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(54) **FIRE CLASSIFIED BUILDING BOARD AND ITS USE, AND PARTITION WALL STRUCTURE**

(57) A building board, which comprises a core material layer and at least one surface layer arranged on a first planar surface of the core material layer. The core material layer comprises inorganic binder and 1-20 weight-% of crushed foam insulation calculated from the

total mass of the binder and crushed foam insulation, and the surface layer comprises one or more reinforcement layers, and/or a metal board and/or a composite board comprising metal. The building board can be used in partition wall structures.

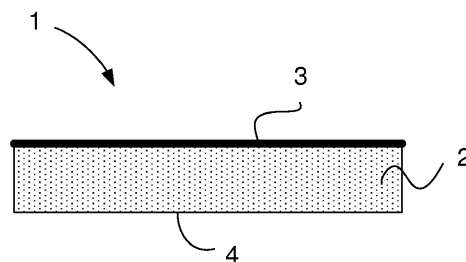


Fig. 1a

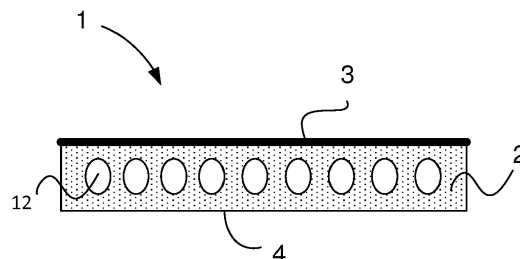


Fig. 1b

DescriptionObject of the invention

5 **[0001]** The invention relates to a fire classified building board according to the enclosed independent claim and its use. The invention additionally relates to a partition wall structure, which comprises a board structure according to the invention.

Background of the invention

10 **[0002]** Light partition walls mean structures, which are between two rooms. Light partition walls are generally not load-bearing structures. Traditionally, partition wall structures use for example a combination of plasterboards and a frame structure. Light partition wall structures typically aim for good soundproofing properties and in some cases also fire safety sets certain requirements for the partition wall structures. In fire classified structures, such as fire classified partition wall
15 structures, a core layer formed from a mineral wool based insulation material is conventionally used, and separate surface layers, such as one or more gypsum boards, are arranged on both of its surfaces. This typically requires several work stages and is time-consuming.

Object and description of the invention

20 **[0003]** An object of the present invention is to reduce or even eliminate the above-mentioned problems appearing in prior art.

[0004] An object of the present invention is to present a new type of fire classified building board, which in addition to its fireproofing properties makes possible good heat insulation and soundproofing properties.

25 **[0005]** An object of the invention is additionally to present a new way of implementing a partition wall structure between rooms, which makes possible soundproofing, heat insulation and fireproofing properties in the partition wall structure.

[0006] An object of the present invention is also to present a partition wall structure, which is easy and simple to implement between rooms.

30 **[0007]** To achieve this object, the building board and partition wall structure according to the invention are primarily characterized in what is presented in the characterising parts of the independent claims.

[0008] The other, dependent claims present some preferred embodiments of the invention.

35 **[0009]** A typical building board according to the invention comprises a core material layer and at least one surface layer arranged substantially over the entire surface of at least the first planar surface of the core material layer. The core material layer of the building board according to the invention comprises inorganic binder and 1-20 weight-% of crushed foam insulation calculated from the total mass of the core material layer, and the surface layer arranged on the first planar surface of the core material layer comprises one or more reinforcement layers and/or a metal board and/or a composite board comprising metal.

40 **[0010]** A typical partition wall structure according to the invention is arranged between two rooms, the height direction of which partition wall structure defines the height of the room. A typical partition wall structure according to the invention comprises

- a first and second wall board, which are building boards according to the invention, and which are continuous in the height direction of the room,
- a fixing profile, with which the wall boards are fixed to the floor structures of the room by the bottom part of the wall board, so that the fixing profile settles at least partly inside the wall board, and
- fastenings, with which the wall boards are fixed to the ceiling structures of the room by the upper part of the wall board.

50 **[0011]** The structure of the building board according to the invention is primarily based on the material of the core material layer, which ensures a desired fire classification for the building board. The core layer of the building board according to the invention comprises foam insulation material, the fireproofing properties of which have been improved by using it in crushed form and mixed with an inorganic binder. Thus, the building board according to the invention makes possible a structure which fulfills fire safety criteria. The material of the core material layer of the building board according to the invention also makes possible sufficient soundproofing and heat insulation properties for the building board, especially when using the building board in light partition wall structures. The building board according to one embodiment
55 of the invention comprises one or more reinforcement layers arranged on the first planar surface of the core material layer, whereby the building board with regard to its properties is sufficiently strong for use for example in partition wall structures.

