

BUILDING ELEMENT, MODULAR HOUSING UNITS, BUILDINGS AND METHOD

Technical Field

5 The present disclosure generally relates to a building element for a modular housing unit. In particular, a building element for forming a part of a modular housing unit, modular housing units comprising at least one building element, buildings comprising at least one modular housing unit, and a method of assembling a building element for forming a part of a
10 modular housing unit, are provided.

Background

Buildings comprising modular housing units, also known as modular buildings, have recently become more popular. The modular housing units may partly or entirely be constructed remote from a building site and the
15 installation of the modular housing units is then made on the building site. Major advantages associated with modular buildings are a relatively low price and high construction speed.

WO 2015115990 A1 discloses a building and a method for assembling a building. The building comprises an external framework with at least three
20 external walls connected with a floor structure and a roof structure such that a space is formed within said framework. The external framework further comprises a support system for each floor, and at least two modules, wherein each module comprises four walls, a floor and a roof. The at least two modules are mounted in the space in the external framework, which said at
25 least two modules rests on said support system.

Summary

One object of the present disclosure is to provide a building element for forming a part of a modular housing unit, which building element contributes to an efficient and/or simple construction of modular housing units.

- 5 A further object of the present disclosure is to provide a building element for forming a part of a modular housing unit, which building element facilitates construction of modular housing units in rainy and/or windy outdoor conditions.

- 10 A still further object of the present disclosure is to provide a building element for forming a part of a modular housing unit, which building element contributes to a simple handling during construction of modular housing units.

- 15 A still further object of the present disclosure is to provide a building element for forming a part of a modular housing unit, which building element contributes to a pleasant climate within the modular housing unit.

A still further object of the present disclosure is to provide a building element for forming a part of a modular housing unit, which building element can carry a high load and has a high torsional stiffness.

- 20 A still further object of the present disclosure is to provide a building element for forming a part of a modular housing unit, which building element has a good fire resistance, a good water and moisture resistance, a good thermal isolation and/or a good noise attenuation.

- 25 A still further object of the present disclosure is to provide a building element for forming a part of a modular housing unit, which building element is cheap and/or environmentally friendly.

A still further object of the present disclosure is to provide a building element for forming a part of a modular housing unit, which building element has low tolerances.

A still further object of the present disclosure is to provide a building element for forming a part of a modular housing unit, which building element solves several or all of the foregoing objects in combination.

5 A still further object of the present disclosure is to provide a modular housing unit comprising at least one building element, which modular housing unit solves one, several or all of the foregoing objects.

A still further object of the present disclosure is to provide a building comprising at least one modular housing unit, which building solves one, several or all of the foregoing objects.

10 A still further object of the present disclosure is to provide a method of assembling a building element for forming a part of a modular housing unit, which method solves one, several or all of the foregoing objects.

15 According to one aspect, there is provided a building element for forming a part of a modular housing unit, the building element comprising a load-bearing wood-based panel; and a sandwich panel fixedly connected to, and substantially parallel with, or parallel with, the wood-based panel; wherein the sandwich panel comprises two outer layers and a core layer between the outer layers.

The building element according to the present disclosure is self-supporting.
20 The load-bearing wood-based panel of the building element is configured to form an active structural element of the modular housing unit, for example one, several, or all exterior walls of the modular housing unit, and/or a roof of the modular housing unit. The wood-based panel may thus be arranged to bear the weight of the elements above the wood-based panel.

25 The building element may be configured to form a load-bearing wall and/or a load-bearing roof of a modular housing unit. A building element according to the present disclosure may thus constitute a wall element or a roof element for a modular housing unit.

By means of the building element, a modular housing unit can be produced without using any elongated load-supporting parts. The building element enables the construction of modular housing units without any skeleton or framework. The removal of a framework greatly reduces costs. The building
5 element contributes to a high torsional stiffness of the modular housing unit.

The two outer layers of the sandwich panel contribute to a high rigidity and a high weather resistance of the sandwich panel. This facilitates storage, handling and mounting of the sandwich panel, for example in rainy and windy outdoor conditions. The two outer layers also improve flexibility and
10 facilitate handling since the sandwich panel may be attached to the wood-based panel in two alternative ways. The outer layer of the sandwich panel most proximate to the wood-based panel, in combination with the wood-based panel, also contribute to a lower speed of change in moisture level of air inside the wood-based panel. In other words, the building element
15 according to the present disclosure contributes to a more pleasant climate within a modular housing unit comprising one or more building elements.

As used herein, a panel has a flat shape. Thus, the wood-based panel and the sandwich panel may alternatively be referred to as a flat wood-based element and a flat sandwich panel, respectively. Each of the wood-based panel and the
20 sandwich panel may be planar, e.g. may have a length and a width that each is at least five times, such as at least ten times, a thickness of the respective panel. In this case, the length and the width of the panel are each oriented perpendicular to the thickness direction of the panel. The sandwich panel may be referred to as a sandwich element.

25 The wood-based panel and the sandwich panel may have the same, or different, thickness. According to one variant, the sandwich panel has a larger thickness than the wood-based panel. The wood-based panel and the sandwich panel do not necessarily need to be of the same size in their extension planes. For example, the building element may comprise a wood-
30 based panel and at least two sandwich panels covering the wood-based panel.

The outer layers of the sandwich panel may or may not constitute the outermost layers of the sandwich panel.

Throughout the present disclosure, the building element may alternatively be referred to as a construction element or a structural element. The modular housing unit may alternatively be referred to as a modular dwelling unit or modular dwelling.

The wood-based panel may comprise a plurality of wood layers, such as at least two, non-aligned wood layers. Examples of such wood-based panels are cross-laminated timber (CLT) and glued laminated timber (GLT or glulam) where the layers are offset. As a further example, the wood-based panel may comprise a stack of plywood panels. In this case, the wood layers constituted by plywood panels may be either aligned or non-aligned. As a further example, the wood-based panel may comprise, or be constituted by, a laminated veneer lumber product, such as a Kerto ® board.

The wood-based panel may comprise at least two differently oriented wood layers. The wood-based panel may comprise, or be constituted by, cross-laminated timber. Cross-laminated timber is a wood panel product made from gluing layers of solid-sawn lumber together. Each layer is oriented perpendicular to adjacent layers, usually in a symmetric way so that the outer layers have the same orientation. The cross-laminated timber according to the present disclosure may for example comprise three, five or seven wood layers. Each wood layer may for example have a thickness of 30 mm to 100 mm. The wood-based panel may for example have a thickness of 50 mm to 200 mm, such as 80 mm to 130 mm. The thickness of the wood-based panel may be determined, inter alia, based on fire regulations.

Each of the wood-based panel and the sandwich panel may be prefabricated. This contributes to a simple handling and assembly when assembling the building element and the modular housing unit. According to one variant, also the building element prefabricated. Thus, the building element can be made modular.

The sandwich panel may for example have a thickness of 50 mm to 200 mm, such as 80 mm to 150 mm, for example 120 mm. The sandwich panel may have a larger thickness than the wood-based panel.

