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(71) Applicant: **PSYCHO-ACOUSTIC RESEARCH LIMITED, Bay Lodge, Hampton Court Surrey (GB)**

(72) Inventor: **King, Brian McMahon, Bay Lodge, Hampton Court Surrey (GB)**

(74) Representative: **Valentine, Francis Anthony Brinsley et al, REDDIE & GROSE 16 Theobalds Road, London WC1X 8PL (GB)**

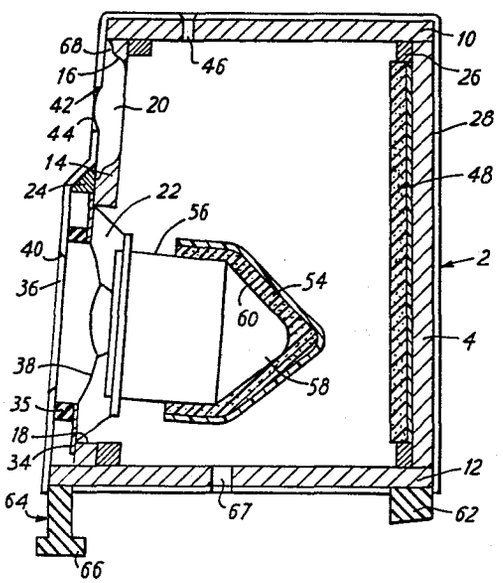
(54) Loudspeaker enclosures.

(57) A loudspeaker enclosure assembly 2 comprises a chipboard box covered by a soud absorbing material. The material comprises an inner layer of expanded polystrene and an outer layer of fine cellular neoprene, to improve the sound reproduction. The loudspeaker enclosure assembly is apertured over the high-frequency loudspeaker 20, low-frequency loudspeaker 22 and in the top wall 10.

The front wall 14 of the loudspeaker enclosure assembly has a step 24, so that there is a gap between the covering and the low-frequency loudspeaker 22. A ring 35 of plastic material is bonded to the covering and to the rim of the low-frequency loudspeaker.

Sound-absorbing from matting 48, 54 backed with a film of filled unexpanded plastics material is bonded to the back wall 4 of the loudspeaker enclosure assembly 2 and to the back of the electromagnet housing 56.

The loudspeaker enclosure assembly 2 stands on three feet. The two back feet 62 are of hard rubber and the front foot 64 is of softer rubber.



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LOUDSPEAKER ENCLOSURES

The invention relates to loudspeaker enclosures. Aspects of the invention are defined in the claims.

An embodiment of the invention will be described, by way of example, with reference to the accompanying drawings, in which :

Figure 1 is a vertical cross-section of a loudspeaker enclosure assembly along the line AA' of Figure 2,

Figure 2 is a plan view of the loudspeaker enclosure assembly,

Figure 3 is a front elevation of the loudspeaker enclosure assembly, and

Figure 4 is an enlarged cross-section of the back wall of the loudspeaker enclosure assembly.

The loudspeaker enclosure assembly 2 shown in the drawings comprises a box having a back wall 4, side walls 6 and 8, a top wall 10, a bottom wall 12 and a front wall 14, all of high density chipboard. The front wall 14, often known as the baffle board, has an upper aperture 16 and a lower aperture 18, which respectively receive a high-frequency loudspeaker 20 and a low-frequency loudspeaker 22. The baffle board 14 makes an angle of slightly less than 90^{o} with the bottom wall 12, and thus faces slightly upwards. Front and back walls 4 and 14 are detachable, and are screwed to battens 26, themselves fixed to other walls.

A triangular batten 24 is attached to the baffle board between the two apertures, and is parallel to the bottom wall 12.

The loudspeaker enclosure assembly has a covering 28 formed of plastics material. This covering 28 comprises an inner layer 30 of expanded polystyrene and a thicker outer layer 32 of foamed neoprene. The covering reduces the spurious sound radiated by the walls of the chipboard box and improves the sound reproduction, partly as a result of the differences in density and compliance of the materials which constitute the covering. Another reason for the

improvement is that the neoprene absorbs reflected sound from adjacent surfaces in the room.

