



(12) **EUROPEAN PATENT APPLICATION**

(21) Application number : **92500123.2**

(51) Int. Cl.⁵ : **E04B 1/90, E06B 5/20**

(22) Date of filing : **30.09.92**

(30) Priority : **03.10.91 ES 9102171**
08.06.92 ES 9201182

(43) Date of publication of application :
07.04.93 Bulletin 93/14

(84) Designated Contracting States :
DE FR GB IT

(71) Applicant : **NOISETEC, S.A.**
Pol. Ind. "La Ferreria", Calle N, Nave 17
E-08110 Montcada i Reixac (Barcelona) (ES)

(72) Inventor : **Galofre Ferrerons, Pedro**
C. Cardoner, 26
E-08024 Barcelona (ES)
 Inventor : **Magrans Fontrodona, Francisco**
Javier
C. Ramiro de Maeztu, 10
E-08024 Barcelona (ES)
 Inventor : **Arranz Serrat, Francisco Javier**
C. Rocafort, 62
E-08015 Barcelona (ES)

(74) Representative : **Ponti Sales, Adelaida et al**
C. Consell de Cent, 322
E-08007 Barcelona (ES)

(54) **Sound-insulating and heat insulating panel.**

(57) The panel (1) consists of either one or two corrugated sheets (2) with parallel cavities (5) open on both faces, at least one of which is covered by a sheet (6). It is also possible that the panel consists of two juxtaposed corrugated sheets (2).

The panel (1) possesses a certain amount of elasticity to increase its ability to absorb sound waves and thermal radiation incident transversely thereon. At the same time the panel (1) is strong in the longitudinal direction in order to withstand the forces to which it is subjected once fitted.

Sound resonators can be formed within each of said air chambers (5), by providing within the air chamber (5) and transversely thereto, a cover (10) provided with an axial orifice (11) and a closed cover (12).

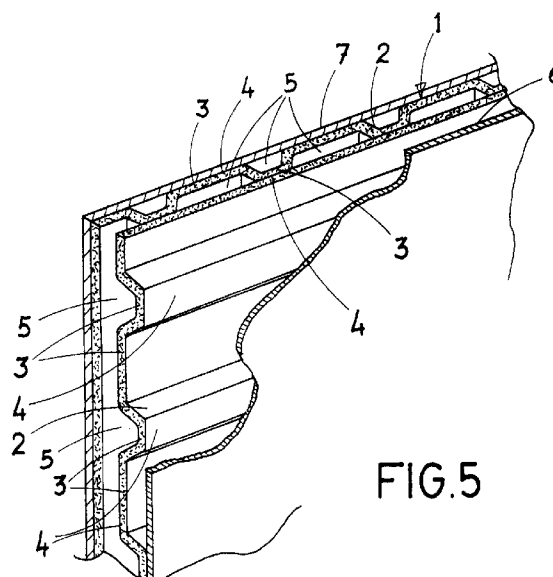


FIG.5

The present invention relates to a sound-insulating and heat-insulating panel by means of which the results obtained in room insulation are improved relative to those achieved with known panels and at a relatively reduced cost.

The invention also relates to incorporating sound resonators within the panels in order to reduce the transmission of noise and vibrations through the panels, and rigid layers to make it easier to fix the panels to a wall.

BACKGROUND OF THE INVENTION

The room insulating means which are currently known consist of fitting the facings with an insulating panel consisting of flat sheets made out of a suitable material, such as fibre glass or textile fibre, heavy sheets, spongy or expanded plastic or other materials with similar characteristics.

Fitting the facings of an enclosure with these kind of panels does not provide efficient insulation because the ability of such panels to damp and absorb sound waves is less than what would normally be desired. It is for this reason that the insulation achieved by the known means is not totally satisfactory.

Furthermore, increasing the sound insulating capability of the known panels implies in some cases a reduction in its strength or resistance for withstanding the forces to which the panel will be subjected once it is fitted.

Attempts have been made to improve the performance which the known insulating panels provide by increasing their thickness and weight, but this is an uneconomic solution.

DESCRIPTION OF THE INVENTION

Studies carried out have lead to the conclusion that it is necessary to create spaces between the facings of the enclosures to be insulated and increase the elasticity of the panels used, without causing a reduction in the strength of the panel. Therefore the new panel which forms the object of the present invention has been devised.

