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(71) Applicant: **Zenergy AB**
568 32 Skillingaryd (SE)

(72) Inventor: **Gurbin, Robert**
568 32 Skillingaryd (SE)

(74) Representative: **Awapatent AB**
Östra Storgatan 7
553 21 Jönköping (SE)

(54) FIRE RESISTANT CONSTRUCTION PANEL ELEMENT SYSTEM

(57) The present invention relates to a fire resistant construction panel system (1), comprising at least a first and a second panel element (9a, 9b). Each panel element comprises a first face sheet (10a, 10b) and a second face sheet (11a, 11b), adapted to lend stability to the construction panel. The panel element further comprises an insulating core layer (12a, 12b) arranged between the first and the second face sheet The first face sheet, the second face sheet and the core layer together form a sandwich-type construction panel, and at least one of the first and the second face sheet consists of a fireproof material.

The construction panel system further comprises a connector element (16), adapted to be received in corresponding at least one groove (24). The groove is arranged in a longitudinal direction along a rim of the respective core layers. The connector element, when provided in the groove, joins the panel elements) together. The connector element is made from a fire resistant material.

The invention further relates to a method of forming a wall using the system.

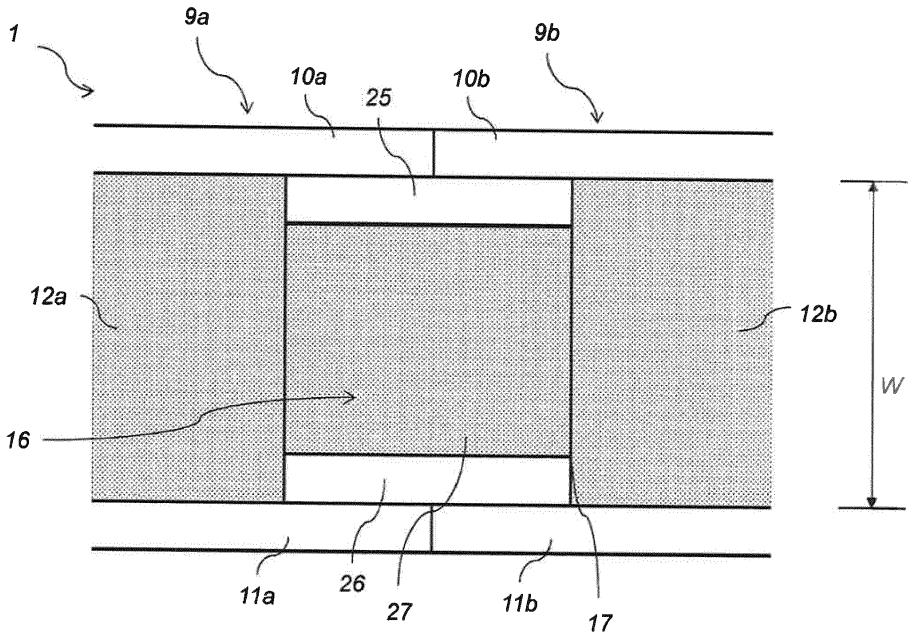

Fig. 4

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Description

Technical Field

[0001] The present disclosure relates to a construction panel for building, and especially to a fire resistant construction panel.

Background

[0002] In the field of building construction, prefabricated construction panels are increasingly used in order to facilitate the building process. The prefabricated construction panel may thus be fabricated in a controlled indoor area without the risk of adding moisture from the outside into the panels, ensuring that the quality of the panel is stable.

[0003] So-called sandwich insulating panels (SIP) for walls, for example, have previously been used in the construction of buildings. A sandwich panel consists of two face sheets and a core layer arranged between the two face sheets. The face sheets are made of a stable material in order to support the construction. The function of the core layer is mainly to contribute insulating properties and to have a load-transmitting function between the two face sheets. These sandwich panels can be prefabricated in a protected environment in order to avoid the entry of damp into the panel. Sandwich panels are often designed with wooden face sheets, which may challenge the fire safety in the wall construction. Furthermore, wooden face sheets can give rise, for example, to mould and fungus damages etc. in the panel.