[0012] According to one advantageous embodiment of the invention the fireproofing properties of the building board

according to the invention can be improved by arranging a metal board and/or a composite board comprising metal on the first planar surface of the core material layer. The building board according to the invention does not require a metal board and/or a composite board comprising metal on both surfaces of the core material layer, as sufficient fireproofing properties are achieved by arranging a metal board and/or a composite board comprising metal on only one of the surfaces of the core material layer. No metal board and/or composite board comprising metal is required on the second planar surface of the building board according to the invention, whereby the building board can also be made significantly lighter.

[0013] The fire classified building board according to the invention prevents and/or slows down heat generated in a burning room and fire from spreading outside the burning room through the structure. Typically, the building board according to the invention is used in partition wall structures, but the building board according to the invention can also be used in other applications, where fire classified structures are required. Some exemplary applications, in addition to buildings, can be among others other structures requiring good fire safety, such as structures of ships and other vehicles or facade structures of buildings or other structures requiring fire classification. The building board according to the invention can be used in wall structures, floor structures and/or ceiling structures. The building board according to the invention can especially be used in partition wall structures as a wall element or wall board.

[0014] The partition wall structure according to the invention is based on the use of the building boards according to the invention as wall boards, where fixing profiles are used for fixing them, whereby it is possible to implement a light partition wall structure easily and quickly. The building boards according to the invention are structurally sufficiently strong and it has now been found that they can be used to implement a partition wall structure, where the building boards according to the invention used as wall boards are continuous over the entire height of the room. In the wall structure a continuous fixing profile is arranged in the bottom end of the wall boards, which stiffens the structure. The partition wall structure according to the invention is a so-called light wall structure, which is not a load-bearing structure. Additionally, the material of the wall boards makes possible good soundproofing properties and fireproofing properties. The partition wall structure according to the invention can be used to replace a traditional combination of gypsum boards and a frame structure in partition wall structures. The building board formed from a combination of crushed foam insulation and a ceramic binder according to the invention is also safer with regards to moisture technology for use as a wall board than a traditional gypsum board structure.

[0015] Fire classifications required from the structures and building materials depend on the application, but the building board according to the invention has been found to possess fireproofing properties, which fulfill fire classifications defined by different standards. By altering the materials and proportions of materials forming the core material layer of the building board according to the invention, building boards fulfilling the requirements of different fire classes can easily and cost-effectively be formed. A typical building board according to the invention is a fire class EI30 (testing method standard EN 1364-1:2015 and classification standard EN 13501-2:2016) building board.

Brief description of the drawings

[0016] In the following, the invention will be described in more detail with reference to the appended drawings, in which

Figs. 1a and 1b show as a schematic drawing building boards according to some embodiments of the invention,
 Figure 2 shows a partition wall structure according to an embodiment of the invention,
 Figure 3 shows a partition wall structure according to a second embodiment of the invention,

Detailed description of the invention

[0017] The core material layer of the building board according to the invention comprises inorganic binder and crushed foam insulation. The materials of the core material layer are typically selected so that the building board attains a desired fire class. A surface layer has been arranged on the first planar surface of the core material layer of the building board according to the invention, which surface layer comprises one or more reinforcement layers, and/or a metal board and/or a composite board comprising metal.

[0018] The crushed foam insulation used in the core material layer can comprise any cellular plastic suitable for the purpose. Crushed foam insulation can also be called crushed cellular plastic or crushed cellular plastic insulation. Cellular plastic is a generic name for different plastics, the final structure of which has been achieved by expanding with a propellant. Cellular plastics are usually used as insulation materials, such as insulation boards formed from cellular plastics. The core material layer of the building board according to the invention is formed with the aid of an inorganic binder from crushed foam insulation, which comprises for example crush formed from cellular plastic insulation material. According to one embodiment of the invention, the crushed foam insulation comprises pieces of foam insulation, which comprise extruded polystyrene (XPS), expanded polystyrene (EPS), polyurethane (PUR/PIR) and/or phenolic foam. In one embodiment of the invention, the crushed foam insulation can comprise recycled foam insulation material, such as

recycled XPS, EPS, polyurethane (PIR/PUR) and/or phenolic foam material. The crushed foam insulation can comprise crushed foam insulation manufactured from one or more cellular plastics. The crushed material can further comprise some crushed rubber material, such as crushed recycled rubber material. According to one embodiment, the crushed material can be a mixture of one or more crushed foam insulation materials, and it can further comprise one or more crushed rubber material.

