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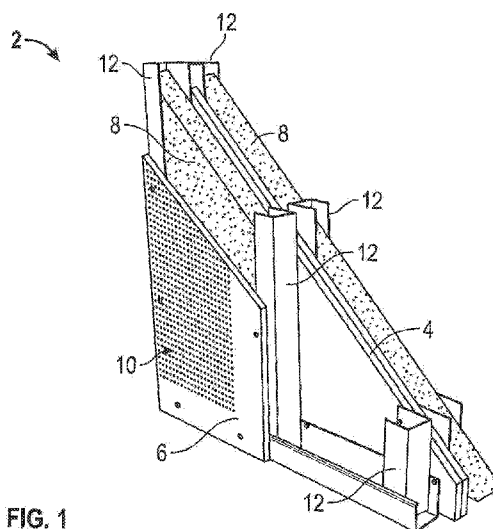


FIG. 1

(57) Abstract: The invention pertains to a wall panel 2 comprising a core board 4, first and second outer boards 6, and an insulation layer 8 disposed between the core board 4 and each of the first and second outer boards 6. The layers of boards 4, 6 and insulation 8, preferably have a symmetrical cross section in relation to the core board 4, and the core board 4 is preferably substantially thicker than one of the outer boards 6, at least one of the outer boards 6 comprising at least one perforated region 10. The invention also pertains to a method of assembling such a panel, and to a wall comprising a plurality of such panels.

ACOUSTIC WALL PANEL

TECHNICAL FIELD

The present invention pertains to an acoustic wall panel.

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BACKGROUND OF THE INVENTION

Wall panels have undergone a tremendous development during the last decades due to increasing demands regarding fire standards, acoustic and constructive mechanical properties.

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In US 4,538,390 is disclosed a wall system for inner walls used in residential houses. The wall panels comprise a gypsum plate, which is sandwiched between two outer panels made from glass fiber boards on each side. The panels of this wall system are assembled at the job site and would require a rather time consuming assembly process by skilled craftsmen, such as carpenters.

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In EP 0 260 028 is disclosed a fire resistant partition wall of a building. The disclosed partition wall comprises two internal gypsum partition boards disposed with a certain interval provided between them, and two external gypsum partition boards with a certain interval provided from the internal partition boards, so as to form three closed spaces. The middle space is filled with a sound insulating material, such as glass wool. The position of an internal partition portion disposed on one side does not coincide with the position of an internal partition portion disposed on the other side. A gypsum reinforcing board is adhered by an adhesive to the external face of the internal partition portion. The external partition boards are adhered by the adhesive to the reinforcing board in such a manner that an external partition portion is disposed between both ends of the reinforcing board.

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EP 1 007 803 pertains to a fire resistant wall structure comprising two rows of spaced vertical supports or studs (U-profiles), in which the rows of studs are separated by a central layer of fire resisting building board, to which the studs of both rows are secured, while the opposite outer faces of the studs are covered by respective facing layers of fire resisting building board secured to the studs. The thickness of the central layer is greater than that of either of the facing layers.

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- US 2008/0115442 relates to a composite sandwich wall panel comprising: two outer panels formed from fine sand gypsum or concrete, in each of which a glass fiber web is disposed at the center, and one central panel formed by the same materials as mentioned above. Between the central panel and each of the two outer panels is placed a polystyrene panel, which is bonded to the sand gypsum panels. The wall panel of the present invention has advantages of good performance of thermal insulation and sound insulation. Furthermore, it is fireproof as well as suitable for use as internal wall and external wall. The outer panels are however not perforated.
- 10 In WO 2011/123058 is disclosed a wall section for use as partition walls in apartment buildings and commercial buildings. The wall section comprises a ferro concrete member disposed between a first sideboard and a second sideboard. The first sideboard and the second sideboard may be mechanically fastened to the ferro concrete member. Alternatively, they may also be fastened to the ferro concrete member using chemical adhesives. A gap between the ferro concrete member and one or more of the first and the second sideboards may be filled with insulation material, such as rock wool. The sideboards may comprise any one of dry board, fiber glass, cement boards, or recycled dry boards.
- 20 WO 2009/105468 discloses a construction panel system comprising a first panel of one or more construction panels. The first construction panel comprises a core board, a first insulation layer (comprising rock wool) coupled to a first side of the core board, and a second insulation layer coupled to a second side of the core board, where the core board provides a structural integrity for the first panel, the first insulation layer covers the first side of the core board, and the second insulation layer covers the second side of the core board. It is disclosed that the core board could be a USB, plywood, etc., which is not fireproof. Furthermore, it is nowhere disclosed that the outer sideboards could be perforated.
- 30 In Scandinavian building legislation regarding schools and kindergartens, there is a demand for placing absorbers on the walls in order to get short reverberation times and less sound reflections. Often classrooms are built up against each other, which implies that the sound absorbers must to be placed on each side of one and the same wall. At the same time there is a demand for maximum air volume, i.e. thin walls, a level of sound reduction of 48 dB, fire ratings of minimum 60 minutes, and impact resistance.
- 35

Despite the various solutions already described in the art, there is a need for a wall panel for an inner wall of a building which fulfills all these requirements, i.e. which has improved sound dampening and fire resistant properties and at the same time does not take up more space than most conventional walls in the market today.