Said panel is designed to be used as a covering for enclosure screens and facings, as a partition or as a door, and is characterised in that it consists of a corrugated sheet of a certain elasticity and which is easily shaped, said corrugations having the bases of the same face coplanar to each other and the bases of one face parallel to those of the opposite face, such that a substantially flat sheet, constituting the outward face of the panel, can be fitted to one or both faces of the corrugated sheet. The two sheets define a plurality of air chambers which give rise to good sound and heat insulation, high rigidity in the longitudinal direction, and a flexibility in the transverse direction which hinders the transmission of structural vi-

brations.

To make the panel more firm, the two faces of the corrugated sheet are each covered by another sheet so that the panel can be used as a door or as a partition for enclosures.

In one possible embodiment the panel consists of two corrugated sheets which are juxtaposed by the external faces of the corrugations which project from one of the faces of each sheet. Furthermore, it is possible that a sheet which constitutes the outward face of the panel is joined to at least one of the external faces of the assembly formed by the two corrugated sheets.

The two juxtaposed corrugated sheets may be arranged in such a way that their corrugations are mutually parallel.

It is also possible that the corrugations of one of the juxtaposed corrugated sheets are transversely arranged relative to those of the other.

In either of these cases, the panel may be covered on one or both faces by external sheets.

According to an embodiment of the invention, within each of said air chambers are formed sound resonators, consisting of rigid enclosures provided with an opening to connect them to a corresponding conduit, and which resonate at a given frequency determined by their geometry, giving rise to significant attenuation within a certain frequency range around the resonant frequency.

Advantageously, each of said sound resonators is formed by providing within the air chamber and transversely thereto, a cover provided with an axial orifice and a closed cover, such that the volume enclosed between both covers and the geometry of the orifice are suitable for filtering the desired frequencies.

To improve the properties of the resonators, the inner walls thereof are covered with a non-porous material, such as, for example, a sheet of aluminium.

Another feature consists in fitting a rigid sheet, advantageously perforated, to each of the surfaces which project from at least one of the faces of each corrugated sheet, to make it easier to fasten the panel to a wall or to other elements by means of screws, for example.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the present invention may be better understood, there follows a series of drawings which represent one example only of a practical embodiment of the panel which forms the object of the invention.

In said drawings, figure 1 is a cross sectional view of a basic panel used for the sound or heat insulation of enclosures; figure 2 is a similar view which shows a facing of the enclosure covered by means of the panel in question; figure 3 is a view similar to that of

figure 1 showing a panel based on the one previously described but more suitable for partition facings, doors and similar separations; figure 4 is a cross sectional view which shows a panel derived from those previously described and whose basic components are two juxtaposed corrugated sheets; figure 5 is a perspective view of a detail of a panel whose basic components are two juxtaposed corrugated sheets where the corrugations of one sheet are transversely arranged relative to those of the other; figure 6 is an exploded perspective view of the sound resonators according to the present invention in two adjacent air chambers; figure 7 is a sectional view of two resonators arranged in an air chamber between two corrugated sheets; figure 8 is a graph which demonstrates how the volume of the resonator affects the attenuation; and figure 9 is a perspective view, partially in section, of a corrugated sheet fitted with a perforated rigid layer.

DESCRIPTION OF A PREFERRED EMBODIMENT

According to the example described by the drawings, the heat-insulating and sound-insulating panel, which shall hereinafter be referred to by the general reference 1, consists of a corrugated sheet 2 made of an insulating material which can be easily shaped by moulding, pressing or any other conventional process. Said sheet can be made, for example, from suitably shaped fibre glass, textile fibre or other types of fibre, or from other materials such as moulded spongy or expanded plastic.

The sheet in question has a number of corrugations 3 which are trapezoidal in cross section, mutually parallel, regularly spaced, and which project from both faces of the sheet. In these corrugations the closed faces or bases 4 of each face of the sheet are coplanar, while the bases of one face are parallel to those of the opposite face.

The corrugations 2 give rise to longitudinal chambers 5 arranged between said corrugations.

To add to the firmness and finish of the panel, a sheet or plate 6 of a suitable material is provided on at least its external face. It can be a metallic plate, with or without perforations, a sheet of thermoplastic material, a layer of textile material or any other similar covering (figures 1 and 2).

It is possible to fit the panels 1 with a second sheet 7 on the face opposite that on which the sheet 6 is located (figure 3).

Sheets 2, 6 and 7 are joined together by any known means, for example glue, screws, staples or otherwise.