[0019] According to one embodiment of the invention, the crushed foam insulation of the core material layer comprises pieces of foam insulation, the diameter of which is typically about 1-20 mm, more typically 1-15 mm or 1-10 mm. In one embodiment of the invention, the crushed foam insulation comprises pieces of foam insulation, the diameter of which is 2-15 mm or 3-10 mm. In one embodiment of the invention, the crushed foam insulation can comprise pieces of foam insulation, the diameter of which is 1-5 mm or 2-5 mm. The pieces of foam insulation can vary in shape and/or size. The size of the pieces of foam insulation can vary and thus the crushed foam insulation used in the core material layer can comprise pieces of foam insulation of different sizes. The material of the core layer can further comprise larger and smaller pieces of foam insulation, but the diameter of the pieces of foam insulation is mainly in the range presented above. The purpose of the crushed foam insulation is to lighten the board structure and to affect the density of the core material layer, and thus pieces of foam insulation with a diameter of under 1 mm are not optimal. Correspondingly, pieces of foam insulation with a diameter of over 20 mm weaken the structure and/or properties of the core material layer. According to one embodiment of the invention, the density of the crushed foam insulation material used in the core material layer is more typically 5-80 kg/m³. By changing the material and/or particle size of the crushed foam insulation, the properties of the building board can be affected.

[0020] In a building board according to one embodiment of the invention, the core material layer comprises 0.1-20 weight-%, more typically 1-15 weight-% and most typically 1-10 weight-% of crushed foam insulation, calculated from the total weight of the core material layer. In a building board according to another embodiment of the invention, the amount of crushed foam insulation and crushed rubber material in the core material layer is 0.1-20 weight-%, more typically 1-15 weight-% and most typically 1-10 weight-%, calculated from the total weight of the core material layer. In a building board according to an advantageous embodiment of the invention, the amount of crushed foam insulation or mixture of crushed foam insulation and rubber material in the core material layer is 2.5-6 weight-%, calculated from the total weight of the core material layer. In one embodiment, the core material layer comprises crushed foam insulation or a mixture of crushed foam insulation and rubber material, which is bound with the aid of an inorganic binder, so that the core material layer comprises 10-80 vol-% of crushed foam insulation or a mixture of crushed foam insulation and rubber material, or for example at least 50 vol-% of crushed foam insulation or mixture of crushed foam insulation and rubber material. According to an advantageous embodiment of the invention, the core material layer comprises 50-80 vol-% of crushed foam insulation or a mixture of crushed foam insulation and rubber material. Mixing crushed foam insulation in with a binder further makes possible good heat insulation and soundproofing properties for a building board and makes the building board lighter. A combination of crushed foam insulation and inorganic binder achieves a light but strong structure of the building board. The soundproofing properties of the building board can further be improved with the aid of crushed rubber material. A core material layer formed from a mixture of binder and crushed foam insulation is typically a nearly incombustible material, which is very durable in a fire event. In order to achieve desired fireproofing properties, the thickness of the core material layer formed from a binder and crushed foam insulation typically varies between 10-200 mm, more typically 20-120 mm, even more typically 30-100 mm.

[0021] The crushed foam insulation in the core material layer of the building board according to the invention is bound into a solid core material layer by using an inorganic binder. The binder used in the core material layer of the building board according to the invention can be any inorganic binder suitable for the purpose, which makes possible the binding of crushed foam insulation or a mixture of crushed foam insulation and rubber material into a solid board structure. According to one embodiment of the invention, the density of the binder is for example 500-1500 kg/m³. According to one embodiment of the invention, an inorganic binder is used in the core material layer of the building board, which binder comprises a concrete-based material. According to one embodiment of the invention, the inorganic binder comprises concrete, furnace slag, flue dust, gypsum and/or silica. According to one embodiment of the invention, the inorganic binder comprises concrete, and the binder additionally comprises furnace slag, flue dust, gypsum and/or silica. According to one embodiment of the invention, the binder comprises concrete, which can be calcium carbonate-, magnesium oxide- and/or zinc oxide-based concrete. The concrete-based binder according to the invention can be used as such by mixing from it an aqueous slurry or it can be a mixture of one or more above-mentioned inorganic binders. The binder compositions according to the invention can also comprise other possible additive, filler and/or blend components and/or fibres.

[0022] In one advantageous embodiment of the invention, the inorganic binder is a foamed inorganic binder, which binder comprises concrete, furnace slag, flue dust, gypsum and/or silica. A foamed binder means that a foaming additive has been added to the aqueous slurry formed from the binder or the foam has been produced separately before it has been mixed with the binder slurry, whereby a binder slurry containing air bubbles is formed. The density of the foamed binder is typically at least 30 % lower than a corresponding non-foamed binder. In this manner, the structure of the building board according to the invention can be further lightened without weakening the fireproofing properties. Addi-

tionally, the foamed binder has a positive effect on the soundproofing properties of the structure. The density of the foamed binder is typically 200-1000 kg/m³.

[0023] The density of the core material layer of a building board according to the invention is typically between 300-500 kg/m³.