5 The sandwich panel may be fireproof. The wood-based panel may be impregnated to provide an improved fire resistance.

The sandwich panel may be directly connected to the wood-based panel. Alternatively, or in addition, the sandwich panel may be connected to the wood-based panel by means of one or more fastening elements, such as screws, and/or by means of adhesive. The fastening elements may penetrate
10 through the sandwich panel and into, or through, the wood-based panel.

The outer layers may be of the same type. Thus, the sandwich panel may be symmetric. The outer layers may for example comprise, or be constituted by, sheet metal, plaster, or fiberglass veil. In any case, each outer layer may have a smaller thickness than a thickness of the core layer.

15 The core layer and the outer layers may be of different types. The outer layers may be waterproof. The sandwich panel may thus provide an outer weather resistant wall covering. Each outer layer may for example comprise sheet metal or plastic.

The core layer may be an isolation layer. The core layer may for example
20 comprise, or be constituted by, rock wool or alternative mineral fibres.

The building element may further comprise one or more plaster panels. The at least one plaster panel may be arranged on an opposite side of the wood-based panel with respect to the sandwich panel. That is, the wood-based panel may be arranged between the sandwich panel and the plaster panel.
25 Each plaster panel may for example have a thickness of 5 mm to 20 mm.

According to a further aspect, there is provided a load-bearing wall for a modular housing unit, which load-bearing wall comprises, or is constituted by, a structural element according to the present disclosure. The sandwich panel may be exterior of the wood-based panel. The sandwich panel may

form the exterior-most part of the wall and/or the wood-based panel may form the interior-most part of the wall.

According to a further aspect, there is provided a modular housing unit comprising at least one building element according to the present disclosure.

- 5 The at least one building element may be arranged in one or more walls of the modular housing unit. The modular housing unit may further comprise a floor having a load-bearing wood-based panel according to the present disclosure.

- The building element according to the present disclosure enables the
10 construction of modular housing units without using any elongated load-supporting parts, e.g. vertical columns. Furthermore, due to the innermost outer layer of the outer sandwich panel and due to the inner wood-based panel, a moisture buffering effect in the wood-based panel is provided. Thereby, a resistance against rapid changes in moisture level within inside
15 the modular housing unit is improved. The at least one building element thus contributes to a pleasant indoor climate in the modular housing unit.

- The at least one building element may constitute one or more load-bearing walls of the modular housing unit. According to one variant, the modular housing unit comprises two side walls, a front wall and a rear wall, each
20 comprising a building element according to the present disclosure that constitutes a load-bearing wall.

- According to a further aspect, there is provided a modular housing unit comprising two building elements according to the present disclosure, wherein the two building elements constitute two perpendicular load-bearing
25 walls of the modular housing unit, and wherein the two building elements are directly connected to each other. For example, the wood-based panels of the two building elements may be directly connected to each other.

According to a further aspect, there is provided a building comprising at least one modular housing unit according to the present disclosure.

According to a further aspect, there is provided a building comprising at least two modular housing units according to the present disclosure, wherein an upper modular housing unit of the at least two modular housing units is arranged on top of a lower modular housing unit of the at least two modular housing units. According to one example, some or all of the modular housing units of the building are vertically aligned. According to an alternative example, several modular housing units of the building are horizontally offset, for example to resemble a typical brick wall.

According to a further aspect, there is provided a building comprising at least two modular housing unit according to the present disclosure, wherein at least one upper modular housing unit is arranged on top of at least one lower modular housing unit, and wherein at least 80 % of the load of the at least one upper modular housing unit is taken up by the one or more load-bearing walls of the at least one lower modular housing unit. For example, the building may comprise one upper modular housing unit arranged on top of at least one lower modular housing unit, and wherein at least 80 % of the load of the upper modular housing unit is taken up by the one or more load-bearing walls of the lower modular housing unit.

At least 80 % of the load from the upper modular housing unit may be carried on upper ends of the wood-based panels of the load-bearing walls. Thus, by means of the one or more load-bearing walls comprising a building element according to the present disclosure, the building can be produced without a skeleton or framework between the modular housing units.

Each modular housing unit according to the present disclosure may have a substantially flat, or flat, upper surface. In this case, upper ends of each wood-based panel of one or more building elements may be substantially flush, or flush, with the upper surface. Alternatively, one or more support blocks may be provided on top of the ends of one or more wood-based panels.

According to a further aspect, there is provided a method of assembling a building element for forming a part of a modular housing unit, the method

comprising providing a load-bearing wood-based panel; providing a sandwich panel comprising two outer layers and a core layer between the outer layers; and fixedly connecting the sandwich panel to the wood-based panel substantially parallel with the wood-based panel. One or several sandwich panels may be connected to the wood-based panel such that an exterior side of the wood-based panel is covered by one or more sandwich panels.

Brief Description of the Drawings

Further details, advantages and aspects of the present disclosure will become apparent from the following embodiments taken in conjunction with the drawings, wherein:

- Fig. 1: schematically represents a cross-sectional view of a sandwich panel and a wood-based panel;
- Fig. 2: schematically represents a cross-sectional view of a building element comprising the sandwich panel and the wood-based panel;
- Fig. 3: schematically represents a cross-sectional front view of a building comprising two modular housing units;
- Fig. 4: schematically represents an enlargement of section A in Fig. 3;
- Fig. 5: schematically represents a partial view of the enlargement of section A in Fig. 3;
- Fig. 6: schematically represents a cross-sectional side view of one of modular housing units in Fig. 3;
- Fig. 7: schematically represents a cross-sectional top view of one of the modular housing units in Fig. 3; and
- Fig. 8: schematically represents a front view of a building comprising a plurality of modular housing units.

Detailed Description

In the following, a building element for forming a part of a modular housing unit, modular housing units comprising at least one building element,

buildings comprising at least one modular housing unit, and a method of assembling a building element for forming a part of a modular housing unit, will be described. The same or similar reference numerals will be used to denote the same or similar structural features.

5 Fig. 1 schematically represents a cross-sectional view of a sandwich panel 10 and a wood-based panel 12. The sandwich panel 10 comprises two outer layers 14 and a core layer 16 between the outer layers 14. Each of a length (perpendicular to the plane in Fig. 1) and a width (in the horizontal direction in Fig. 1) of the sandwich panel 10 is substantially larger than, for example at
10 least five times, a thickness (in the vertical direction in Fig. 1) of the sandwich panel 10. The sandwich panel 10 may for example have a thickness of 80 mm to 150 mm, such as 120 mm. Other thicknesses are also conceivable.

In Fig. 1, the outer layers 14 are waterproof and the core layer 16 is an isolation layer. The outer layers 14 may be of the same type. In the example in
15 Fig. 1, each outer layer 14 is made of sheet metal and the core layer 16 is made of rock wool. Thus, the sandwich panel 10 of the example in Fig. 1 is symmetric. Each outer layer 14 may cover an entire side of the core layer 16.

The two outer layers 14 of sheet metal has a higher stiffness than the relatively weak rock wool of the core layer 16. Thus, the two outer layers 14
20 not only provide an improved weather resistance, but also provide an improved rigidity of the sandwich panel 10.