SUMMARY OF THE INVENTION

It is thus an object of the present invention to provide a wall construction, which is particularly well suited as a partition between school classes, and which fulfills the fire-proofing and sound dampening requirements to such walls.

According to the present invention, the above mentioned and other objects are fulfilled by a wall panel comprising a core board, first and second outer boards, an insulation layer disposed between the core board and each of the first and second outer boards, wherein at least one of the outer boards comprises at least one perforated region.

By using perforated outer panels, an increased reduction in reverberation is also achieved. This, as well as the fact that the panel is formed as a "double-wall" panel with insulation on each side of a core board, makes the panel according to the invention particularly well suited as a partition wall between school rooms, where reverberation from especially babble noise can be a significant problem.

According to one embodiment, the layers of boards and insulation have a symmetrical cross section in relation to the core board. Investigations performed by the applicant have surprisingly shown that a symmetrically layered construction of a wall panel has very good sound reduction properties, as explained above.

In a preferred embodiment of the wall panel according to the invention, the core board is substantially thicker than one of the outer boards.

In a further embodiment of the wall panel according to the invention, the perforated region covers a major part of the at least one outer board. For example, the perforated region covers more than 70% or more than 80% of the total area of said outer board.

In a further embodiment, the core board is composed of at least two boards, which are fastened to each other. These at least two boards are preferably fire retardant boards. In a further embodiment, these two boards may be composed of glass fiber reinforced gypsum. This offers a cheap way to provide a fire retardant panel, which is also easy
5 to work with.

Preferably, the core board and outer boards are separated from each other by a plurality of spacer elements, such as U-profiles, to which the boards are attached. Hereby the usage of pliable insulation materials for the insulation layers is achieved. The
10 spacer elements are preferably made from steel or aluminium.

In a further embodiment of the wall panel, the thickness of each of the insulating layers may be in the interval from 40 mm to 60 mm, preferably in the interval from 45 mm to 55 mm, such as 50 mm.
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In a further embodiment of the wall panel, the total thickness of the panel is in the interval from 110 mm to 180 mm, preferably in the interval from 125 mm to 165 mm, even more preferably in the interval from 140 mm to 150 mm, such as 145 mm.

20 In a further embodiment of the wall panel, each of the outer boards has a thickness in the interval from 10 mm to 20 mm, such as 15 mm. Preferably, the core board is at least twice as thick as each of the outer boards.

In a further embodiment of the wall panel, the core board has a thickness in the interval between 20 mm and 40 mm.
25

In a preferred embodiment of the wall panel, the outer boards are composed of gypsum.

30 In a further embodiment of the wall panel, the perforations are embodied as a plurality of holes, the number and size of which are chosen in dependence of the sound dampening and reverberation dampening requirements that apply in the place wherein the wall panel is to be used.

35 In a further embodiment of the wall panel, the insulation layers are composed of glass wool or rock wool.

In a further embodiment of the wall panel, said panel is manufactured as one single module ready to mount on its place of intended use. Hereby is achieved a panel which can be mounted in a less time consuming manner and thereby can effectively compete
5 in terms of cost, assembly time and skilled labor requirements as compared to current widespread construction methods.

In a further embodiment of the wall panel, the core board has a higher density than any of the two outer boards.
10

In a further embodiment of the wall panel, the core board has a fire rating of at least 60 minutes according to the standard EN 1364-1.

In a further embodiment of the wall panel, the whole panel has a fire rating of at least
15 60 minutes according to the standard EN 1364-1.

In a further embodiment of the wall panel, the whole panel has a fire rating of at least 90 minutes according to the standard EN 1364-1.

20 In a preferred embodiment, the wall panel has a weighted sound reduction index of at least 45 dB, preferably 48 dB.

According to the present invention, the above-mentioned and other objects are fulfilled by a wall comprising a plurality of wall panels according to any of the embodiments
25 described in the present patent specification.

According to the present invention, the above mentioned and other objects are also fulfilled by a method of manufacturing a wall panel according to the following steps:

- providing a core board,
- 30 - attaching spacer elements to each side of the core board,
- mounting an insulation layer so that each side of the core board is covered with the insulation layer, and
- attaching an outer board, having a perforated region, to the spacer elements, whereby each of the two insulation layers are sandwiched between the core board and
35 the outer board, on each side.

In one embodiment of the method, the step of providing the core board comprises the sub step of forming a core board by attaching at least two identical boards to each other in order to provide one single unit having a thickness, which is at least twice the thickness of the individual boards.

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In a further embodiment of the method, the at least two identical boards are fire retardant boards.

10 In a further embodiment of the method, each of the at least two boards are composed of glass fiber reinforced gypsum.

In a further embodiment of the method according to the invention, the spacer elements are made from steel or aluminium.