To increase the insulating capability of the panel which forms the object of the present invention, a panel has been devised consisting of two corrugated sheets 1 which are juxtaposed by the bases 4 of the corrugations 3 on one face of each sheet (figure 4).

In this case the corrugations 3 of one sheet 2 may be parallel to those of the other sheet (figure 4), or alternatively they may be arranged transversely thereto (figure 5).

In both of the cases mentioned the assembly formed by the two corrugated sheets may be covered on one or both faces by sheets 6 and 7.

It is possible to use only one insulating corrugated sheet 1, without any original covering sheet, although the most likely case is that the sheet 1 is provided with at least one sheet 6 on its outward face, either before or after fitting.

Compared to other panels used for insulating enclosures, the heat-insulating and sound-insulating panel of the present invention has the advantage that it forms a number of air chambers 5 through which must pass the sound waves or the thermal radiation coming from the space outside the enclosure to be insulated, having first eliminated any rigid surface which could constitute a direct transmitting medium for such waves or radiation, such that the insulating effect obtained is much greater than with currently known panels.

The structure of the panel which forms the object of the present invention is such that the panel exhibits distinct elastic anisotropy with regard to transverse movement and great rigidity in the longitudinal direction. As a result the panel has a structural strength capable of withstanding the support layer in the longitudinal direction, and is at the same time flexible in the transverse direction in order to hinder the transmission of sound vibrations and thermal radiation.

The panels described can be used to insulate the facings 8, the floor or the ceiling of pre-constructed enclosures (figure 2), or alternatively, by using the panels as facings and doors, to form sound insulated partitions and compartments (figure 3). In this case it is important to increase the rigidity and strength of the panels 1 by means of the sheet 7.

The panels 1 are fixed to the facings by conventional means such as screws, staples or otherwise, or by means of adhesive products.

It is worth underlining the fact that the possibility of increasing the insulating properties of enclosures by the use of the panels described does not imply an increase in cost relative to known panels.

Apart from the insulating function of the air chambers 5, they also constitute a means of locating conduits 9 for various services (water, heating, lighting, communications etc.) which can be hidden without the need to make channels in the masonry facings of the enclosure (figure 2).

One characteristic of the invention consists in forming a plurality of sound resonators within the air chambers which exist between the two sheets 2. To achieve this, covers 10, with an axial orifice 11, and completely closed covers 12, are provided transversely to the air chambers, as can be seen in explod-

ed view in figure 6.

In this way each pair of covers 10,12 together with the walls of the air chamber situated between them, form a sound resonator which filters some of the frequencies which come through the wall.

The sheets 2 are made of an insulating material and are therefore porous. To improve the properties of the resonators, the inner walls of the air chambers are covered with an impermeable material, such as a sheet of aluminium 13.

Figure 7 shows a sectional view of two resonators once the sheets 2 have been fitted with the covers 10,12 and the impermeable material 13.

The resonant frequency of the resonators, and therefore the frequency range which they can attenuate, depends on the geometry of the orifice 11 and the volume of the resonator, and therefore on the distance between the covers 10 and 12.

Figure 8 shows how the resonant frequency varies as a function of the length of the resonator. The continuous line shows the behaviour of a resonator with an inner length of 8cm (resonant frequency 154 Hz), and the broken line corresponds to a resonator of 6cm in length (resonant frequency 173 Hz).

As can be seen from the graph, an increase in inner sound pressure is produced in the resonators, and is very pronounced within a range of frequencies around the resonant frequency, having the effect of attenuating the vibrations corresponding to these frequencies which come through the panel.

Another feature of the present invention is shown in figure 9, and consists of providing the sheets 2 of each panel with a rigid layer 14, advantageously perforated, to make it easier to fix it to the wall, to a screen, to a door or to other elements.

This figure shows a corrugated sheet 2, partially cut away for greater clarity, which is fixed to the external sheet 6 which constitutes the outward face of the panel. Each of the surfaces which project from the sheet 2 are provided with a rigid layer 14 which may be embedded within the sheet as shown in the figure.

The rigid layer 14 gives the sheet 2 sufficient strength and rigidity to ensure that the screws 15 or other fixing elements are firmly fastened.

The perforations in the layers 14 make the sheet 2 easier to shape, since it is important that the flow of air or gaseous fluids through the sheet is not restricted in any way. Furthermore, the perforations can be used to advantage as threads into which the screws 15 can be driven.

It is also possible to fit each surface projecting from the sheet 2 with several perforated layers 14 in those areas in which they are most required.