Each of a length (perpendicular to the plane in Fig. 1) and a width (in the horizontal direction in Fig. 1) of the wood-based panel 12 is substantially larger than, for example at least five times, a thickness (in the vertical
25 direction in Fig. 1) of the wood-based panel 12. The wood-based panel 12 may for example have a thickness of 80 mm to 130 mm. Alternative thicknesses are also conceivable. As can be seen in Fig. 1, the sandwich panel 10 has a slightly larger thickness than the wood-based panel 12.

The wood-based panel 12 comprises a plurality of wood layers 18a, 18b, 18c
30 (each wood layer 18a, 18b, 18c may also be referred to with reference numeral

"18"). In the example in Fig. 1, the wood-based panel 12 comprises three wood layers 18. The two outermost wood layers 18a, 18c are oriented in one direction and the intermediate wood layer 18b is oriented in a perpendicular direction. Thus, the wood layers 18a, 18c are non-aligned with the wood layer
5 18b. The wood layers 18 may be glued to each other.

The wood-based panel 12 in Fig. 1 is a cross-laminated timber (CLT) panel. Although the wood-based panel 12 in Fig. 1 comprises three wood layers 18, the wood-based panel 12 may comprise an alternative number of wood layers 18. In the example in Fig. 1, each wood layer 18 has the same thickness, for
10 example 40 mm.

One single wood-based panel 12 may for example have a length of up to 15 m or more. The width of the wood-based panel 12 may for example be 1.5 m to 4 m. Thus, the wood-based panel 12 may be machined to form a long side wall of a modular housing unit, for example with a length of 10 m and a height of
15 2.95 m. The machining of the wood-based panel 12 gives lower error margins in comparison with concrete panels and steel panels. Channels for electricity (not shown) may also be machined in the wood-based panel 12.

Also the sandwich panel 10 may have a length of 10 m. In some cases, two or more sandwich panels 10 may be needed next to each other in order to fully
20 cover a wood-based panel 12 of a height of 2.95 m.

Fig. 2 schematically represents a cross-sectional view of a building element
20 comprising the sandwich panel 10 and the wood-based panel 12. In Fig. 2, the sandwich panel 10 has been fixedly connected to the wood-based panel 12 such that the sandwich panel 10 and the wood-based panel 12 are parallel.
25 That is, the sandwich panel 10 is mated flat against the wood-based panel 12. In the example in Fig. 2, the sandwich panel 10 is directly connected to the wood-based panel 12, i.e. without any intermediate components.

The sandwich panel 10 may be fixedly connected to the wood-based panel 12 by means of one or more fastening elements, such as screws (not shown),

and/or adhesive. The fastening elements may penetrate through the entire sandwich panel 10 and into, or through, the wood-based panel 12.

The building element 20 is configured to form a part of a modular housing unit, in particular a load-bearing wall. In this case, the wood-based panel 12 of the building element 20 carries all, or substantially all, of the load. Due to the wood-based panel 12, the building element 20 has a high torsional stiffness.

Since the sandwich panel 10 is symmetric in this case, either of the outer layer 14 can be mated with the wood-based panel 12. This adds flexibility and simplicity when constructing the building element 20.

Each of the sandwich panel 10 and the wood-based panel 12 may be prefabricated. Prefabrication of the sandwich panel 10 may comprise attachment of the outer layers 14 to the core layer 16 and optionally a cutting of the sandwich panel 10 into a desired size. Prefabrication of the wood-based panel 12 may comprise gluing of the wood layers 18 and optionally a cutting of the wood-based panel 12 into a desired size. Also the building element 20 may optionally be prefabricated. That is, the sandwich panel 10 may be connected to the wood-based panel 12, e.g. in a factory.

Fig. 3 schematically represents a cross-sectional front view of a building 22. Fig. 4 schematically represents an enlargement of section A in Fig. 3. With collective reference to Figs. 3 and 4, the building 22 comprises an upper modular housing unit 24a and a lower modular housing unit 24b (each modular housing unit 24a, 24b may also be referred to with reference numeral "24"). In this example, the upper modular housing unit 24a is placed on top of the lower modular housing unit 24b without any intermediate framework.

The modular housing units 24a, 24b have the same configuration. The upper modular housing unit 24a comprises two opposite side walls 26aa, 26ab and the lower modular housing unit 24b comprises two opposite side walls 26ba,

26bb (each wall of a modular housing unit 24a, 24b may also be referred to with reference numeral "26").

The upper modular housing unit 24a comprises a roof 28a and a floor 30a and the lower modular housing unit 24b comprises a roof 28b and a floor 30b
5 (each roof and floor of a modular housing unit 24a, 24b may also be referred to with reference numerals "28" and "30", respectively). The roof 28a and the floor 30a each bridges between the walls 26aa, 26ab and the roof 28b and the floor 30b each bridges between the walls 26ba, 26bb.

The walls 26aa, 26ab, 26ba, 26bb and the roofs 28a, 28b are each constituted
10 by a building element 20 according to the present disclosure, i.e. comprising the sandwich panel 10 attached to the wood-based panel 12. The building elements 20 form load-bearing walls 26aa, 26ab, 26ba, 26bb and load-bearing roofs 28a, 28b.

The sandwich panels 10 of the walls 26aa, 26ab, 26ba, 26bb form lateral
15 exterior surfaces of the modular housing unit 24a, 24b. The sandwich panel 10 of each roof 28a, 28b forms an upper exterior surface of a respective modular housing unit 24a, 24b.

In the example in Figs. 3 and 4, also the floors 30a, 30b each comprises a load-bearing wood-based panel 12, here constituted by a cross-laminated
20 timber panel. Each floor 30a, 30b further comprises a floor structure 32 for installations, such as drain lines, and a chipboard 34 on top of the floor structure 32. The chipboard 34 may have a thickness of 22 mm. However, in case the roof 28b comprises a wood-based panel 12, an adjacent floor 30a may not need a wood-based panel 12. Correspondingly, in case the floor 30a
25 comprises a wood-based panel 12, an adjacent roof 28b may not need a wood-based panel 12.

Prefabricated wood-based panels 12 may first be erected as walls 26. A prefabricated wood-based panel 12 may then be connected between the walls 26 as a roof 28. Prefabricated sandwich panels 10 may then be connected to
30 the exterior of the wood-based panels 12 of the walls 26 and roof 28, e.g. by

means of fastening elements. Due to the two outer layers 14, the sandwich panels 10 are rigid and for example maintain their shape when lifted. Moreover, the two outer layers 14 of the the sandwich panels 10 provide good protection against rain prior to connecting the sandwich panels 10 to the

5 wood-based panels 12.

In this example, an optional plaster panel 36 is attached to the interior surfaces of the walls 26 and the roof 28. Each plaster panel 36 is arranged on an opposite side of a wood-based panel 12 with respect to an associated sandwich panel 10.

10 The plaster panel 36 may for example be attached to a respective wood-based panel 12 by means of nails or glue. Each plaster panel 36 may for example have a thickness of 13 mm.