15 In a further embodiment of the method according to the invention, the combined thickness of each of the insulating layers is in the interval from 40 mm to 60 mm, preferably in the interval from 45 mm to 55 mm, such as 50 mm.

20 In a further embodiment of the method according to the invention, the total thickness of the panel is in the interval from 110 mm to 180 mm, preferably in the interval from 125 mm to 165 mm, even more preferably in the interval from 140 mm to 150 mm, such as 145 mm.

25 In a further embodiment of the method according to the invention, each of the outer boards has a thickness in the interval from 10 mm to 20 mm, such as 15 mm.

In a further embodiment of the method according to the invention, the core board is at least twice as thick as each of the outer boards.

30 In a further embodiment of the method according to the invention, the core board has a thickness in the interval between 20 mm to 40 mm.

In a further embodiment of the method according to the invention, the outer boards are composed of gypsum.

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In a further embodiment of the method according to the invention, the perforations are embodied as a plurality of holes, the number and size of which are chosen in dependence of the sound dampening and reverberation dampening requirements that apply in the place wherein the wall panel is to be used.

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In a further embodiment of the method according to the invention, the insulation layers are composed of glass wool or rock wool.

10 In a further embodiment of the method according to the invention, said panel is manufactured as one single module ready to mount on its place of intended use.

In a further embodiment of the method according to the invention, the core board has a higher density than any of the two outer boards.

15 In a further embodiment of the method according to the invention, the core board has a fire rating of at least 60 minutes according to the EN 1364-1.

In a further embodiment of the method according to the invention, the whole panel has a fire rating of at least 60 minutes according to the EN 1364-1.

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In a further embodiment of the method according to the invention, the whole panel has a fire rating of at least 90 minutes according to the EN 1364-1.

25 In a further embodiment of the method according to the invention, the panel has a weighted sound reduction index of at least 45 dB, preferably 48 dB.

BREIF DESCRIPTION OF THE DRAWINGS

30 A further understanding of the nature and advantages of the present invention may be realized by reference to the remaining portions of the specification and the drawings. In the following, preferred embodiments of the invention are explained in more detail with reference to the drawings, wherein:

35 Fig. 1 shows an embodiment of a partial view of an embodiment of a wall panel according to the invention,

Fig. 2 shows a cross section of an embodiment of a panel according to the invention,

Fig. 3 shows how spacer elements are mounted on a core board,
Fig. 4 shows how spacer elements are mounted on a core board, and
Fig. 5 shows the results of certified fire testing of a panel according to the invention.

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DETAILED DESCRIPTION

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. The invention may, however, be embodied in different forms and should not be
10 construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like reference numerals refer to like elements throughout. Like elements will, thus, not be described in detail with respect to the description of each figure.

15

Fig. 1 shows an embodiment of a partial view of an embodiment of a wall panel 2 according to the invention. In the illustration, all essential parts – as well as optional parts – of the wall panel 2 are visible. The illustrated wall panel 2 comprises a core board 4, first and a second outer boards 6 (of which only one is visible), an insulation layer 8
20 disposed between the core board and each of the first and second outer boards 6, wherein the layers of boards 4, 6 and insulation 8 have a symmetrical cross section in relation to the core board 4, wherein the core board 4 is substantially thicker than one of the outer boards 6, and wherein at least one of the outer boards comprises at least one perforated region 10.

25

The core board 4 and outer boards 6 are separated from each other by a plurality of spacer elements 12, to which the boards 4, 6 are attached. These spacer elements 12 are in the illustrated embodiment asymmetric U-profiles. Hereby the usage of pliable insulation materials for the insulation layers 8 is achieved. The spacer elements 12 are
30 preferably made from steel or aluminium. The illustrated insulation layers 8 are composed of glass wool. However, alternatively, rock wool may be used.

Fig. 2 shows a cross section of an embodiment of a panel 2 according to the invention. The panel 2 is symmetrical in relation to a plane, A, extending through the middle of
35 the core board 4 and further being parallel to the core board 4.

The thickness of each of the insulating layers 8 is in the illustrated embodiment 50 mm, and the total thickness of the panel 2 is 145 mm. Scientific tests (reported below) have shown that this choice of dimensions is an optimal tradeoff between all sound absorption and reverberation properties on one hand, and on the other hand the desire
5 to provide as thin walls as possible in order to increase the free space within the building, in which the panel 2 is to be used.

In the illustrated embodiment of the wall panel 2, the outer boards 6 are composed of gypsum, and the perforations 10 are embodied as a plurality of holes, the number and
10 size of which are chosen in dependence of the sound dampening and reverberation dampening requirements that apply in the place wherein the wall panel 2 is to be used.

Fig. 3 and 4 show how the spacer elements 12 are mounted on the core board 4. In the illustrated embodiment, the core board 4 is composed of two boards 14, which are
15 fastened to each other, for example by a plurality of screws. These two boards 14 are preferably fire retardant boards 14, which are composed of glass fiber reinforced gypsum. This offers a cheap way to provide a fire retardant panel 2, which is also easy to work with. The illustrated boards 14 have a thickness of 12.5 mm and a density of 1358 kg per cubic meters. In the illustrated embodiment, the outer boards 6 have the
20 same thickness as the boards 14, but have a lower density.