[0024] According to an embodiment of the invention, at least the first planar surface layer of the core material layer of the building board comprises one or more reinforcement layers over substantially the entire surface of the core material layer. In one embodiment according to the invention, a surface layer is arranged also on the second planar surface of the core material layer, which surface layer comprises one or more reinforcement layers. In one advantageous embodiment of the invention, both planar surfaces of the core material layer of the building board comprise one or more reinforcement layers, substantially over the surface of the entire core material layer. The reinforcement layer is typically arranged directly on the surface of the core material layer. In one embodiment of the invention, the reinforcement layer comprises a strengthening fiber mat and/or a corresponding structure, such as a fiber net or fiber tissue, in order to among others improve the bending strength and tensile strength of the building board. The fiber mat or the like can be made of glass fibers, carbon fibers and/or other material having a good tensile strength. The building board according to an embodiment of the invention comprises a netlike fiber mat or the like, which is formed of individual fibers or fiber strands. According to an embodiment of the invention, the diameter of the fiber used in the fiber net is typically 0.2-3 mm, most typically 1-3 mm. The mesh size of the fiber net is typically 3 x 3 mm-20 x 20 mm. In one embodiment of the invention, the building board can comprise one, two or more strengthening reinforcement layers. In one advantageous embodiment according to the invention, the reinforcement layer comprises alkali-protected glass fiber net. According to one embodiment of the invention, the reinforcement layers on the first and second surface of the building board can be corresponding to each other or differ from each other, depending on the properties required from the structure of the building board. In a typical embodiment according to the invention, the reinforcement layer is arranged over the area of substantially the entire surface of the building board in at least one layer, so that the reinforcement layer is attached to the surface of the board structure with the aid of an inorganic binder, whereby the structure is made strong and uniform.

Alternatively, the reinforcement layer can be attached also in some other manner suitable for the purpose.

[0025] According to one embodiment of the invention, the first planar surface of the core material layer of the building board comprises a metal board and/or a composite board comprising metal. The board typically cover substantially the entire core material layer on the second planar surface. The metal board can for example be sheet metal, aluminium, zinc or steel. In a composite board comprising metal, the metal component can be aluminium, zinc, steel and/or any metal suitable for the purpose. The purpose of this metal board and/or composite board comprising metal arranged on the surface of the core material layer is to improve the fireproofing properties of the building board according to the invention. In one embodiment of the invention, the thickness of the metal board or composite board comprising metal arranged on the first planar surface of the core material layer is only about 0.05-0.15 mm and more typically about 0.1 mm, for example 0.08-0.12 mm. The core material layer of the building board according to the invention itself ensures a sufficient strength for the building board, so the metal board and/or composite board comprising metal can be only a thin film, which is used for improving the fireproofing properties of the building board. A thin metal board and/or composite board comprising metal also makes the building board according to the invention lighter compared to known insulation elements comprising a metal board (so-called sandwich elements), in which substantially thicker metal boards are used. In a building board according to an embodiment of the invention, one or more reinforcement layers are arranged between the core material layer and the metal board and/or composite board comprising metal. Alternatively, the metal board and/or composite board comprising metal is arranged directly on the surface of the core material layer.

[0026] In one advantageous embodiment according to the invention, the first planar surface of the building board comprises a metal board and/or a composite board comprising metal and the second planar surface is formed from the core material layer without any separate coatings or the second planar surface can comprise one or more above-described reinforcement layer, which does not comprise metal like the coating board on the first planar surface of the building board. In one embodiment according to the invention, the second surface of the core material layer comprises one or more above-described reinforcement layers, which substantially completely covers the second surface of the core layer. In one embodiment according to the invention the first surface of the core material layer comprises one or more reinforcement layers and a metal board and/or composite board comprising metal, and the second surface comprise one or more reinforcement layers, which substantially completely covers the second surface of the core layer. In one embodiment according to the invention, the reinforcement layer comprises a strengthening fiber mat or the like. The fiber mat can be made of glass fibers, carbon fibers and/or other material having a good tensile strength. There can be one or more reinforcement layers, depending on the desired properties and the requirements of the application. These reinforcement layers on the second planar surface of the building board make possible a light and durable building board structure and a solution with low cost. Thus, the fire classified building board can be manufactured so that a metal board and/or composite board comprising metal is arranged only on one of the surfaces of the core material layer.

[0027] The core material layer of a building board according to an embodiment of the invention comprises cavities in the length or width direction of the board.

[0028] These cavities are typically arranged in the length or width direction over the entire length of the structure. The purpose of these cavities is to form air channels in the building board, whereby the soundproofing of the building board can be improved. Additionally, the cavity structure requires less material for the core material layer of the building board. The cavities also make possible the installation of pipings, electrical wires and the like in the cavities. In one embodiment of the invention, the building board, the thickness of the core material layer of which is at least 60 mm, comprises cavities in the length or width direction of the board. The shape and number of cavities in the core material layer can vary.