Each building element 20 is self-supporting. As shown in Fig. 3, the wood-based panels 12 of the walls 26aa, 26ab, 26ba, 26bb extend vertically over the

15 entire height of the respective modular housing unit 24a, 24b. Thus, in this example, the height of the wood-based panel 12 of the walls 26 is the same as the height of the respective modular housing unit 24a, 24b. As shown in Fig. 3, each modular housing unit 24a, 24b has a substantially flat upper surface. Thus, the upper ends of the wood-based panels 12 of the walls 26 are

20 substantially flush with the upper surface of the respective modular housing unit 24a, 24b.

A vertical load-bearing path is defined through the wood-based panels 12 of the walls 26. The load of the upper modular housing unit 24a is carried on the upper ends of the wood-based panels 12 of the walls 26 of the lower

25 modular housing unit 24b. The wood-based panels 12 of the walls 26 are thus configured to form active structural element of the respective modular housing unit 24a, 24b that bear the weight of one or more above elements, such as upper modular housing units 24. This enables the construction of the modular housing units 24 without any elongated load-supporting parts or

30 framework. Furthermore, since each building element 20 comprises an inner

wood-based panel 12, and an outer layer 14 between the wood-based panel 12 and the core layer 16, the moisture level in the modular housing unit 24a, 24b can be kept more even.

As shown in Fig. 4, the building 22 comprises an optional cover plate 38
5 between between the upper modular housing unit 24a and the lower modular housing unit 24b. The cover plate 38 is folded down on each side of the upper surface of the lower modular housing unit 24b. The cover plate 38 provides a watertight seal on top of the lower modular housing unit 24b.

The upper modular housing unit 24a and the lower modular housing unit 24b
10 may optionally be connected to each other, for example by means of one or more fastening elements (not shown). Anti-vibration pads may also be arranged between the upper modular housing unit 24a and the lower modular housing unit 24b.

Fig. 5 schematically represents a partial view of the enlargement of section A
15 in Fig. 3. As shown in Fig. 5, the wood-based panel 12 for the roof 28b is in this example connected to the wood-based panel 12 for each wall 26 by means of a fitting 40. The fitting 40 comprises a hook portion 42 and a knee 44. Alternative ways of connecting the roof 28 to the walls 26, including alternative fittings, are conceivable. The hook portion 42 is hooked onto the
20 top of the wood-based panel 12 for the wall 26ba. Then, the wood-based panel 12 for the roof 28b is fastened to the knee 44, e.g. by means of fastening elements, such as screws. One or several fittings 40 may be arranged in joints between adjacent sandwich panels 10 in the building element 20 for the roof 28b.

25 Prefabricated wood-based panels 12 may first be erected as walls 26. A prefabricated wood-based panel 12 may then be connected between the walls 26 as a roof 28. Prefabricated sandwich panels 10 may then be connected to the exterior of the wood-based panels 12 of the walls 26 and the roof 28, e.g. by means of fastening elements.

The interior width of the modular housing unit 24a, 24b, i.e. the distance between the plaster panels 36 of the side walls 26aa, 26ab, 26ba, 26bb, may for example be 3.7 m. The exterior width of the modular housing unit 24a, 24b may for example be 4.2 m. The height of the modular housing unit 24a, 24b may for example be 3.0 m.

Fig. 6 schematically represents a cross-sectional side view of the lower modular housing units 24b in Fig. 3. As shown in Fig. 6, the modular housing unit 24b comprises a front wall 26bc and a rear wall 26bd. Each of the front wall 26bc and the rear wall 26bd comprises a building element 20 comprising a sandwich panel 10 connected to a load-bearing wood-based panel 12. At least the rear wall 26bd may comprise a structural load-bearing building element 20 of the same type as the side walls 26ba, 26bb. The wood-based panel 12 of the roof 28b is connected to the top of the wood-based panel 12 of the front wall 26bc. The wood-based panel 12 of the front wall 26bc is also connected to the wood-based panel 12 of the floor 30b.

The interior length of the modular housing unit 24b, i.e. the distance between the plaster panels 36 of the front wall 26bc and the rear wall 26bd, may for example be 9.0 m. The exterior length of the modular housing unit 24b may for example be 10.3 m.

Fig. 7 schematically represents a cross-sectional top view of the lower modular housing units 24b in Fig. 3. The modular housing unit 24b of this specific example comprises an entrance door 46, a bathroom 48, a balcony 50, and a balcony door 52. An extra layer of plaster panels 36 may be provided in the bathroom 48. The interior layout of the modular housing unit 24b in Fig. 7 is only one of many possible examples.

As shown in Fig. 7, not only the side walls 26ba, 26bb, but also each of the front wall 26bc and the rear wall 26bd is self-supporting and forms an active structural element of the modular housing unit 24b. The walls 26 of the lower modular housing unit 24b are configured to carry the entire load of the upper modular housing unit 24a, and optionally further upper modular housing

units 24. However, not all of the walls 26 may form an active structural element of the modular housing unit 24b. The front wall 26bc may for example be entirely replaced with glass.

As shown in Fig. 7, the modular housing unit 24b does not comprise any
5 elongated load-supporting parts. Rather the several pairs of load-bearing perpendicular walls 26ba, 26bb, 26bc, 26bd are connected to each other. More specifically, the wood-based panels 12 of these walls 26ba, 26bb, 26bc, 26bd are connected to each other. At least 80 % of the load from one or several modular housing units 24 above the lower modular housing unit 24b
10 may be taken up by the load-bearing walls 26ba, 26bb, 26bc, 26bd.

Fig. 8 schematically represents a front view of a building 22 comprising a plurality of modular housing units 24, each of the type described previously. The building 22 of the example in Fig. 8 comprises 16 modular housing units 24, distributed in four stories. The building 22 of this specific and non-
15 limiting example comprises a foundation 54, an exterior roof 56, and an exterior stairwell 58.

Each story of the building 22 comprises four modular housing units 24. The modular housing units 24 are placed directly on top of each other. That is, the building 22 comprises several vertically aligned modular housing units 24.
20 However, a wide range of alternative arrangements of the modular housing units 24 in the building 22 are possible, including for example several horizontally offset modular housing units 24. The building 22 does not comprise any framework between the modular housing units 24, although some components may be arranged between the modular housing units 24,
25 such as support blocks between two wood-based panels 12 and/or the cover plate 38.

While the present disclosure has been described with reference to exemplary embodiments, it will be appreciated that the present invention is not limited to what has been described above. For example, it will be appreciated that the
30 dimensions of the parts may be varied as needed.