The triangular batten 24 fixed to the front of the baffle board 14 forms the covering 28 into a step. In this way the plane of the covering 28 in the lower region is spaced from the plane of the rim 34 of the low-frequency loudspeaker 22, and the covering in this region is attached to the box at the triangular batten 24 and at the lateral edges of the bottom wall 12, and side walls 6 and 8.

A ring 35 of foamed neoprene isbonded to the innermost of the outer face of the rim 34 of the low-frequency loudspeaker 22, and to the inner surface of the covering 28.

The covering 28 over the front wall 14 of the box has two circular apertures. One aperture 36 is coaxial with, and of smaller diameter than,the diaphragm 38 of the low-frequency loudspeaker. This aperture 36 has a bevelled edge 40. The spacing between the covering and the diaphragm in this region permits movement of the latter. The second aperture 42 is coaxial with, and 1mm larger in diameter than, the diaphragm 44 of the high-frequency loudspeaker 20.

The sound reproduction is further improved by a slot 46 formed in the top wall 10. The slot extends through the chipboard 10 and its covering 28, the latter being bevelled. The slot 46 is a rectangle whose longer axis is substantially parallel to the front of the loudspeaker enclosure.

Within the enclosure, a sheet 48 of sound absorbing material is bonded to the whole of the inner surface of the back wall 4. The material comprises a layer 50 of foamed plastics material laminated to a layer 52 of unfoamed plastics material filled with slate dust. This material is commercially available for industrial soundproofing in which context it is known as industrial barrier matting. The unfoamed plastics side is bonded to the back chipboard wall 4.

Sound absorbing material of the same type is bonded to the electromagnet housing 56 of the low-frequency loudspeaker 22. One sheet is folded into a V-shaped channel 58 and fixed to the housing 56, the width of the longitudinal opening of the channel being of similar size to the diameter of the diaphragm 38 of the loudspeaker

22. A second sheet, not shown in the drawings, is joined to the housing 56 and to the first sheet, and covers one of the ends of the channel 58, the other end being left open. The foam side 60 of both sheets faces the diaphragm 38 of the loudspeaker 22.

The loudspeaker enclosure assembly 2 is supported on a floor by three feet. The two back feet 62 are rubber blocks of square horizontal cross-section, fixed to the back corners of the bottom wall 12 of the box. The height of the front face of each back foot exceeds the corresponding height of the back face. The feet are of hard rubber of the type used in door stops available under the Trademark "CROYDEX". The front, softer rubber foot 64 is a one-piece moulding, which is fixed centrally to the front edge of the bottom wall 12. The foot is of T-shaped profile, as seen from the side. The cross-piece 66 of the 'T' rests on a carpeted floor.

The feet 62,64 are bonded to the bottom wall 12, the covering 28 being apertured to allow this. An electrical cable, not shown extends through a fourth aperture 67 in the bottom wall 12 and covering 28. The cable links the cross-over unit in the loudspeaker enclosure with the amplifier. The hole 67 is sealed around the cable.

In the embodiment described the low-frequency loudspeaker 22 is an AUDAX HD 17 B37 and the high-frequency loudspeaker 20 is a KEF T27. The size of the chipboard box, excluding the covering 28 is: height, 305 mm; width, 230 mm; depth at top, 210 mm; depth at bottom, 245 mm. The baffle board 14 is inclined to the bottom face of the loudspeaker enclosure enclosure assembly at an angle of 83.5^{o} and has openings 16, 18 of diameter 72 mm and 147 mm to receive the high- and low-frequency loudspeakers 20, 22, respectively. Additionally a rebate 68 of depth 3 mm and diameter 108 mm is formed around the opening 16 to receive the rim of the high-frequency loudspeaker. The baffle board is 16 mm thick, and the other chipboard walls are 13 mm thick.

The triangular batten 24 which forms the step in the front face 14 of the loudspeaker enclosure assembly 2, spaces the covering 28 in the upper and lower regions by 18 mm.