The illustrated spacer elements 12 are embodied as asymmetric U-profiles, wherein one 20 of the flanges is longer than the other 22. The spacer element 12 is fastened to the core board 4 by a screw 16, which is screwed into the long flange 20 of the spacer
25 element 12. Then – as illustrated in Fig. 4 – another spacer element 12 is fastened to the other side of the core board 4. Due to the asymmetry of the spacer elements 12, the outer end 24 of the long flange 20 of one of the spacer elements 12 is displaced relative to the other spacer element 12 by a distance D when the two spacer elements 12 are aligned, such that the centerline 18 through the middle of the short flange 22 of
30 both of the spacer elements 12 is perpendicular to the core board 4.

In a preferred embodiment, the illustrated panel 2 is manufactured as one single module ready to mount on its place of intended use. Hereby is achieved a panel 2 which may be mounted in a less time consuming manner, and thereby may effectively com-
35 pete in terms of cost, assembly time and skilled labor requirements as compared to the current widespread construction methods.

TEST RESULTS

A series of tests on a preferred embodiment of a panel 2 discussed above and shown
5 in the Figures 1-4 has been performed on behalf of the applicant.

Fire tests

A series of certified fire tests was performed by DBI (*Dansk Brand- og Sikringsteknisk
Institut*) in accordance with the standard EN 1364-1. The results can be seen in Fig. 5,
10 which shows average temperature versus test time in minutes.

The results regarding Integrity failure:

- After 89 minutes of testing the cotton wool pad was ignited.
- During testing no sustaining flames occurred.
- 15 - During test no through-going opening occurred where a 6 mm gap gauge could pass
for more than 150 mm.
- During test no through-going opening occurred where a 25 mm gap gauge could
pass.

20 Insulation failure occurred at 89 minutes (due to failure of integrity), and during testing
the maximum temperature rise did not exceed 180 degrees Celsius, and the average
temperature did never exceed 140 degrees Celsius.

The conclusion of the fire testing was that the panel easily passed a fire rating of 60
25 minutes according to the EN 1364-1, and in fact was very close to reach a rating of 90
minutes, which would probably have been achieved if rock wool were used instead of
glass wool.

Sound reduction tests

30 A series of 3 sound reduction tests was conducted by Delta Laboratories, and the re-
sults are reported in the table below. In the first test, 100% of the outer surfaces of the
wall panel were covered with perforations on both sides. In the second test, 54% of the
outer surfaces were perforated on both sides of the panel, and in the third test, 8% of
the surface of the panel were covered with perforations on both sides. For each series
35 of tests the weighted sound reduction index R'w was calculated. As can be seen from
these measurements, a very good performance regarding sound reduction was

achieved. Additionally, sound absorption values were determined. These values (α_w - values) ranged from 0.65 – 0.95, and the corresponding noise reduction coefficients ranged from 0.6 – 0.85. The Noise Reduction Coefficient (commonly abbreviated NRC) is a scalar representation of the amount of sound energy absorbed upon striking a particular surface. Accordingly, an NRC of 0 indicates perfect reflection, and an NRC of 1 indicates perfect absorption.

Frequency [Hz]	1	2	3
50	22.2	21.9	22.1
63	31.8	29.5	25.1
80	25.0	19.8	16.0
100	27.0	23.5	18.8
125	28.8	29.4	27.3
160	29.8	35.2	40.4
200	34.2	39.8	51.3
250	40.8	45.4	54.7
315	46.9	50.3	59.4
400	51.2	54.2	60.9
500	54.9	57.5	63.6
630	58.7	61.6	67.5
800	61.1	63.2	66.2
1000	64.0	65.6	67.3
1250	65.0	65.7	66.7
1600	65.0	65.9	67.1
2000	67.3	68.3	68.7
2500	67.4	65.7	65.6
3150	67.0	65.0	63.2
4000	65.9	66.7	66.4
5000	69.1	71.1	71.7
Rw	51.4	54.0	55.5

The NRC is the arithmetic average rounded to the nearest multiple of 0.05 of the sound absorption coefficients for a specific material determined at the one-third octave band at the center frequencies of 250, 500, 1000 and 2000 Hz. The sound absorption coefficients of materials are commonly determined through the use of standardized testing procedures, such as ASTM C423, which are used to evaluate the sound

absorption of materials in eighteen one-third octave frequency bands with center frequencies ranging from 100 Hz to 5000 Hz. Sound absorption coefficients used to calculate NRC are commonly determined in reverberation rooms of qualified acoustical laboratory test facilities using samples of the particular materials of specified size and
5 appropriate mounting.

NRC is most commonly used to rate general acoustical properties of acoustic ceiling tiles, baffles, banners, office screens, and acoustic wall panels. It is occasionally used to rate floor coverings and construction materials. NRC is intended to be a simplified
10 acoustical rating of room construction and finish materials when the acoustic objectives of the space are less than sensitive.