CLAIMS

1. A building element (20) for forming a part of a modular housing unit (24), the building element (20) comprising:
 - a load-bearing wood-based panel (12); and
 - 5 - a sandwich panel (10) fixedly connected to, and substantially parallel with, the wood-based panel (12);wherein the sandwich panel (10) comprises two outer layers (14) and a core layer (16) between the outer layers (14).
- 10 2. The building element (20) according to claim 1, wherein the wood-based panel (12) comprises at least two non-aligned wood layers (18).
3. The building element (20) according to claim 1 or 2, wherein the wood-based panel (12) comprises at least two differently oriented wood layers (18).
- 15 4. The building element (20) according to any of the preceding claims, wherein the wood-based panel (12) comprises cross-laminated timber.
5. The building element (20) according to any of the preceding claims, wherein each of the wood-based panel (12) and the sandwich panel (10) are prefabricated.
- 20 6. The building element (20) according to any of the preceding claims, wherein the sandwich panel (10) is directly connected to the wood-based panel (12).
7. The building element (20) according to any of the preceding claims, wherein the outer layers (14) are of the same type.
8. The building element (20) according to any of the preceding claims, 25 wherein the outer layers (14) are waterproof.
9. The building element (20) according to any of the preceding claims, wherein the core layer (16) is an isolation layer.

10. A modular housing unit (24) comprising at least one building element (20) according to any of the preceding claims.
11. The modular housing unit (24) according to claim 10, wherein the at least one building element (20) constitutes one or more load-bearing walls (26) of the modular housing unit (24).
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12. A modular housing unit (24) comprising two building elements (20) according to any of claims 1 to 9, wherein the two building elements (20) constitute two perpendicular load-bearing walls (26) of the modular housing unit (24), and wherein the two building elements (20) are directly connected to each other.
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13. A building (22) comprising at least one modular housing unit (24) according to any of claims 10 to 12.
14. A building (22) comprising at least two modular housing units (24) according to claim 10 to 12, wherein an upper modular housing unit (24a) of the at least two modular housing units (24) is arranged on top of a lower modular housing unit (24b) of the at least two modular housing units (24).
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15. A building (22) comprising at least two modular housing unit (24) according to claim 11 or 12, wherein at least one upper modular housing unit (24a) is arranged on top of at least one lower modular housing unit (24b), and wherein at least 80 % of the load of the at least one upper modular housing unit (24a) is taken up by the one or more load-bearing walls (26) of the at least one lower modular housing unit (24b).
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16. A method of assembling a building element (20) for forming a part of a modular housing unit (24), the method comprising:
25
 - providing a load-bearing wood-based panel (12);
 - providing a sandwich panel (10) comprising two outer layers (14) and a core layer (16) between the outer layers (14); and

- fixedly connecting the sandwich panel (10) to the wood-based panel (12) substantially parallel with the wood-based panel (12).

ABSTRACT

A building element (20) for forming a part of a modular housing unit (24), the building element (20) comprising a load-bearing wood-based panel (12); and a sandwich panel (10) fixedly connected to, and substantially parallel
5 with, the wood-based panel (12); wherein the sandwich panel (10) comprises two outer layers (14) and a core layer (16) between the outer layers (14). Modular housing units (24) comprising at least one building element (20), buildings (22) comprising at least one modular housing unit (24), and a method of assembling a building element (20) for forming a part of a
10 modular housing unit (24), are also provided.

(Fig. 4)