[0029] The composition of the crushed foam insulation material and the inorganic binder to be used in the core material layer of a building board according to the invention can vary according to the desired properties and application. Among others the price, soundproofing at low frequencies and/or high frequencies, weight, heat insulation and durability as well as desired fireproofing properties affect the selection of materials to be used in the building board. By altering the materials and/or proportions of materials and/or thickness of layers forming the core material layer of the building board according to the invention, building boards fulfilling the requirements of different fire classes can easily and cost-effectively be implemented.

[0030] A building board according to the invention fulfils the requirements of fire class EI30 (testing method standard EN 1364-1:2015 and classification standard EN 13501-2:2016).

[0031] The building board according to the invention is typically installed so that the surface formed by the metal board or composite board comprising metal is the visible outer surface of the structure and/or the surface to the outside of the structure. For example in a wall structure, the surface formed by the metal board and/or composite board comprising metal is toward the room.

[0032] The building board according to the invention can be used in a partition wall structure. The partition wall structure according to the invention is formed from wall boards arranged adjacent, which are building boards according to the invention and which wall boards are continuous in the height direction of the room in the distance between the floor and the ceiling structure. The wall boards are fixed by their lower edge to the floor structures and by their upper edge to the ceiling structures of the room. The joints between wall boards are vertical in the height direction of the wall structure. The wall structure is typically free from horizontal joints in the wall structure. The floor structures and ceiling structures of the room can be formed for example from hollow slabs or corresponding structure elements. The partition wall structure according to the invention is suitable for use with all kinds of structures, and its use is not limited to certain room floor and/or ceiling structures. A typical room comprises a floor structure, ceiling structures and a partition wall structure according to the invention.

[0033] The first and second wall board are advantageously in contact with each other by means of a tongue-and-groove joint or their long side edges in the height direction of the room are bevelled to fit each other. With the aid of the tongue-and-groove joint, easy installation of the wall boards is made possible. The wall boards are advantageously half-grooved and the wall boards are set vertically in the wall structure. In one embodiment a sealant, such as for example fire-protected joint sealing paste, has been arranged between the long side edges of the wall boards. By using a sealant, such as a fire-protected joint sealing paste, in the joint between the wall boards, the fire safety of the wall structure can be improved.

[0034] In the partition wall structure according to the invention, the wall boards are fixed to the floor structure with the aid of a fixing profile, so that the fixing profile settles at least partly inside the core material layer of the wall board. There is typically at least one shaped groove for the fixing profile in the lower edge of the wall board, depending on the design of the fixing profile. In one embodiment according to the invention, the fixing profile comprises at least one protrusion, which in the completed wall structure is inside the wall board by at least 10-50 mm, most typically 10-20 mm in the height direction of the wall. The shape and size of the fixing profile can vary. Typically, the fixing profile is of standard length and it can be extended by connecting several profiles together. In a typical wall structure according to the invention, the fixing profile is in the horizontal direction of the wall structure formed of one or more pieces, which pieces are attached to each other to form a uniform fixing profile for the entire width of the wall structure. The fixing profile used for fixing the wall board is in the longitudinal direction of the lower edge of the wall board. In an advantageous embodiment of the invention, the fixing profile is continuous in substantially the entire width direction of the wall structure, i.e. the uniform profile according to the invention continues over the joints in the wall boards, whereby the strong entire wall structure is achieved. In one embodiment of the invention, in which two or more profiles are attached to each other to form a profile that has the width of the whole partition wall structure, the fixing profiles are fixed to each other via a connective element or alternatively two or more fixing profiles are arranged partly overlapping to form a longer, uniform fixing profile. The fixing profile can be manufactured from any material suitable for the purpose. The fixing profile is typically manufactured from metal, such as sheet metal or stainless steel sheet. The thickness of the fixing profile is typically about 0.2-3 mm.

[0035] In the lower edge of the wall boards, in the joint between the fixing profile and the wall board, can, if necessary, be arranged some sealant, glue or the like suitable for the purpose, such as for example fire-protected joint sealing paste, in order to improve the fireproofing properties of the wall structure.

[0036] In the partition wall structure according to the invention, the wall boards are fixed to the ceiling structures of the room with fastenings, typically the fastenings are arranged on both sides of the wall board. In a typical wall structure

according to the invention, the fastenings in the upper edge of the wall board are corner fastenings or the like, which make possible easy and simple fixing of the wall board to the ceiling structures of the room. In a typical partition wall structure according to the invention there is a gap between the upper edge of the wall board and the ceiling structures of the room, which gap is filled with a sealant, such as joint foam or a corresponding sealant suited for the purpose.

Thus, the partition wall structure can take into account for example bending allowance of the ceiling structures. In one advantageous embodiment, the gap between the upper edge of the wall board and the ceiling structures of the room is filled with a fire-protected joint sealing paste, whereby the fireproofing properties of the wall structure can additionally be improved.