The expanded polystyrene layer 30 of the skin is 1.6 mm thick and the neoprene layer 32 is 5 mm thick. The opening 16 over the high-frequency loudspeaker 20 is 28 mm in diameter, and the opening 18 over the low-frequency unit 22 is 87 mm in diameter.

The width of the ring 35 in the radial direction is 7 mm.

The slot 46 in the top wall 10 of the box is a rectangle of size 22 mm by 6.35 mm. Its central point is 53 mm from the front edges of the top wall.

The hole 67 in the bottom wall 12, which receives a cable, is 11.5 mm by 4 mm.

The expanded foam of the sound absorbing layers 48, 54 is 12 mm thick and its laminate is 3 mm thick. The sheet 54 which is bonded to the electromagnet housing 56 is a rectangle 255 mm by 165 mm, the latter dimension being the lateral width of the sheet.

The cross-piece 66 of the front foot 64 is 13 mm by 25 mm by 25 mm, and the other part, which joins the cross-piece 66 to the loudspeaker enclosure proper, is 13 mm by 25 mm by 35 mm.

The back feet 62 are 23 mm by 23 mm in horizontal cross-section. The rear and front faces are, respectively, 22 mm and 24 mm in height.

Other expanded plastics material may be used in place of cellular neoprene e.g. polyester foam.

In all embodiments, the width of the longitudual openings of the channel of sound absorbing material behind the low-frequency loudspeaker should be approximately equal to, or greater than, the diameter of its diaphragm. When the low-freqeuncy loudspeaker has a diaphragm whose diameter substantially exceeds the diameter of the electromagnet housing, unlike the AUDAX HD 17 B37 of the first embodiment, the barrier matting behind the diaphragm should be bonded to a fixture other than the electromagnet housing in such a way as to envelop the diaphragm e.g. by attaching it to the back face of the baffle board.

In all embodiments, the proportion of the volume of the loudspeaker enclosure to the area of the slot in the top wall 10 should be within the range 60 to 100 (metres), and the proportion of the area of the slot to the thickness of the top wall 10 of the box should be between 0.008 to 0.012 (metres). Thus the proportion of the volume of the enclosure to the thickness of the top wall is preferably between 0.48 and 1.2 metres^2.

In order to reduce the effects of diffraction of the high frequency sound waves emitted it may be desired to provide a sound absorbing strip, for example, a thin cylinder of textile-covered, soft rubber a few millimetres in diameter, on the outer face of the loudspeaker enclosure, around one or more of the sound emitting apertures adjacent the edges of the aperture or apertures, and/or along the edges of the front face of the enclosure.

C L A I M S :

1. A loudspeaker enclosure assembly comprising a box and a covering of vibration absorbing material on the outside of the box, the box housing a low frequency loudspeaker, and the box and the covering being apertured adjacent the diaphragm of the loudspeaker, wherein the covering extends inwards over the radially outer part of the diaphragm of, and is spaced from the plane of the rim of, the loudspeaker.

2. A loudspeaker enclosure assembly according to claim 1 wherein the top wall of the box has a slot therethrough.

3. A loudspeaker enclosure assembly according to claim 1 or 2 wherein the covering comprises two or more layers of different density and compliance.

4. A loudspeaker enclosure assembly according to any preceding claim in which a ring of expanded plastics material is bonded to the outer face of the rim of the low frequency loudspeaker, and to the rim of the covering.

5. A loudspeaker enclosure assembly according to any preceding claim, and further housing a high frequency loudspeaker, the box and the covering being apertured adjacent the diaphragm of the high frequency loudspeaker, wherein the covering extends over the rim of the high frequency loudspeaker but is spaced from the diaphragm of the high frequency loudspeaker.

6. A loudspeaker enclosure assembly in which sound absorbing material formed into a channel shape is disposed behind the electromagnet of the low-frequency loudspeaker of the assembly with the channel facing the diaphragm of the loudspeaker, the longitudinal opening of the channel receiving at least the rear portion of the said electromagnet.