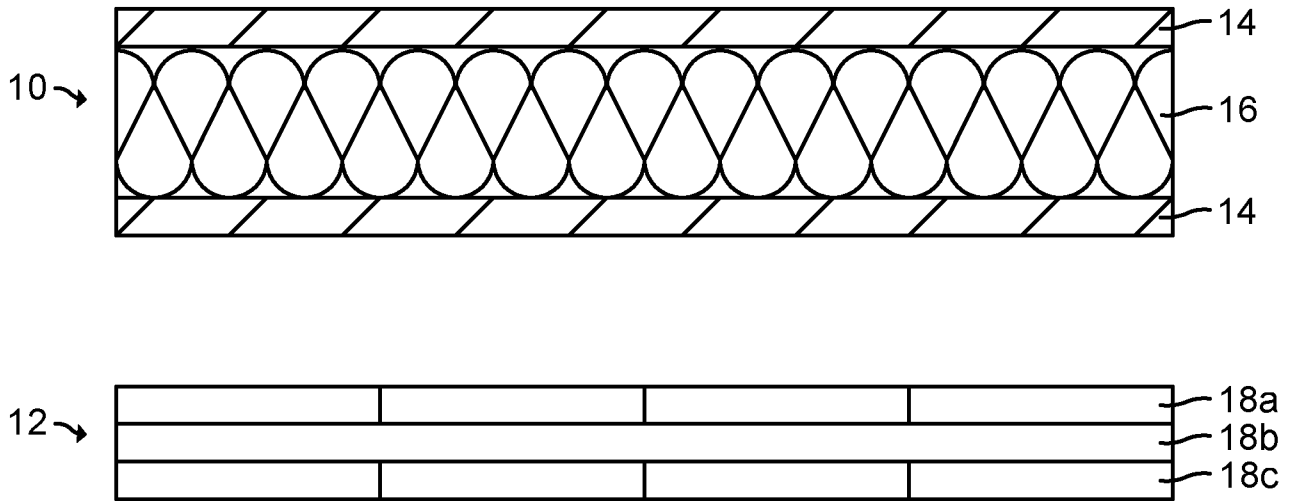


Fig. 1

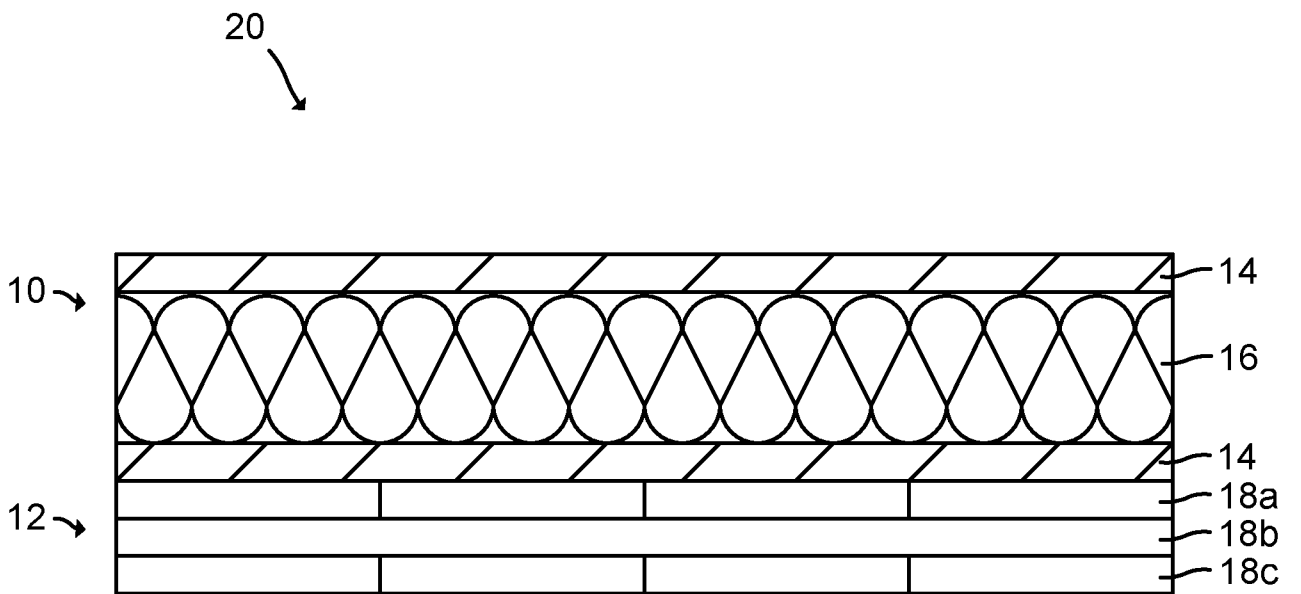


Fig. 2

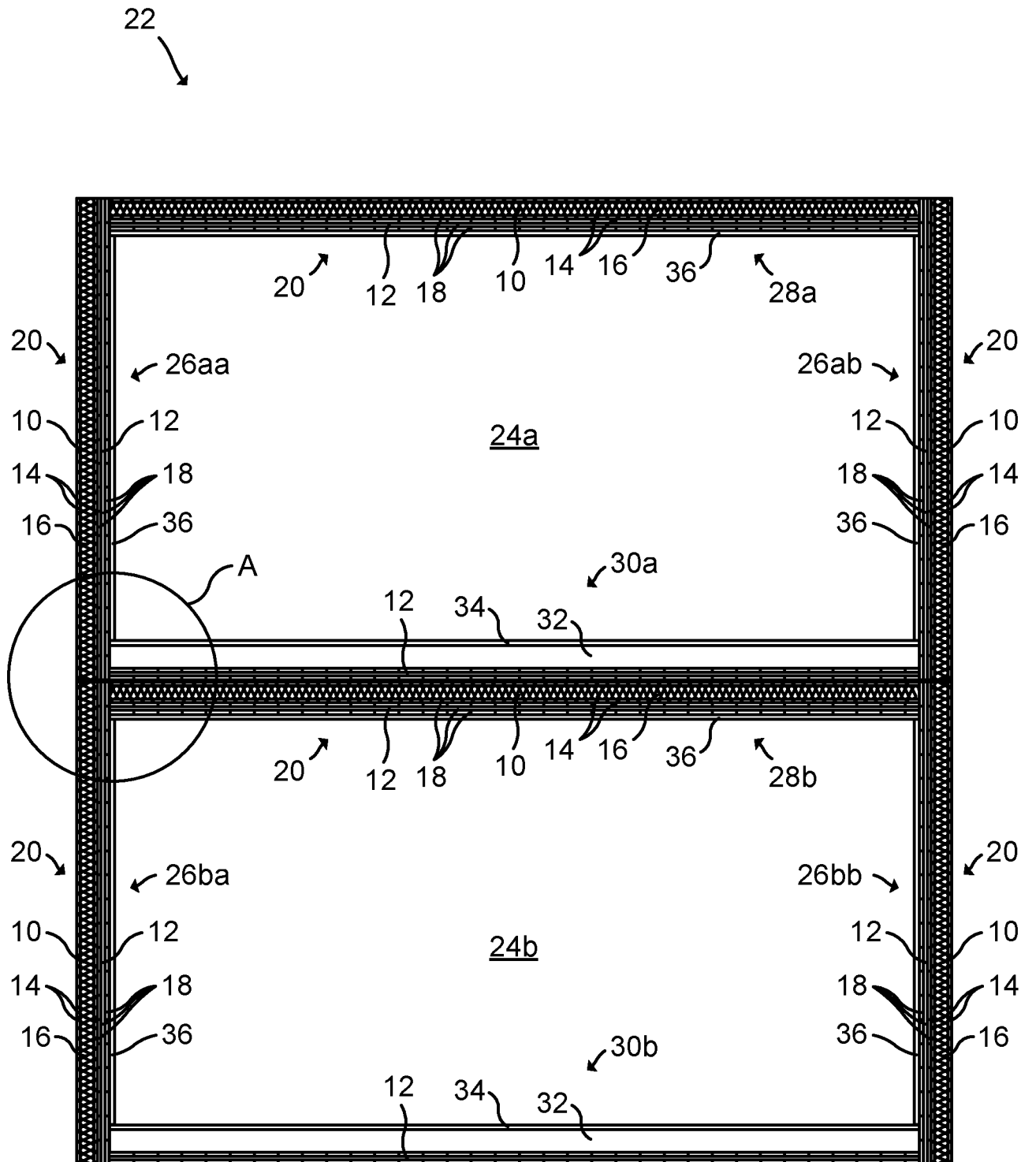


Fig. 3