Claims

1. A sound-insulating and heat-insulating panel used as a cover for enclosure screens and facings, as a partition or as a door, characterised in that it comprises a corrugated sheet (2), of a certain elasticity, with corrugations (3) having the bases of the same face coplanar to each other and the bases of one face parallel to those of the opposite face, at least one of the faces of the corrugated sheet being provided with a substantially flat sheet (6) which constitutes the outward face of the panel, both sheets (2, 6) defining a plurality of air chambers (5) giving rise to good sound and heat insulation, great stiffness in the longitudinal direction and a flexibility in the transverse direction which hinders the transmission of structural vibrations.
2. A panel according to claim 1, characterised in that the corrugated sheet (2) is covered by an external sheet (6) which constitutes the outward face of the panel, and by another stronger sheet (7) fixed to the opposite face thereof.
3. A panel according to claim 1, characterised in that it consists of two corrugated sheets (2) which are juxtaposed by the external faces of the corrugations (3) projecting from one of the faces of each sheet, and where a sheet (6) which constitutes the outward face of the panel is joined to at least one of the external faces of the assembly formed by the two corrugated sheets.
4. A panel according to claims 1 to 3, characterised in that the corrugations (3) of the juxtaposed corrugated sheets are mutually parallel.
5. A panel according to claims 1 to 3, characterised in that the corrugations (3) of one of the juxtaposed corrugated sheets are transverse to those of the other.
6. A panel according to claim 1, characterised in that within each of said air chambers are formed sound resonators.
7. A panel according to claim 6, characterised in that each of said acoustic resonators is formed so as to provide within the air chamber and transversely thereto, a cover (10) provided with an axial orifice (11) and a closed cover (12), such that the volume enclosed between both covers (10,12) and the geometry of the orifice (11) are suitable for filtering the desired frequencies.
8. A panel according to claims 6 or 7, characterised in that the inner walls of the resonators are cov-

ered with a non-porous material (13).

9. A panel according to claim 1, characterised in that each of the surfaces projecting from at least one of the faces of the corrugated sheet (2) is fitted with a rigid layer (14). 5

10. A panel according to claim 9, characterised in that said layer (14) is perforated.

10

15

20

25

30

35

40

45

50

55

5

FIG.1

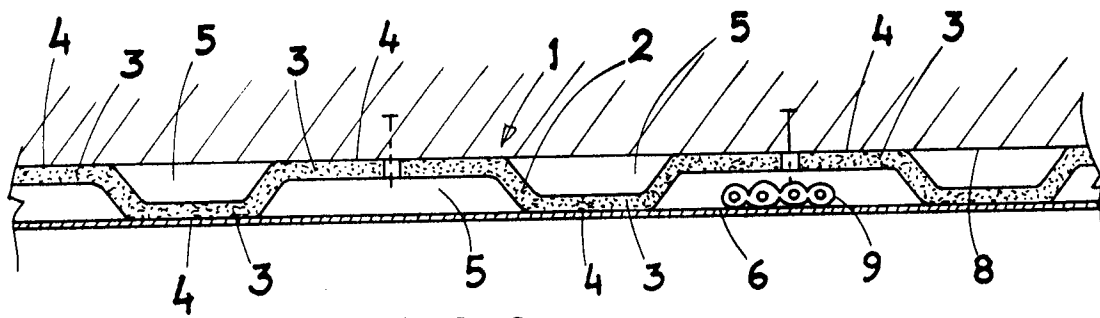
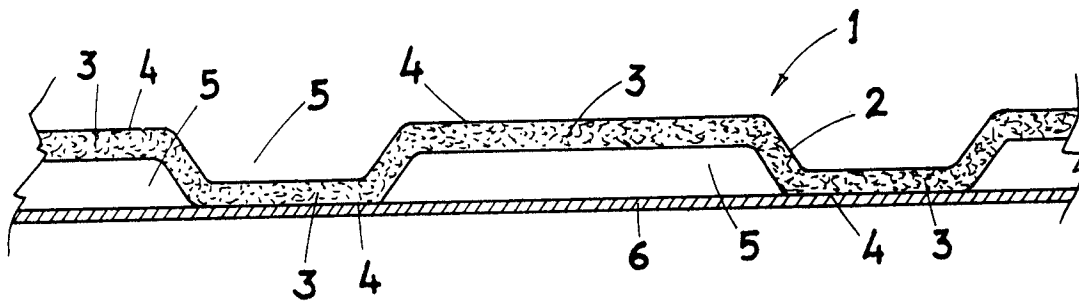