[0037] The wall board usually has a rectangular shape, which comprises two parallel planar large surfaces, and a first and second parallel long side edge and parallel first and second short side edges, which are perpendicular to the long side edges, delimiting the surfaces. The long side edges of the wall boards are in the height direction of the wall structure. The length of the long side edge of the wall boards thus typically varies between 1800-4000 mm or 2000-3000 mm or 2200-3000 mm. The short side edges of the wall boards are horizontal in the wall structure in relation to the height direction of the wall structure. The length of the short side edge of the wall plate is typically 300-1500 mm, more typically 500-1300 mm, even more typically 600-1200 mm. The large surfaces of the wall plate are in one embodiment as even and ungrooved as possible.

[0038] The partition wall structure according to the invention is suited for use in all kinds of partition wall structures. The partition wall structure according to the invention comprises adjacent wall boards, which are building boards according to the invention. The long side edges of the wall boards set adjacent to each other in the partition wall structure are against each other, whereby the long side edges of the wall boards are in the height direction of the room.

[0039] According to one embodiment of the invention, the building board according to the invention is used in a partition wall structure, which partition wall structure comprises two building boards according to the invention at a distance from each other and an air gap between them. Thus, the soundproofing properties of the partition wall structure can be improved. In one embodiment according to the invention, the partition wall structure is formed from building boards according to the invention, the core material layer of which comprises cavities. In this case, two wall boards do not necessarily need to be arranged at a distance from each other, but the building board comprising cavities already in itself improves the soundproofing properties of the structure.

Detailed description of the drawings

[0040] Figure 1a shows as a schematic view of a building board 1 according to an embodiment of the invention, which comprises a core material layer 2 and at least one surface layer 3 arranged on the first planar surface of the core material layer, which surface layer comprises a metal board and/or a composite board comprising metal. The second planar surface of the core material layer 2 can comprise one or more reinforcement layers 4. Structural layers arranged on the planar surfaces typically cover the core material layer over the entire planar surface. Figure 1b shows a building board 1 according to a second embodiment of the invention, in the core material layer 2 of which has been arranged cavities 12 in the length or width direction of the building board.

[0041] Figures 2 and 3 illustrate some partition wall structures according to the invention seen as cross-sectional views of the wall board. The same reference signs have been used in the figures for parts corresponding to each other. The structures shown in Figures 2 and 3 differ from each other with regards to the shape of the profile arranged in the lower edge of the wall board.

[0042] The partition wall structure 10 shown in Figures 2 and 3 is between two rooms A, B. The partition wall structure 10 comprises a wall board 5, which is continuous in the height direction of the room. The wall boards 5 are typically building boards according to the invention. Wall boards 5 are set beside each other in the width direction of the wall structure (not shown in the figure). The wall boards 5 of the partition wall structure are fixed by the lower part of the wall board to the floor structures 6 with the aid of a fixing profile 7, so that the fixing profile 7 settles at least partly inside the core layer of the wall board 5. The fixing profile 7 shown in Figure 2 comprises one protrusion 7a, which extends into the wall board. The fixing profile 7 shown in Figure 3 comprises two protrusions 7a, 7b, which extend into the wall board. The partition wall further comprises fastenings 8a, 8b, with which the wall boards 5 are fixed to the ceiling structures 9 of the room by the upper part of the wall board. Between the upper edge of the wall board 5 and the ceiling structure 9 of the room there is a gap, which is filled with a sealant 11.

[0043] The following examples show a burning test performed on the building board according to the invention and its results, and a soundproofing test.

Example 1: Burning test

[0044] The structure burning test was performed according to standard EN 1364-1:2015. The test was done in a vertical furnace and the size of the test piece was 0.7 m x 1.3 m.

[0045] The building board according to the invention to be tested comprised a core material layer and reinforcement layers formed from glass fiber net on both surfaces of the core material layer. The thickness of the building board to be tested was 30 mm. The density of the material of the core material layer was 460 kg/m³. The core material layer comprised 3.5 weight-% of crushed EPS (diameter on average 2-15 mm) and inorganic concrete-based binder.

[0046] During the burn test, the average rise in temperature measured by the sensors 1, 3, 5, 7 and 9 did not exceed 140°C during 30 minutes. No rise in temperature measured by any sensor exceeded 180 °C during 30 minutes. The test piece remained completely intact during the 30-minute burning. As a conclusion it can be noted that the test piece fulfills the requirements of fireproofing of an EI30 (standard EN 1364-1:2015) wall structure.

[0047] The building board according to the invention was additionally tested according to standard EN 13823 (SBI - single burning item). The total heat release THR₆₀₀ of the building board according to the invention was very close to zero. The building board according to the invention did not generate smoke during the burn test.

Example 2: Soundproofing test

[0048] The soundproofing test used the method described in standard ISO 10140-2 to determine the soundproofing of the building part with a pressure method and the results were used for determining a weighted soundproofing value Rw [dB] for the structure according to standard ISO 717-1:1996.