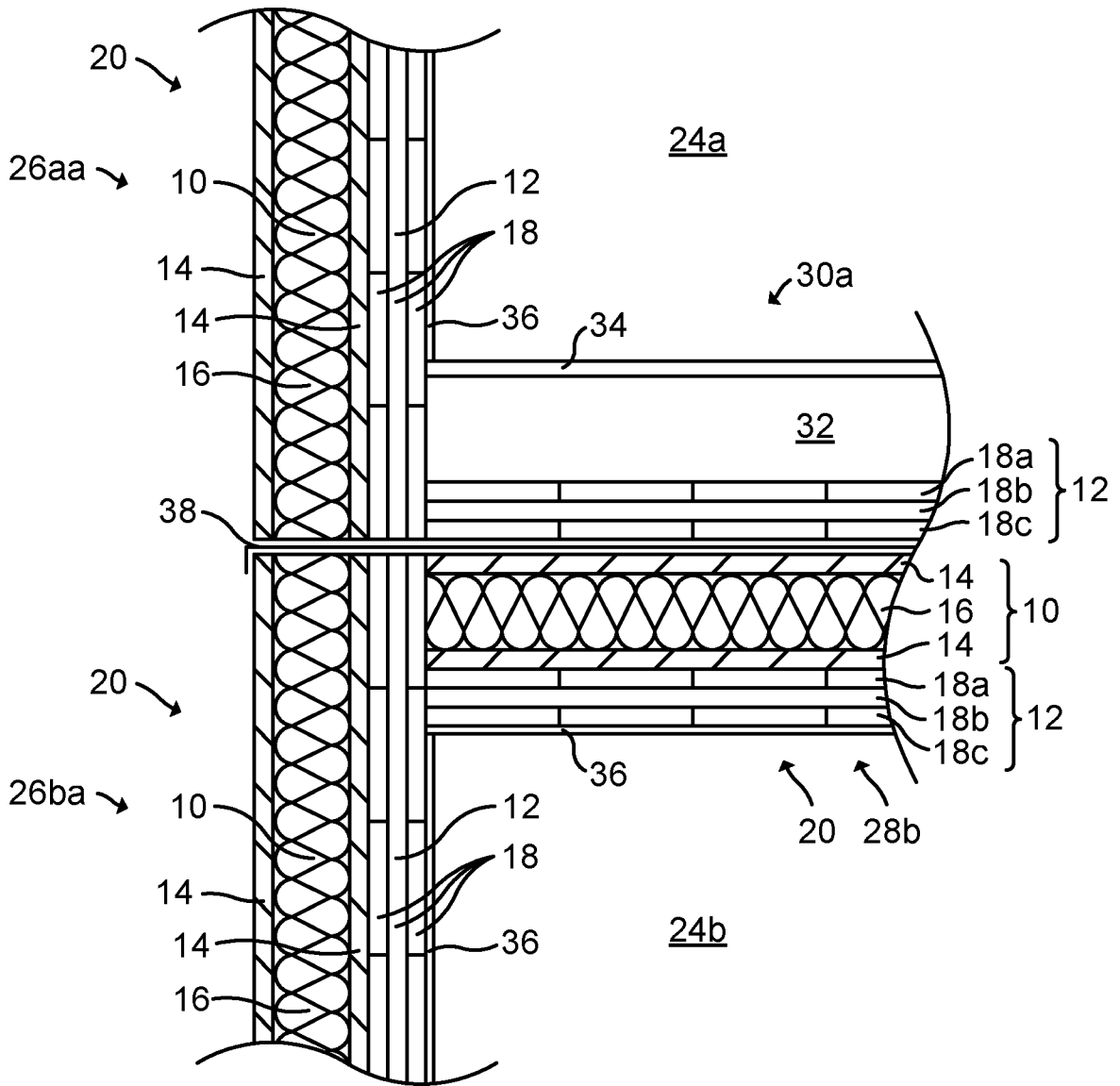


Fig. 4

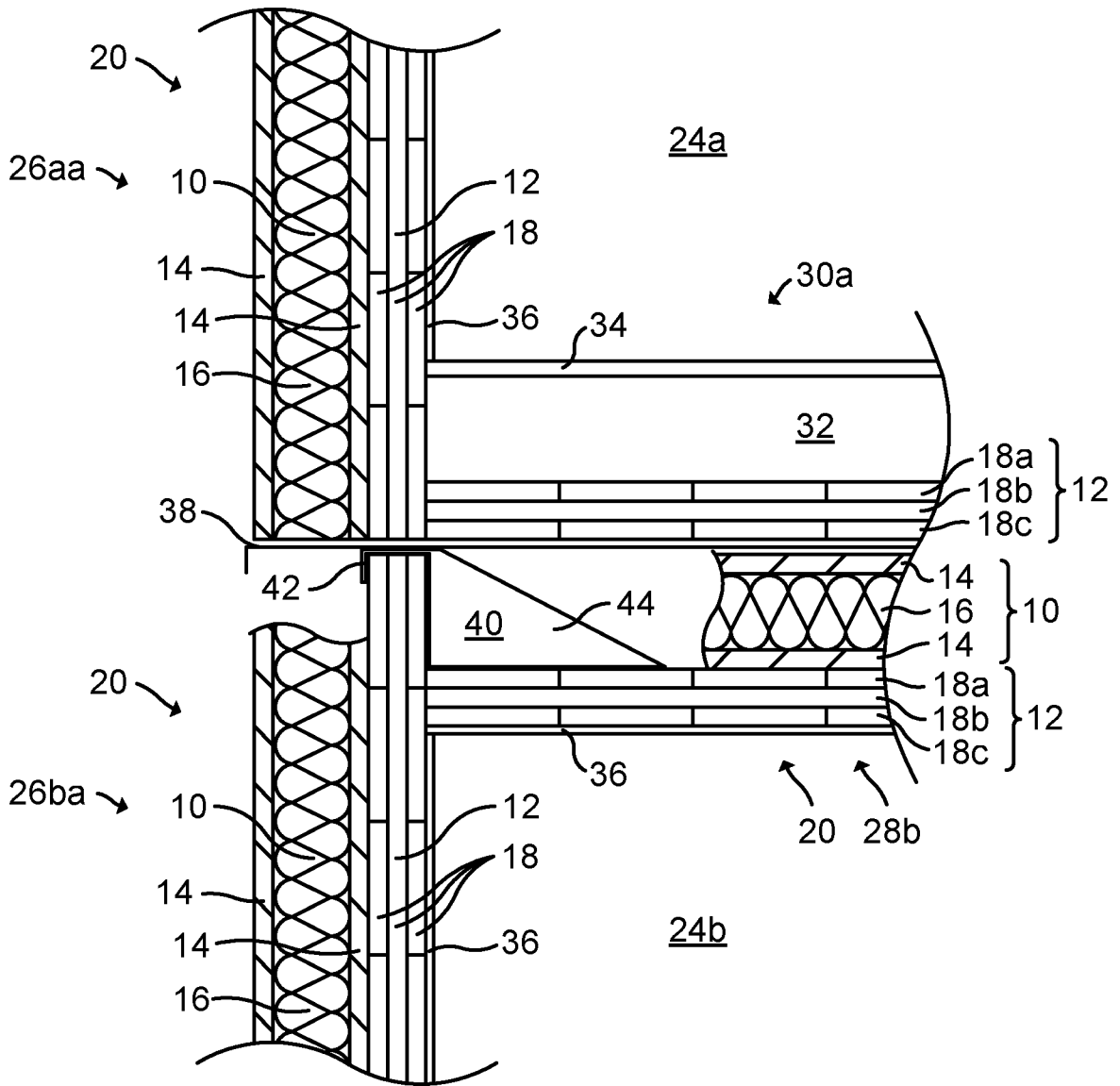


Fig. 5

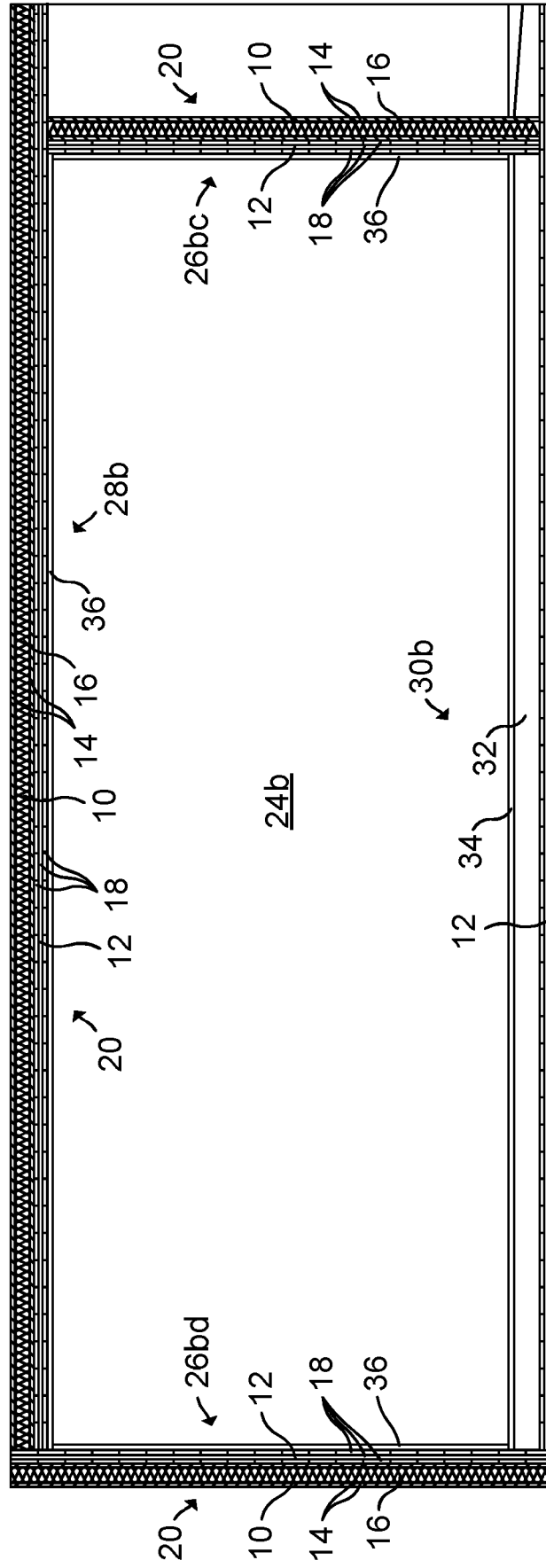


Fig. 6