7. A loudspeaker enclosure assembly according to claim 6 in which the channel of sound absorbing material is open at one end, and closed at the other end by a second piece of sound absorbing material.

8. A loudspeaker enclosure assembly according to claim 6 or 7 and further including a layer of sound absorbing material which covers the inner surface of the back wall of the loudspeaker enclosure.

9. A loudspeaker enclosure assembly according to any of claims 6 to 8 in which the sound absorbing material comprises a layer of foamed plastics material laminated to a layer of unfoamed plastics material.

10. A loudspeaker enclosure assembly according to claim 9 in which the unfoamed plastics material is filled with slate dust.

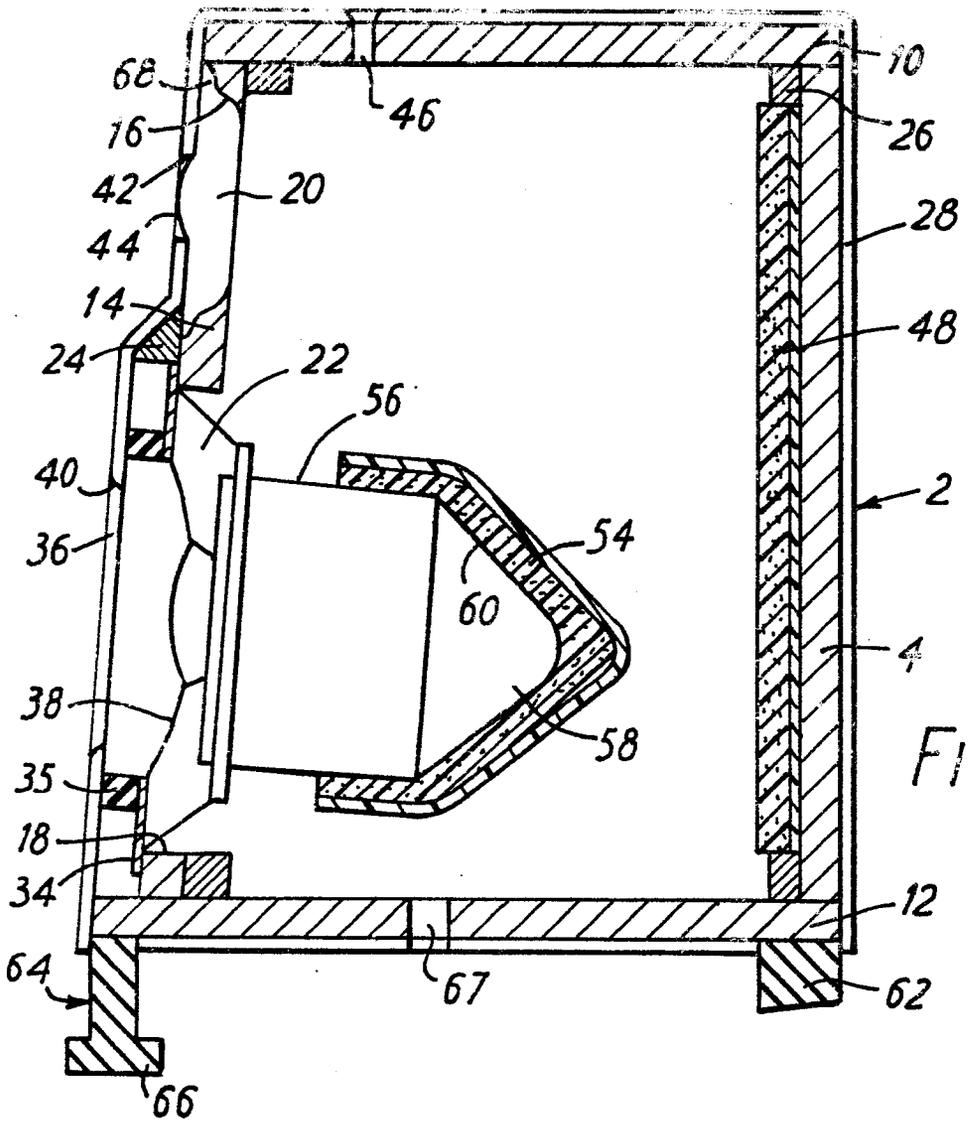
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FIG. 1