Accordingly, it has been verified by the above-mentioned tests that the requirements set forth in current Scandinavian building legislation regarding schools and kinder-
15 gartens are fulfilled to the fullest by a wall panel according to the invention, without compromising the total thickness of the wall, i.e. a rather thin wall panel (no thicker than standard walls in school buildings today), having a sound reduction index of at least 48 dB and fire ratings of minimum 60 minutes.

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LIST OF REFERENCE NUMBERS

In the following is given a list of reference numbers that are used in the detailed description of the invention.

5	2	wall panel,
	4	core board,
	6	outer boards,
	8	insulation layers,
	10	perforations,
10	12	spacer element,
	14	fire retardant boards,
	16	screw,
	18	centerline,
	20	long flange of spacer element,
15	22	short flange of spacer element, and
	24	outer end of long flange of spacer element.

CLAIMS

1. A wall panel (2) comprising a core board (4), first and second outer boards (6), an insulation layer (8) disposed between the core board (4) and each of the first and second outer boards (6), wherein at least one of the outer boards (6) comprises at least one perforated region (10).
2. A wall panel (2) according to claim 1, wherein the layers of boards (4, 6) and insulation (8) have a symmetrical cross section in relation to the core board (4).
3. A wall panel (2) according to claim 1 or 2, wherein the core board (4) is substantially thicker than one of the outer boards (6).
4. A wall panel (2) according to claim 1, 2 or 3, wherein the perforated region (10) covers a major part of the at least one outer board (6).
5. A wall panel (2) according to any of the preceding claims, wherein the core board (4) is composed of at least two boards (14), which are fastened to each other.
6. A wall panel (2) according to claim 5, wherein the at least two boards (14) are fire retardant boards.
7. A wall panel (2) according to claim 5 or 6, wherein each of the at least two boards (14) is composed of glass fiber reinforced gypsum.
8. A wall panel (2) according to any of the preceding claims, wherein the core board (4) and outer boards (6) are separated from each other by a plurality of spacer elements (12), such as U-profiles, to which the boards (4, 6) are attached.
9. A wall panel (2) according to claim 8, wherein the spacer elements (12) are made from steel or aluminium.
10. A wall panel (2) according to any of the preceding claims, wherein the thickness of each of the insulating layers (8) is in the interval from 40 mm to 60 mm, preferably in the interval from 45 mm to 55 mm, such as 50 mm.

11. A wall panel (2) according to any of the preceding claims, wherein the total thickness of the panel (2) is in the interval from 110 mm to 180 mm, preferably in the interval from 125 mm to 165 mm, even more preferably in the interval from 140 mm to 150 mm, such as 145 mm.
- 5 12. A wall panel (2) according to any of the preceding claims, wherein each of the outer boards (6) has a thickness in the interval from 10 mm to 20 mm, such as 15 mm.
13. A wall panel (2) according to any of the preceding claims, wherein the core board
10 (4) is at least twice as thick as each of the outer boards (6).
14. A wall panel (2) according to any of the preceding claims, wherein the core board (4) has a thickness in the interval between 20 mm and 40 mm.
- 15 15. A wall panel (2) according to any of the preceding claims, wherein the outer boards (6) are composed of gypsum.
16. A wall panel (2) according to any of the preceding claims, wherein the perforations
20 (10) are embodied as a plurality of holes, the number and size of which are chosen in dependence of the sound dampening and reverberation dampening requirements that apply in the place wherein the wall panel (2) is to be used.
17. A wall panel (2) according to any of the preceding claims, wherein the insulation
25 layers (8) are composed of glass wool or rock wool.
18. A wall panel (2) according to any of the preceding claims, wherein said panel (2) is manufactured as one single module ready to mount on its place of intended use.
19. A wall panel (2) according to any of the preceding claims, wherein the core board
30 (4) has a higher density than any of the two outer boards (6).
20. A wall panel (2) according to any of the preceding claims, wherein the core board (4) has a fire rating of at least 60 minutes according to the EN 1364-1.
- 35 21. A wall panel according to any of the preceding claims, wherein the whole panel has a fire rating of at least 60 minutes according to the EN 1364-1.