FIG.2

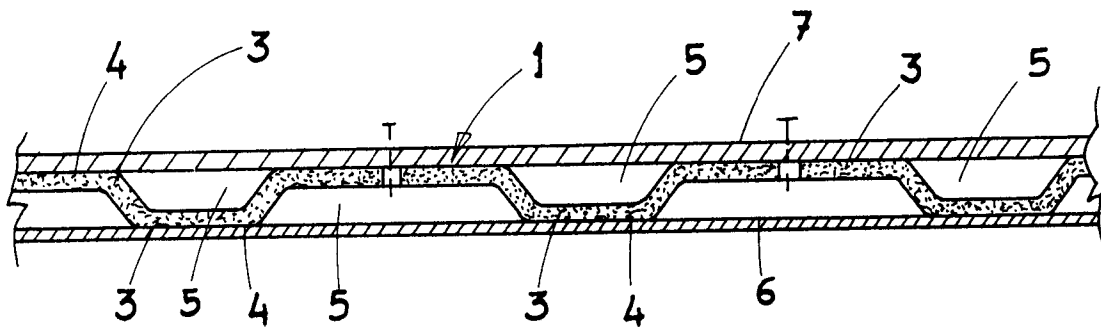


FIG.3

FIG. 4

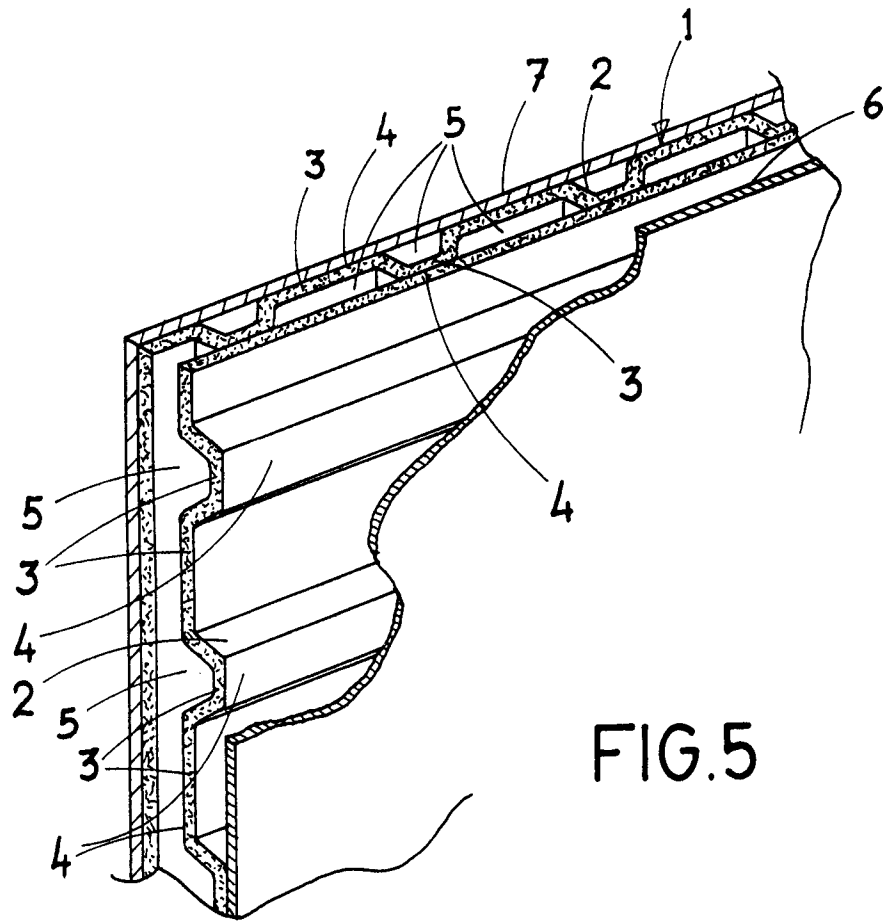
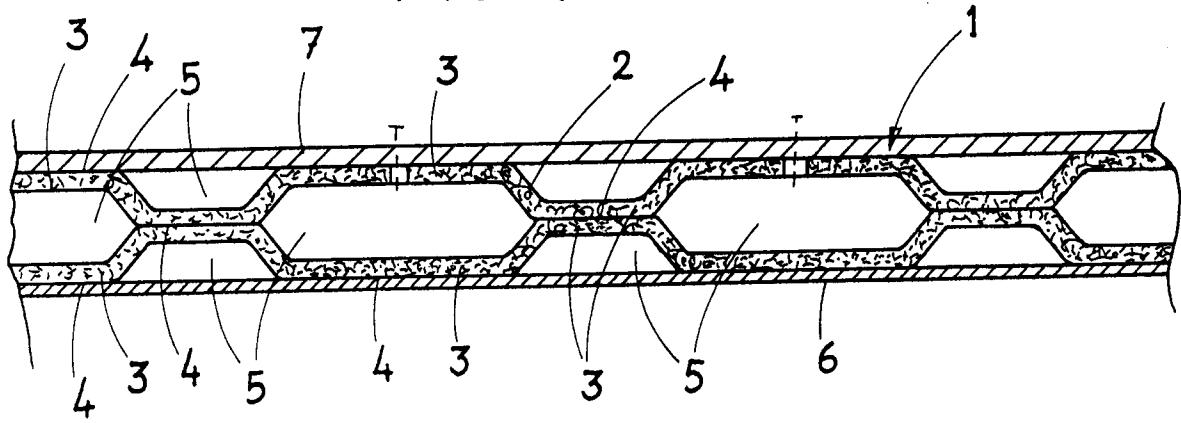