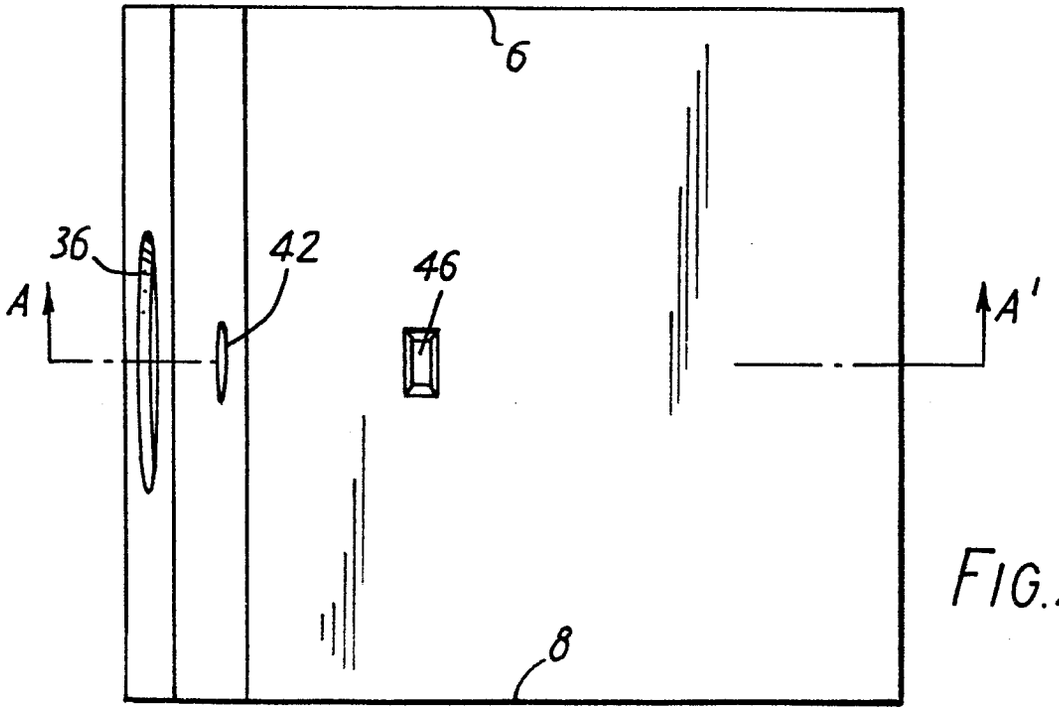
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FIG. 2