[0004] A way to solve this is by using a construction panel having face sheets and core layers resistive to mould, and containing a fire resistant material. This type of panel may also be suitable in the construction of so called passive houses, which require an effective climate shield and moisture barrier. However, prefabricated construction panels cannot be made in continuous sizes without having to join two or more panels in order to achieve large walls. These joints may weaken the construction as well as decrease the ability of the panel element of resisting fire due to gaps. Also, in order to maintain an effective climate shield and moisture barrier it is necessary to avoid carriers of cold and moisture into the panel, such as nails, screws, and rivets.

[0005] A way to solve this is to provide the fire resistant panel with a male/female tongue and groove arrangement in order to join two panels together. However, this type of construction may not fulfill the high standard fire resistant classification to EI60, which is required for certain building types. It is also a complicated and time consuming procedure in the prefabrication stages since it is not possible to easily adapt to the size of the building on site.

[0006] It is therefore a need for a solution for a fire resistant construction panel which solves the abovementioned problems in the construction of buildings.

Summary

[0007] It is an object of the present invention to provide an improved solution that alleviates the mentioned drawbacks with present devices.

[0008] According to a first aspect of the invention, a fire resistant construction panel system is provided, comprising at least a first and a second panel element, each panel element comprising a first face sheet and a second face sheet, adapted to lend stability to the construction panel, an insulating core layer arranged between the first and the second face sheet, wherein the first face sheet, the second face sheet, and the core layer together form a sandwich-type construction panel, and wherein at least one of the first and the second face sheet consists of a fireproof material. The construction panel system further comprises at least one longitudinally extending connector element, adapted to fit into a groove in each panel element. The groove in each panel element extends along a longitudinal direction and is formed by each first and second panel element comprising a recess, wherein the recess extends between the first and second face sheets along a rim of the core layer. The connector element comprises a first panel sheet, a second panel sheet, and an insulating core layer arranged between the first and second panel sheet, wherein the first panel sheet, the second panel sheet, and the core layer together form a sandwich-type connector element, and the outer dimension of the connector element corresponds to the width of the groove between the face sheets of the panel elements.

[0009] Since the first face sheet, the second face sheet, and the core layer may together form a sandwich-type construction panel, a construction panel which is stable yet relatively thin and has very good insulating capacity may thus be achieved. The same insulating capacity with a wall made from traditional building methods may require a much thicker wall. By providing the surface elements of a construction panel, that is the face sheets, with fire resistant material, the overall fire resistance of a wall may be improved. When joining two (or more) panel elements in order to form large walls or systems, a gap in the panel joint occur. This gap may give rise to a number of weaknesses in the structure, for instance strength, but also the gap may allow air, oxygen, moisture or other unwanted material to enter the structure and the building.

[0010] By joining two construction panels with an overlapping connector element, that has fire resistant characteristics, the negative effects of that gap can be reduced or prevented. Further to this the, progression of fire can be greatly reduced.

[0011] By overlapping it is meant that between the edges of a first and a second panel element to be joined, a groove may be formed by removal of core material along the rim of the panel element. The groove in between the panel elements houses the connector element which bridges the gap between the two panel elements. The

term "connector element" or "connector" is to be interpreted as means for joining (i.e. a joining means) at least two panel elements together. The overlapping connector element may thus be arranged in the groove between each pair of the core layers to be joined. By providing a connection between the panel elements according to the invention fire resistance classification EI60 may be achieved.

[0012] According to an embodiment of the invention, the width of the panel sheet of the connector element equals the width of the connector element core layer and the longitudinal extension of the panel sheet of the connector element equals the longitudinal extension of the connector element core layer.