22. A wall panel (2) according to any of the preceding claims, wherein the whole panel (2) has a fire rating of at least 90 minutes according to the EN 1364-1.
- 5 23. A wall panel (2) according to any of the preceding claims, having a weighted sound reduction index of at least 45 dB, preferably 48 dB.
24. A wall comprising at least one wall panel (2) according to any of the claims 1-23.
- 10 25. A method of manufacturing a wall panel (2) according to the steps of:
- providing a core board (4),
 - attaching spacer elements (12) to each side of the core board (4),
 - mounting an insulation layer (8) so that each side of the core board (4) is covered with the insulation layer (8), and
 - 15 - attaching an outer board (6), having a perforated region (10), to the spacer elements (12), whereby each of the two insulation layers (8) is sandwiched between the core board (4) and the outer board (6) on each side.
26. The method according to claim 25, wherein the step of providing the core board (4) comprises the sub step of forming a core board (4) by attaching at least two identical
20 boards (14) to each other in order to provide one single unit having a thickness, which is at least twice the thickness of the individual boards (14).
27. The method according to claim 26, wherein the at least two identical boards (14)
25 are fire retardant boards (14).
28. The method according to claim 26 or 27, wherein each of the at least two boards (14) is composed of glass fiber reinforced gypsum.
- 30 29. The method according to any of the claims 25-28, wherein the spacer elements (12) are made from steel or aluminium.
30. The method according to any of the claims 25-29, wherein the thickness of each of the insulating layers (8) is in the interval from 40 mm to 60 mm, preferably in the inter-
35 val from 45 mm to 55 mm, such as 50 mm.

31. The method according to any of the claims 25-30, wherein the total thickness of the panel (2) is in the interval from 110 mm to 180 mm, preferably in the interval from 125 mm to 165 mm, even more preferably in the interval from 140 mm to 150 mm, such as 145 mm.

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32. The method according to any of the claims 25-31, wherein each of the outer boards (6) have a thickness in the interval from 10 mm to 20 mm, such as 15 mm.

33. The method according to any of the claims 25-32, wherein the core board (4) is at least twice as thick as each of the outer boards (6).

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34. The method according to any of the claims 25-33, wherein the core board (4) has a thickness in the interval between 20 mm and 40 mm.

35. The method according to any of the claims 25-34, wherein the outer boards (6) are composed of gypsum.

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36. The method according to any of the claims 25-35, wherein the perforations (10) are embodied as a plurality of holes, the number and size of which are chosen in dependence of the sound dampening and reverberation dampening requirements that apply in the place wherein the wall panel (2) is to be used.

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37. The method according to any of the claims 25-36, wherein the insulation layers (8) are composed of glass wool or rock wool.

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38. The method according to any of the claims 25-37, wherein said panel is manufactured as one single module ready to mount on its place of intended use.

39. The method according to any of the claims 25-38, wherein the core board (4) has a higher density than any of the two outer boards (6).

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40. The method according to any of the claims 25-39, wherein the core board (4) has a fire rating of at least 60 minutes according to the EN 1364-1.

41. The method according to any of the claims 25-40, wherein the whole panel (2) has a fire rating of at least 60 minutes according to the EN 1364-1.

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42. The method according to any of the claims 25-41, wherein the whole panel (2) has a fire rating of at least 90 minutes according to the EN 1364-1.
- 5 43. The method according to any of the claims 25-42, wherein the panel (2) has a weighted sound reduction index of at least 45 dB, preferably 48 dB.