[0049] The testing was performed with building boards according to the invention, the thicknesses of which were 30 mm and 50 mm and with a partition wall structure, which has a 30 mm thick building board + a 20 mm air gap + a 30 mm thick building board. The material of the building board according to the invention to be tested was corresponding to the burn test.

	Rw [dB]
Building board 30 mm	32
Building board 50 mm	32
Building board 30 mm + air gap 20 mm + building board 30 mm	44

[0050] When a wall structure is formed from building boards according to the invention, such as a partition wall structure, which comprises two building boards according to the invention and an air gap between the building boards, the airborne soundproofing can be improved.

Claims

1. A building board (1), which comprises a core material layer (2) and at least one surface layer arranged on a first planar surface of the core material layer, **characterized in that**

- the core material layer (2) comprises inorganic binder and 0.1-20 weight-% of crushed foam insulation calculated from the total mass of the core material layer, and
- a surface layer (3) arranged on the first planar surface of the core material layer comprises one or more reinforcement layers and/or a metal board and/or a composite board comprising metal.

2. The building board according to claim 1, **characterized in that** the crushed foam insulation comprises foam insulation pieces, the diameter of which is 1-20 mm, more typically 1-15 mm or 1-10 mm and most typically 2-15 mm or 3-10 mm.

3. The building board according to claim 1 or 2, **characterized in that** the crushed foam insulation comprises foam insulation pieces formed from expanded polystyrene (EPS), extruded polystyrene (XPS), polyurethane (PIR/PUR) and/or phenolic foam.

4. The building board according to any of the preceding claims, **characterized in that** the core material layer (2) more typically comprises 1-15 weight-% and most typically 1-10 weight-% of crushed foam insulation, calculated from the total weight of the core material layer.

5. The building board according to any of the preceding claims, **characterized in that** the inorganic binder comprises concrete, furnace slag, flue dust, gypsum and/or silica.

6. The building board according to any of the preceding claims, **characterized in that** the inorganic binder is a foamed inorganic binder.
- 5 7. The building board according to any of the preceding claims, **characterized in that** the thickness of the core material layer (2) is 10-200 mm, more typically 20-120 mm, even more typically 30-100 mm.
8. The building board according to any of the preceding claims, **characterized in that** the thickness of the metal board or composite board comprising metal is 0.05-0.15 mm.
- 10 9. The building board according to any of the preceding claims, **characterized in that** cavities in the length and width direction of the board have been formed in the core material layer (2).
10. The building board according to any of the preceding claims, **characterized in that** a surface layer (4) has been arranged on the second planar surface of the core material layer (2), which surface layer comprises one or more reinforcement layers.
- 15 11. The use of a building board according to any of the preceding claims 1-10 as a wall structure.
12. A partition wall structure (10) between two rooms (A, B), **characterized in that** the partition wall structure (10) comprises
 - a first and second wall board (5), which are building boards according to any of the preceding claims 1-10, and which are continuous in the height direction of the room,
 - a fixing profile (7), with which the wall boards (5) are fixed to the floor structures (6) of the room by the bottom part of the wall board, so that the fixing profile (7) settles at least partly inside the wall board (5), and
 - fastenings (8a, 8b), with which the wall boards (5) are fixed to the ceiling structures (9) of the room by the upper part of the wall board.
- 25 13. The partition wall structure according to any of the preceding claims, **characterized in that** the first and second wall board (5) are in contact with each other by means of a tongue-and-groove joint or their long side edges in the height direction of the room are bevelled to fit each other.
- 30 14. The partition wall structure according to any of the preceding claims, **characterized in that** the fixing profile (3) is in the length direction of the lower edge of the wall board (2) and substantially continuous in the width direction of the entire partition wall structure.
- 35 15. The partition wall structure according to any of the preceding claims, **characterized in that** there is a gap between the upper edge of the wall board (5) and the ceiling structure (9) of the room, which gap is filled with a sealant (11).