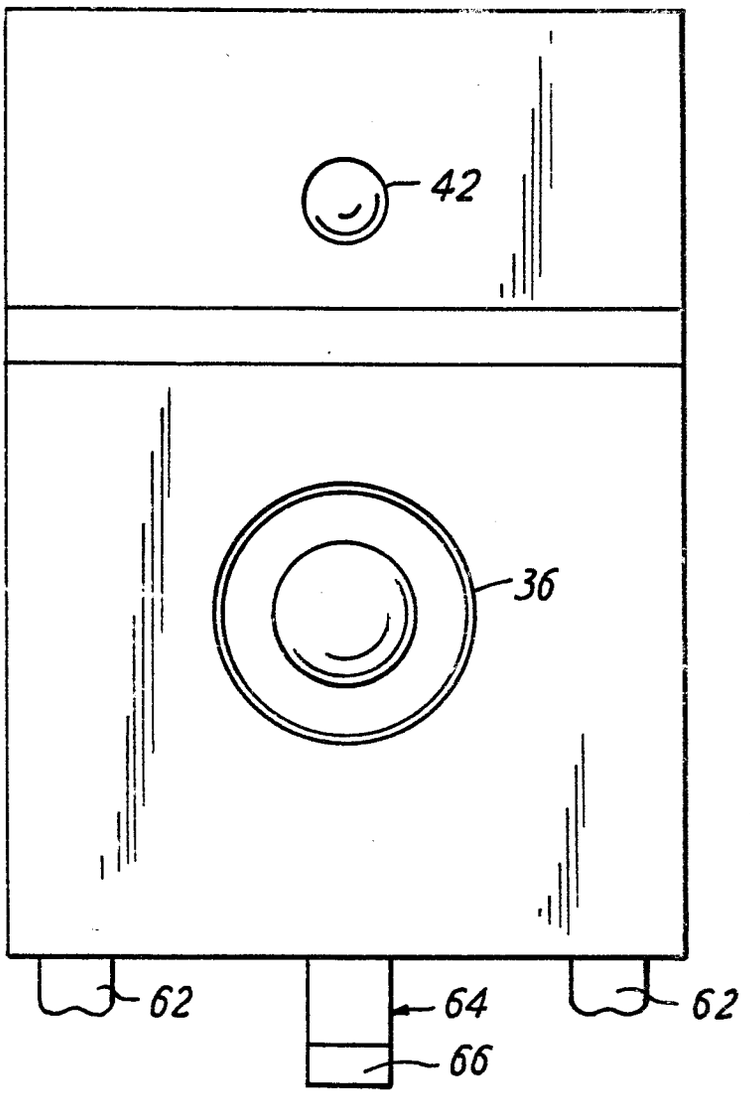

FIG.3

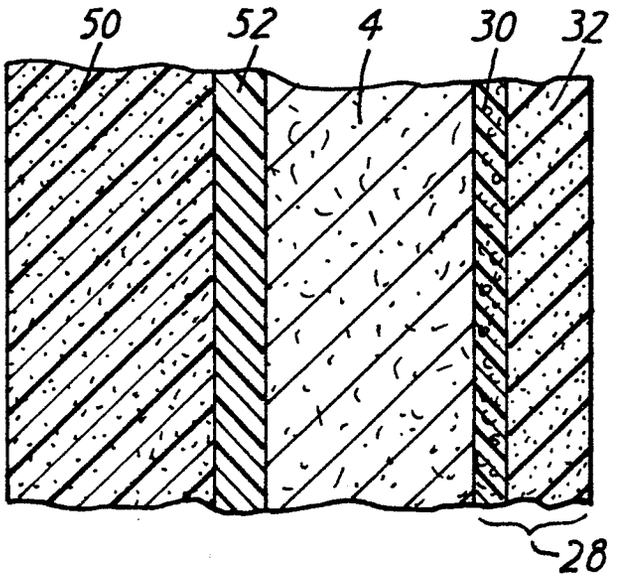

FIG.4

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EUROPEAN SEARCH REPORT

Application number

EP 83 30 3473

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	BE-A- 673 136 (V.F. VERHEYDEN) * Page 3, line 5 - page 6, line 18; claim 1; figures *	1,5	H 04 R 1/28
Y		3	
Y	DE-B-1 018 467 (RUNDFUNK BETRIEBSTECHNIK GmbH.) * Claims 1,2; figures *	4	
A		1	
X	GB-A- 747 263 (GOODMANS INDUSTRIES) * Page 1, line 9 - page 2, line 75; figures *	6-8	
A		1,2	TECHNICAL FIELDS SEARCHED (Int. Cl. ³) H 04 R
X	US-A-4 127 751 (SHOUZO KINOSHITA) * Column 2, line 64 - column 3, line 18; claim 1; figures 2-6 *	6-8	
A	US-A-4 167 985 (J. DUNLAVY) * Column 5, lines 18-56; figures 1-6 *	1	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	09-09-1983	MINNOYE G.W.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EUROPEAN SEARCH REPORT

Application number

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	US-A-3 720 285 (K. RUSSELL) * Whole document * -----	6,9	
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

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