[0013] As the width and longitudinal extension of the panel sheet of the connector element corresponds to the width and longitudinal extension of the core layer of the connector element, a planar surface around the circumference of the connector element is formed which may allow for a tight fitting towards the surfaces of the groove and thereby improve the fire resistance.

[0014] According to another embodiment of the invention, at least one of the first and the second face sheet may consist of magnesium oxide.

[0015] Magnesium oxide has fire resistant capabilities, which means that a face sheet that contains magnesium oxide may provide a fire resistant panel element. Since the face sheet may be the part of the element that is arranged towards the environment in a room or towards the outside, a fire resistant shield may be advantageous. It is possible that the face sheets may contain other fire resistant components or a mixture of several fire resistant components. Furthermore, a highly alkaline, yet inorganic material, such as magnesium oxide, can thus prevent the possible incipient growth of mould, for example, in the construction in the event of damp formation. This may be in contrast to a situation in which, for example, wood is used in the face sheets.

[0016] According to another aspect of the invention the panel sheet of the connector element may be made from magnesium oxide.

[0017] By making the panel sheet of the connector element from magnesium oxide, the connector element may be provided with fire resistant capabilities. The fire resistant characteristics may be similar to that of the face sheet.

[0018] It may be possible that the panel sheet may be made from the same material as the face sheet. The thickness of the panel sheet may be the same as the thickness of the face sheet. However, if required due to safety and/or stability or any other reason, the thickness may be different.

[0019] According to another embodiment of the invention, the connector element may be fixated in the groove by a fixating means.

[0020] The connector element may require fixating in the groove. Fixating the connector element may be required in order to provide a stable joint, but also in order to seal any gaps that may carry oxygen from outside of the building which may serve as fuel to a fire. The fixating means may be for instance a glue, foam, self adhesive tape or a paste or the like. The fixating may also be achieved by a mechanical fit.

[0021] According to another embodiment of the invention, the fixating means may be fire resistant adhesive glue.

[0022] It is an advantage fixating the connector element by using fire resistant adhesive glue. By doing this, a safe construction may be provided, minimizing any possible fire hazards. Further, by using adhesive glue, any use of fastening elements, such as nails and screws may be avoided. Nails and screws serve as cold bridges and may affect the indoor climate of the building. Since cold bridges out towards the outer side of the wall may be avoided, it may make the wall construction more energy-efficient.

[0023] According to another embodiment of the invention, the core layer may consist of a plastics material, preferably a foamed plastics material.

[0024] The principal object of the core layer to have an insulating function may thus be met. Furthermore, a plastics material of this kind may have the advantage that it is not organic, and thus further prevents mould growth, for example, in the panel. Moreover, such a material may not be water-permeable, which may give less risk of damp damage and greater insulating capacity.

[0025] According to another embodiment of the invention, the core layer of the connector element may consist of a plastics material, preferably a foamed plastics material.

[0026] According to another embodiment of the invention, the panel elements may be prefabricated in a plant, prior to use of the panel element in the construction of a building.

[0027] By using prefabricated panel elements, it may provide flexibility to the building procedure on site as well as the prefabrication process is done in a controlled process in a plant where moisture levels may be low.

[0028] According to a second aspect of the invention, it is provided a method for forming a wall using a fire resistant construction panel system comprising the steps of: providing a first and second panel element, each panel element comprising a first face sheet and a second face sheet, adapted to lend stability to the construction panel, an insulating core layer arranged between the first and the second face sheet, wherein the first face sheet, the second face sheet, and the core layer together form a sandwich-type construction panel, and wherein at least one of the first and the second face sheet consists of a fireproof material; providing a first longitudinal recess between the first and second face sheet of the first panel element along a rim of the core layer; providing a second longitudinal recess between the first and second face sheet of the second panel element along a rim of the core layer; arranging a first and second panel element such that a longitudinal groove is formed from the first and

second recesses; providing a connector element of a fire resistant material in the groove, the connector element joining the first and second panel element together, the connector element comprising a first panel sheet, a second panel sheet, and an insulating core layer arranged between the first and second panel sheet, wherein the first panel sheet, the second panel sheet, and the core layer together form a sandwich-type connector element, wherein at least one of the first panel sheet and the second panel sheet consists of a fireproof material, and wherein an outer dimension of the connector element corresponds to the width of the groove between the face sheets of the panel elements. Any steps may be repeated as required.

