the cabinet **1** is provided with a loudspeaker aperture **2** as before but, this time, the acoustic impedance is provided in the front wall of the cabinet enclosure. As already explained, it may be provided in any wall or in more than one wall.

In this alternative method of providing the acoustic impedance there is provided a single, larger aperture covered with a layer (or layers) of gauze or other open-work resistive material **5**, the open mesh of the latter con-

stituting the small openings in place of the slits 4 of Fig. 1.

By leaving an open portion 6 not covered by gauze, there can be provided the main port 3 of Fig. 1. The gauze 5 is braced by a rear grill 7 and a front grill 8, the latter being shown broken away to reveal the inner construction. These grills are made of wood, metal or other convenient material.

In accordance with a modified embodiment of the invention, the port or vent together with the slits or equivalent openings are provided in a detachable frame unit provided with a flange or other means for enabling it to be secured in an opening in the wall of the loudspeaker cabinet or enclosure. This may be done with either of the acoustic impedance units already described.

In Fig. 3 is shown a detachable unit constructed generally on the same lines as that shown in Fig. 2. This time, however, the gauze 5 provided with a port 6 and braced by grills 7 and 8 is fixed in a flanged frame 9 insertable in a large aperture 10 in the wall of the cabinet 1. The flanged construction of the frame 9 allows it to be secured in the aperture 10 by screws such as 11.

Throughout the description and claims, the general term "walls" is intended to include the top and bottom of the cabinet as well as the side walls.

I claim:

1. A cabinet having walls for enclosing the rear side of a loudspeaker, at least one of its walls being provided with a plurality of small openings providing a resistive relief to air compression and rarefaction developed by the loudspeaker, and said wall being provided with a non-radiating port for producing a lowering and damping of the effective loudspeaker resonance.

2. A cabinet as defined in claim 1, in which said small openings are provided by at least one sheet of open-work material, and in which said port is provided by leaving a space in the open-work material.

3. A cabinet as defined in claim 2, including a frame in which said open-work material is mounted to form an acoustic impedance unit, and a wall of the cabinet is provided with an aperture corresponding with said frame and in which said frame and unit are detachably mounted.

4. A cabinet having walls for enclosing the rear side of a loudspeaker, at least one of its walls having a plurality of openings sufficiently small to provide a resistive relief to air compression and rarefaction developed by the loudspeaker and having a port communicating with the exterior of the cabinet and of a size sufficiently large to produce a lowering and damping of the effective loudspeaker resonance but sufficiently small to have negligible radiation.

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