1/3

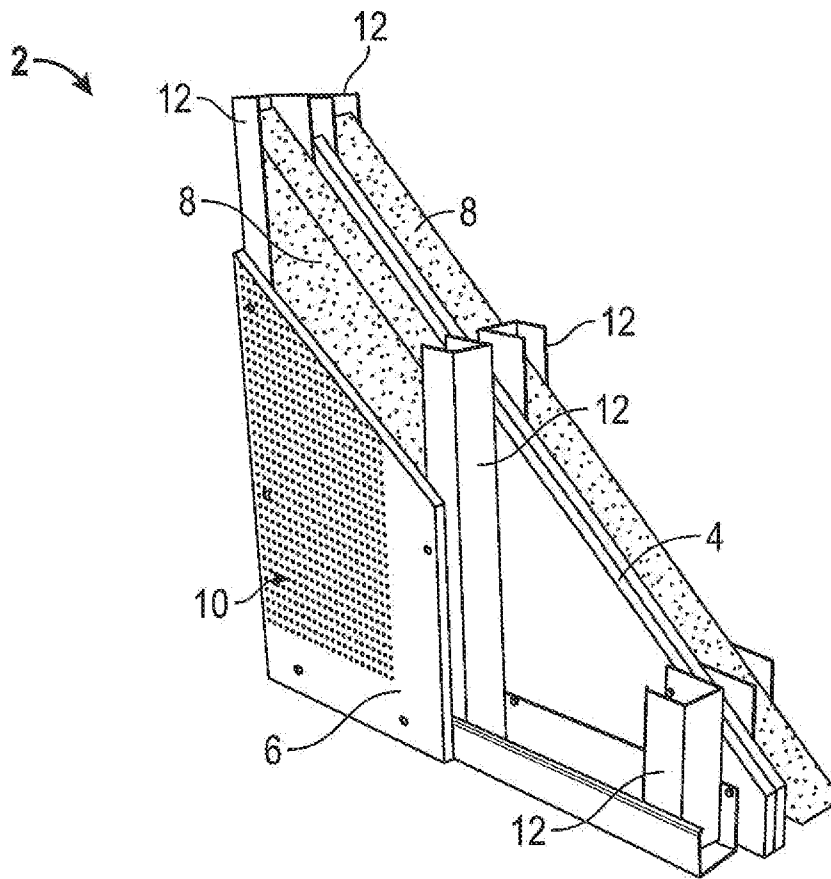


FIG. 1

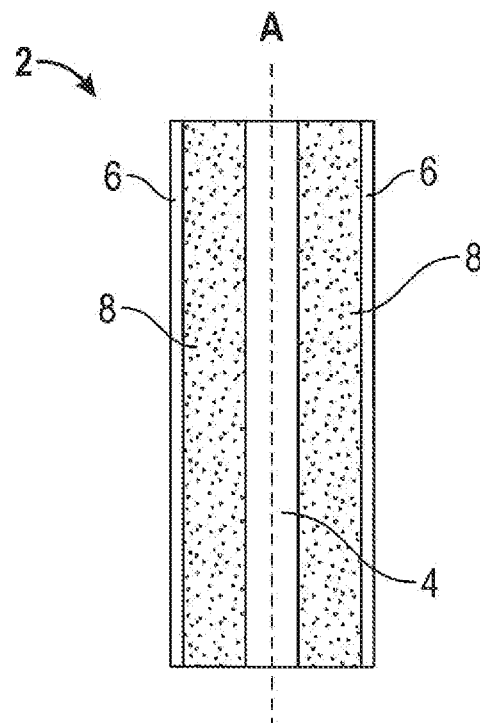


FIG. 2

2/3

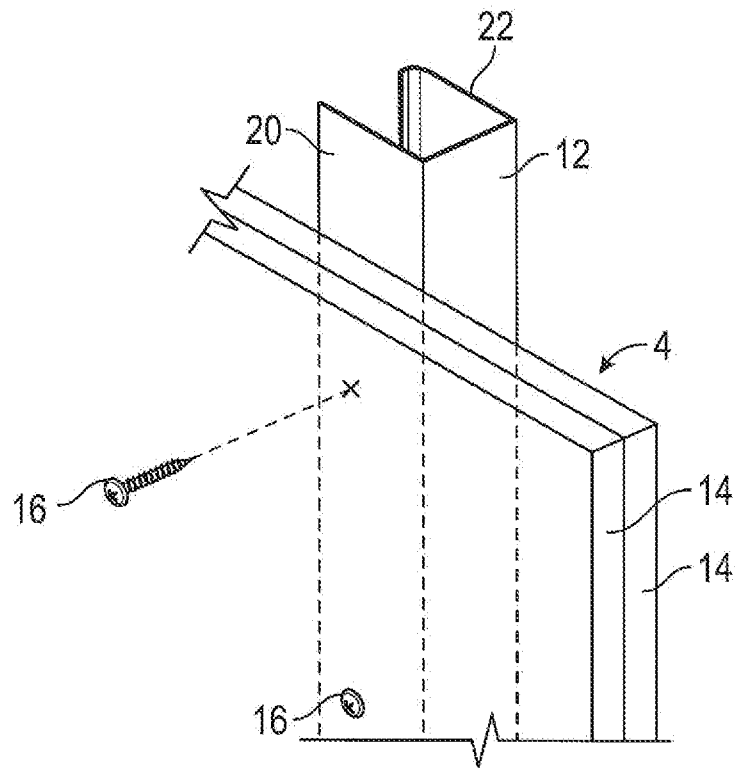


FIG. 3

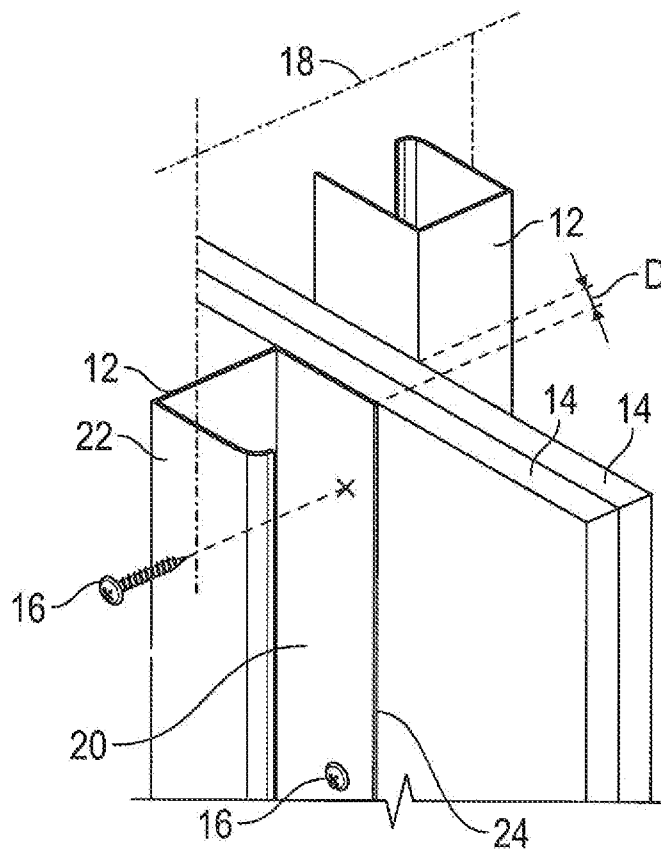


FIG. 4

3/3

Average

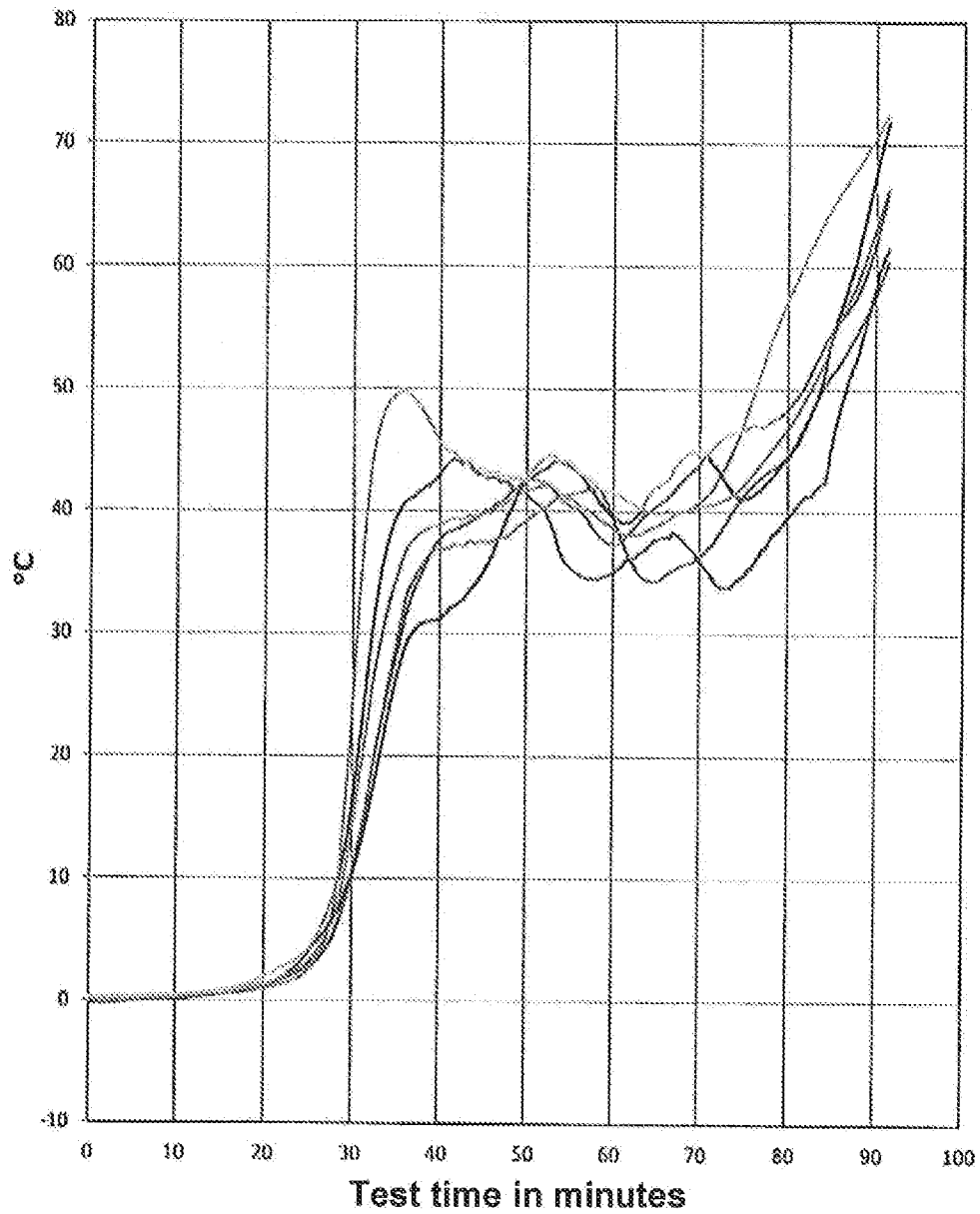


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2012/057188

A. CLASSIFICATION OF SUBJECT MATTER

INV. E04B1/86 E04B2/74 E04C2/284
ADD. E04C2/04 E04B2/78

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E04B E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	BE 665 063 A (UNITED STATES GYPSUM COMPANY [US]) 1 October 1965 (1965-10-01) page 2, line 25 - page 9, line 1; figure 1 -----	1-43
X	FR 893 678 A (YVES BOUILLON [FR]) 11 August 1944 (1944-08-11) page 2, line 6 - page 3, line 64; figures 1-7 ----- -/--	1-43

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

6 September 2013

Date of mailing of the international search report

17/09/2013

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INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2012/057188

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 5 009 043 A (KURRASCH ANDREW J [US]) 23 April 1991 (1991-04-23)</p> <p>column 2, line 47 - column 6, line 23; figures 1,2</p> <p>-----</p>	<p>1,2,4,5, 10-12, 14, 16-18, 20-25, 30-32, 34, 36-38, 40-43</p>

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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