FIG. 5

FIG. 6

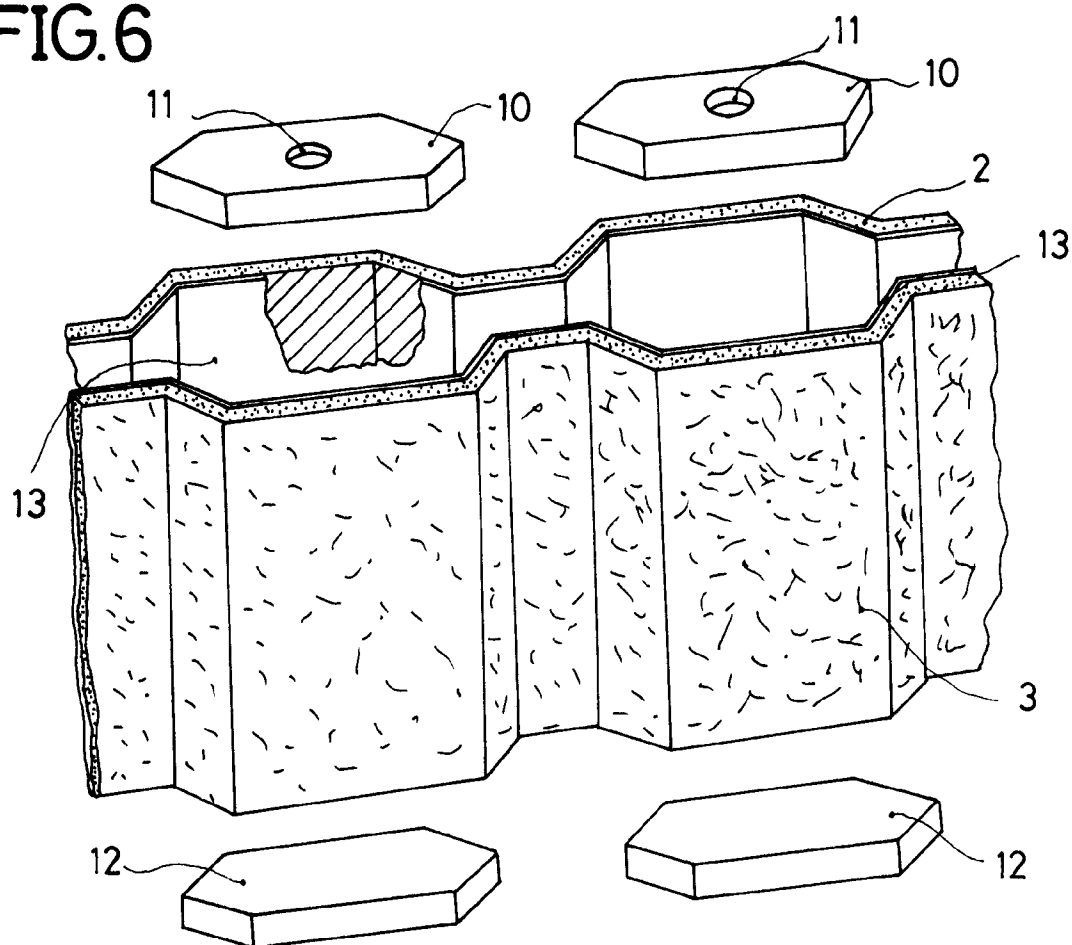
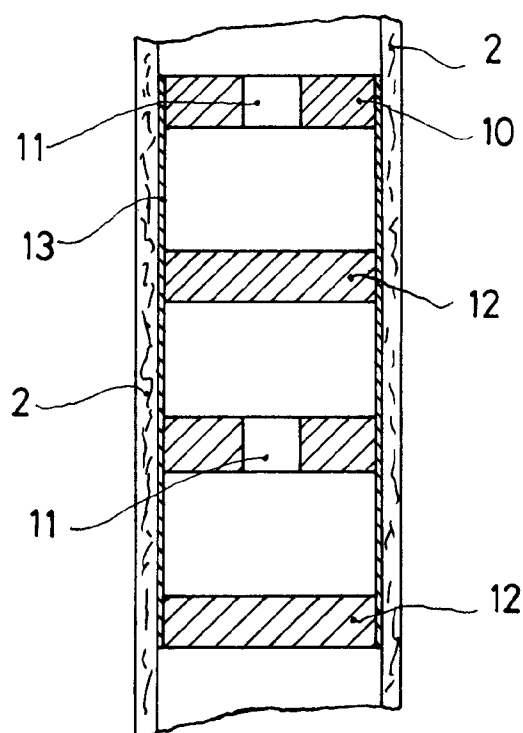