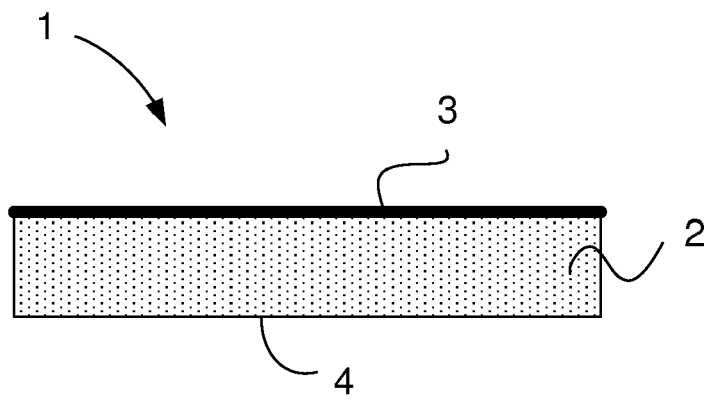


Fig. 1a

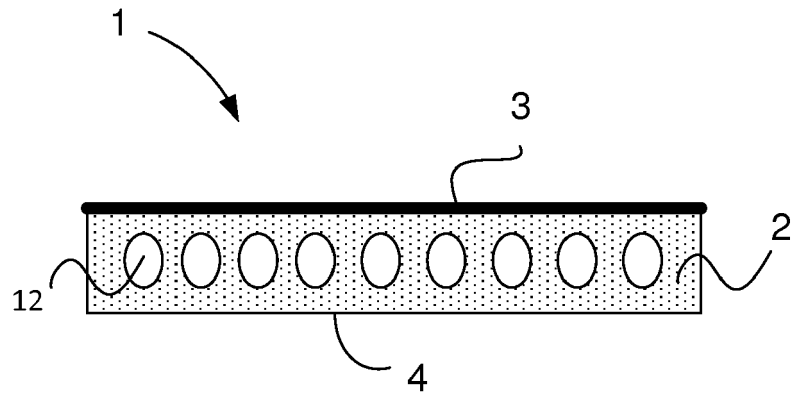


Fig. 1b

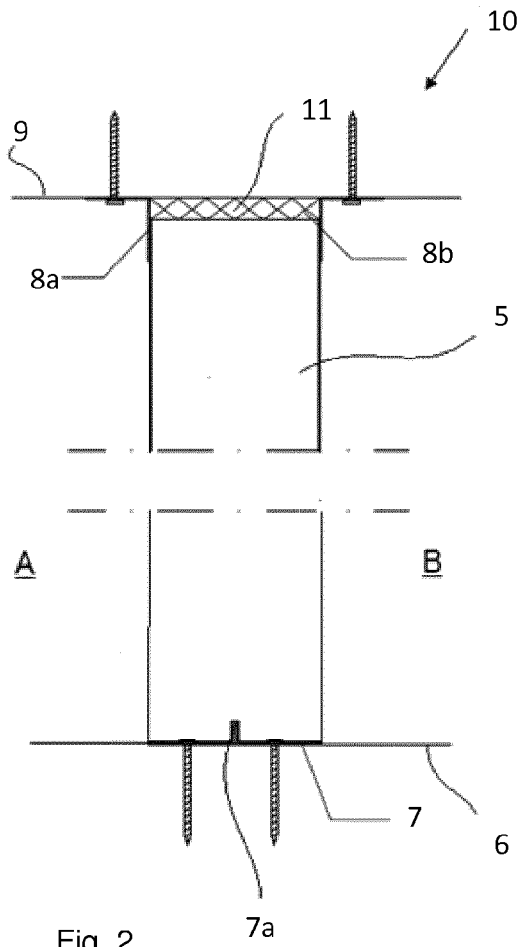


Fig. 2

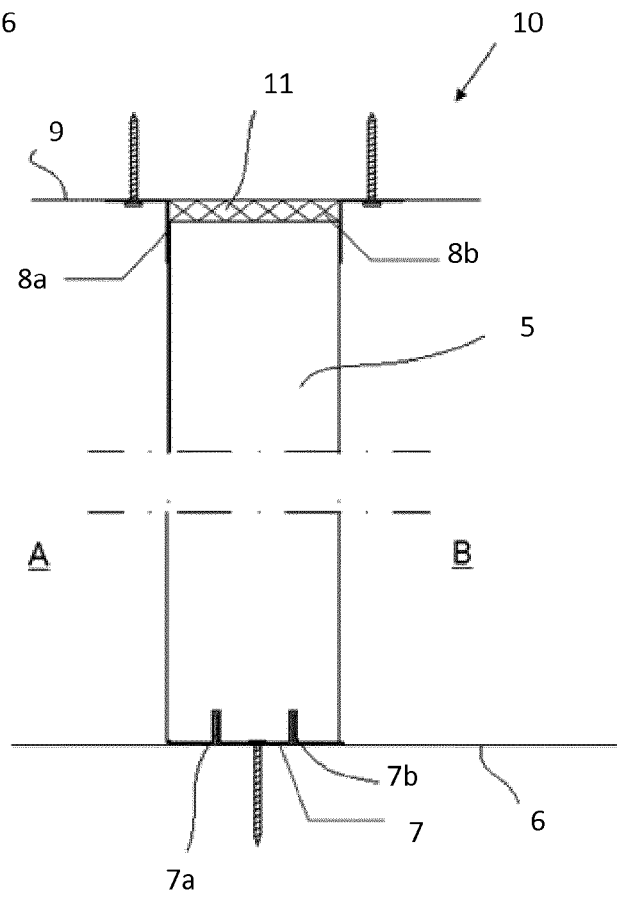


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
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			E04B E04C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 April 2020	Examiner Melhem, Charbel
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			

**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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