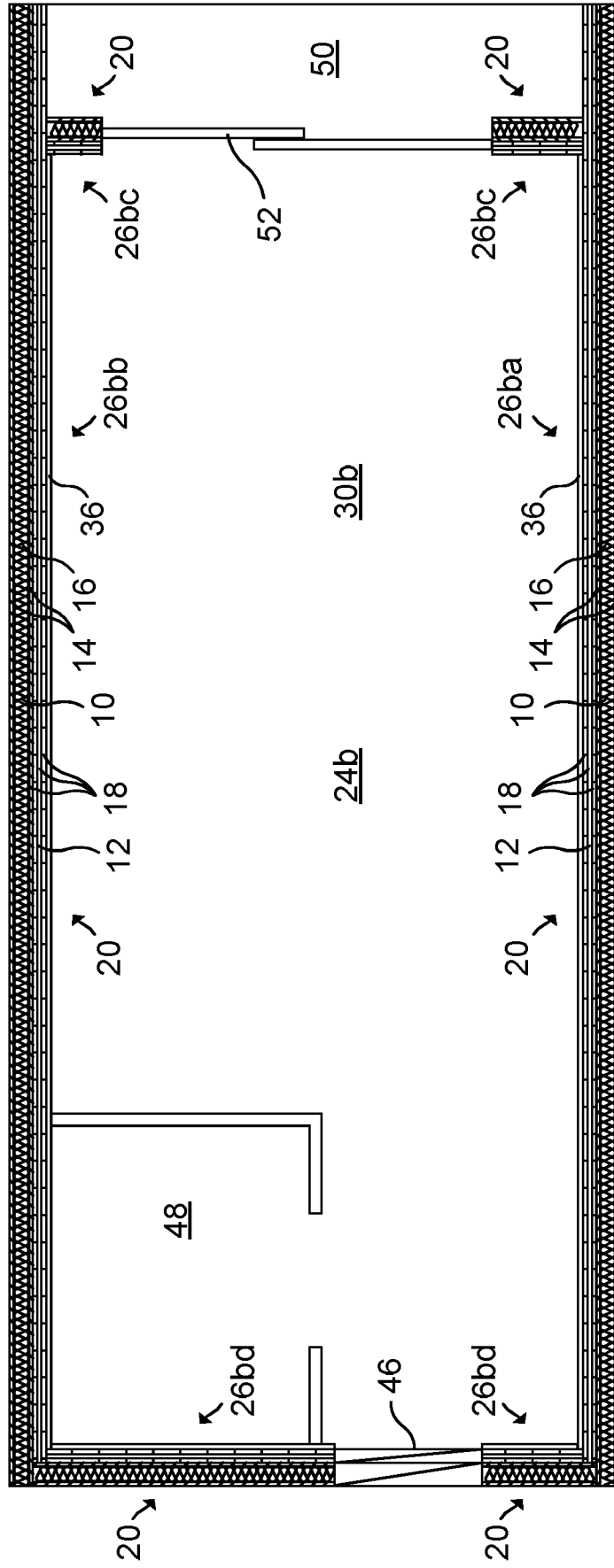


Fig. 7

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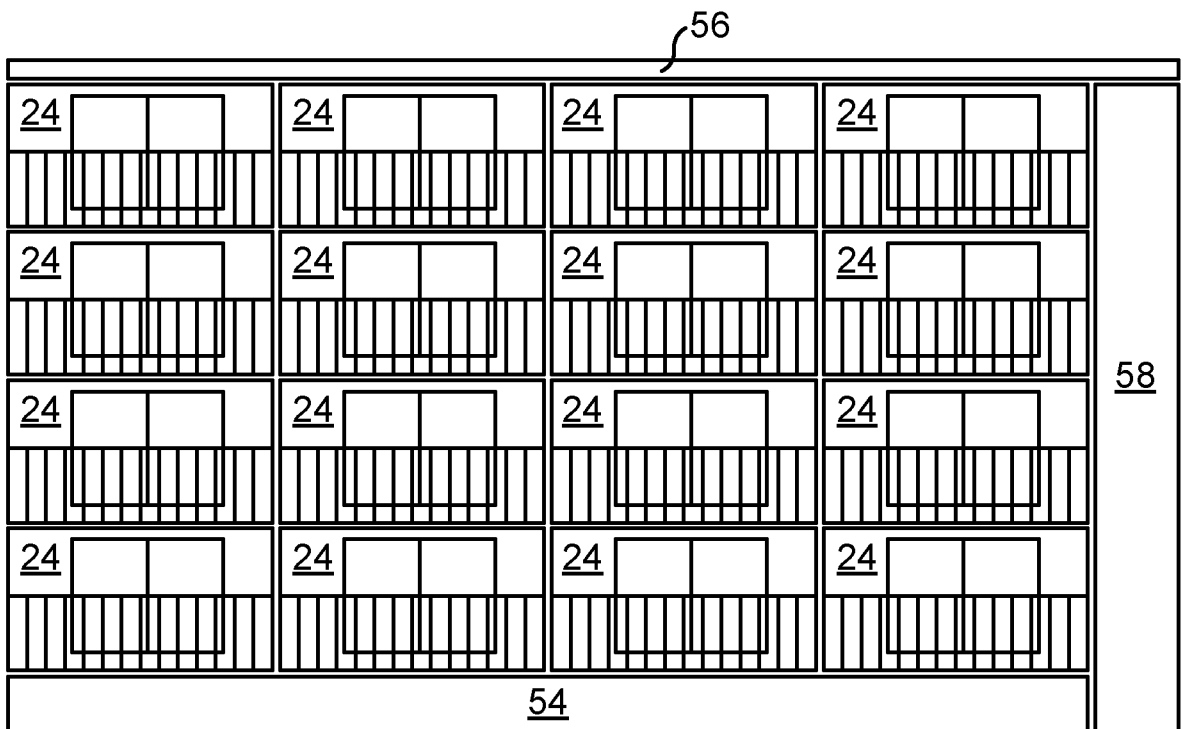


Fig. 8