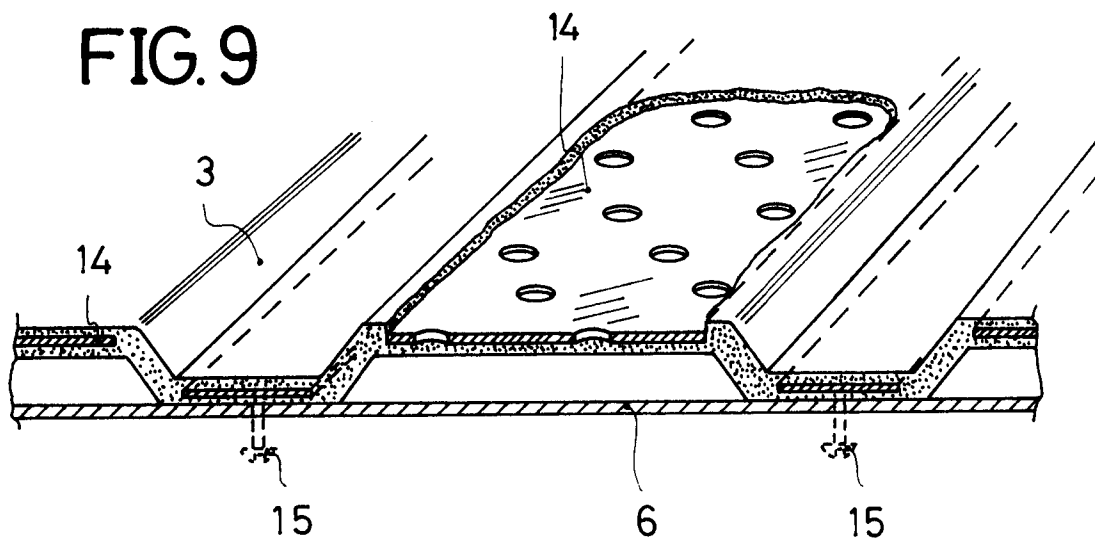
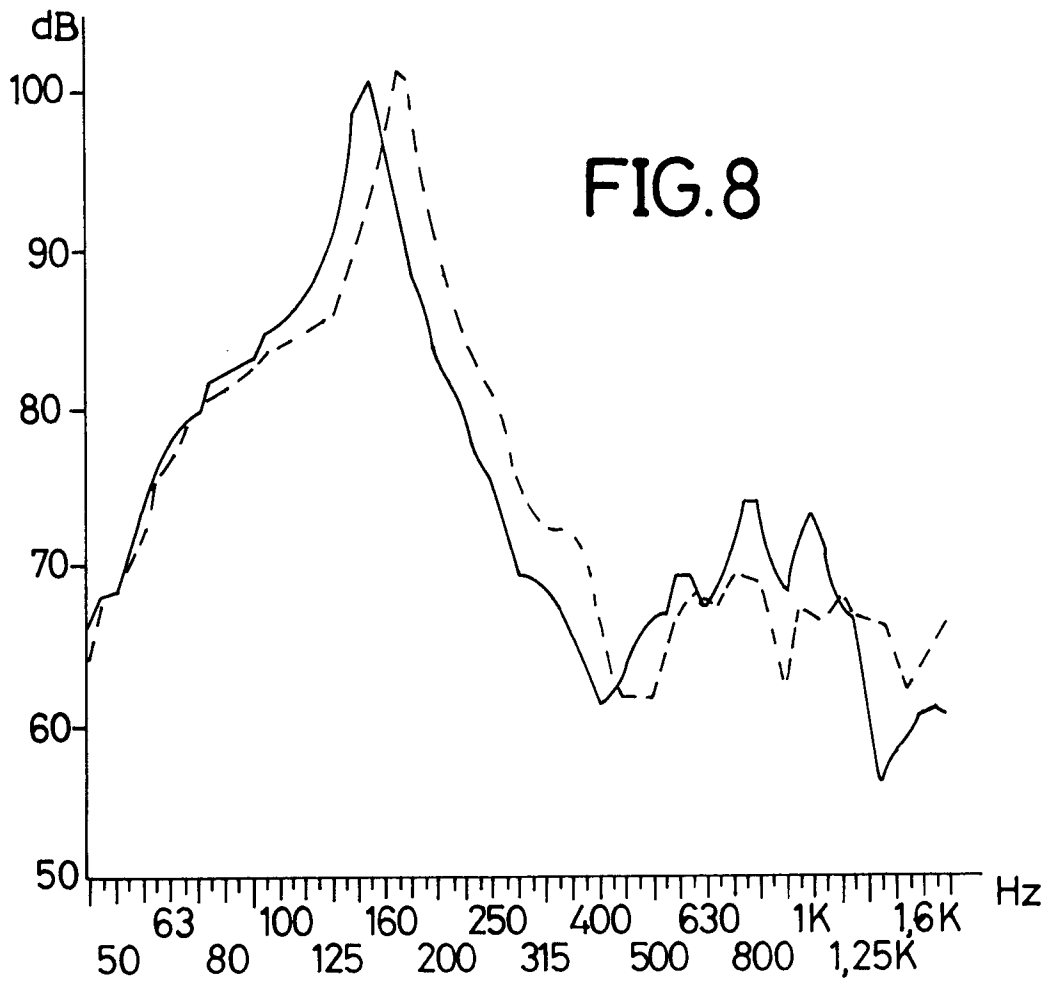


FIG. 7







European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 50 0123

Page 1

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.5)
X	AU-B-600 116 (BIALOWAS)	1-5	E04B1/90
Y	* page 3, line 17 - page 4, line 14 *	8-10	E06B5/20
	* page 5, line 1 - line 37; figures 1,2,5 *		

X	FR-A-776 649 (BRUGIER ET.AL.)	1-5	
	* page 2, line 14 - page 3, line 1; figures *		

Y	DE-A-3 337 090 (HOLZLEHNER)	8	
	* page 4, line 3 - page 5, line 8 *		
	* page 8, line 1 - line 5 *		
	* page 8, line 18 - page 9, line 10; figures 3,5,6 *		

Y	DE-A-2 937 389 (IRBIT HOLDING AG)	9,10	
	* page 5, line 8 - page 6, line 13; figures 2-4 *		

A	US-A-4 472 473 (DAVIS ET.AL.)	1,9	
	* column 1, line 52 - column 2, line 24 *		
	* column 3, line 5 - line 40; figures 1,2 *		

A	DE-A-1 264 021 (GRÜNZWEIG & HARTMANN A.G.)	6,7	E04B E04C E06B G10K
	* column 1, line 24 - line 41 *		
	* column 3, line 8 - line 20 *		

A	US-A-3 483 947 (SULEWSKY)	6,7	
	* column 1, line 28 - column 2, line 6; figure 1 *		

A	DE-A-2 744 382 (FRAUNHOFER-GESELLSCHAFT)	6,7	
	* page 6, line 31 - page 7, line 27 *		
	* page 9, line 5 - line 29; figures 3,9,10 *		

	--- -/--		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 DECEMBER 1992	Examiner HENKES R.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 50 0123
Page 2

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.5)
A	EP-A-0 296 690 (ZWAAN) * column 3, line 10 - line 55; figures * -----	6,7	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 DECEMBER 1992	Examiner HENKES R.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.82 (P0401)