[0029] By using a method according to this, it is possible to directly and instantly connect two or more panel elements together easily on the building site. This may be an advantage, since it may occur that the panel sizes are erroneously calculated, and the method may thus allow an existing panel element to be joined with another without the need of fastening elements such as nails or screws. The steps may be done in any suitable order, depending on the type of manufacture. The core layer and the face sheet may be joined, and that the recess is cut or milled out subsequently. Alternatively, the recess may be cut out or milled before the face sheet is applied. Alternatively, the core layer may be manufactured having dimensions smaller than the face sheet, thereby forming the recess when they are joined.

[0030] Further, the step of arranging the connector element may be altered to suit the type of manufacture and may thus be performed in a number of ways. The panel elements may be arranged next to each other, and subsequently the connector element is arranged in the groove simultaneously. Alternatively, the connector element is arranged in one recess of a first panel element, and subsequently the second panel element is arranged next to the first panel element such that the connector element connects the first and second panel elements. The method allows to repeat any steps as required, and to perform the steps in any necessary order.

[0031] The method may further comprise the step of applying fixating means in the longitudinal groove on a first and a second core layer.

[0032] This step allows a fixating means to be applied in the groove prior to arranging a connector element. The fixating means may be an adhesive, a self adhesive tape or glue which may be fire resistant. Applying fixating means is the most preferred embodiment, but depending on the alternative fixating, for instance a mechanical press fit, the step of applying fixating means may be optional.

Brief Description of the Drawings

[0033] The invention will in the following be described in more detail with reference to the enclosed drawings, wherein:

Fig. 1 shows a top view of a panel element.

Fig. 2 shows a top view of the groove between two panel elements.

Fig. 3 shows an exploded perspective view of a joint between two panel elements.

Fig. 4 shows a top view of two panel elements joined by a connector element.

Fig. 5 shows a top view of a joint between two panel elements according to an embodiment of the invention,

Fig. 6 shows an exploded perspective view of a joint between two panel elements according to an embodiment of the invention,

Fig. 7 shows a perspective view of a joint between two panel elements according to an embodiment of the invention,

Fig. 8 shows a top view of a joint between two panel elements according to an embodiment of the invention,

Fig. 9 shows a front view of a wall built from a plurality of panel elements according to an embodiment of the invention.

Description of Embodiments

[0034] The present invention will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be 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. In the drawings, like numbers refer to like elements.

[0035] In fig. 1 a top view of a fire resistant construction panel element is illustrated. The panel element comprises a first face sheet 10a and a second face sheet 11 a, arranged on one side each of a core layer 12a. These three parts, the first and second face sheet and the core layer, together form a so-called sandwich panel or element. The face sheets 10, 11 can be made of magnesium oxide. This gives the face sheets stability and fireproofing properties. The face sheets can also be made of other materials, such as polymer concrete, alkaline polymer or polyester mixed with a filler material such as sand, lime, potash or some ceramic material. The core layer 12 may be made of a foamed plastics material, for example polyurethane foam or an EPS plastic (Expanded Polystyrene). The function of the core layer 12 is to contribute to the strength and insulating capacity of the construction panel 1. The core layer 12 has a function of transmitting load to the face sheets 10, 11.In fig. 2 a top view of two joined panel elements 9a, 9b is illustrated. The panel elements may be joined to create a bigger wall or panel system. A groove 24 is formed in-between the two panel elements 9a, 9b by the recesses 23a, 23b in the respective panel element 9a, 9b. The groove 24 may run along

the entire longitudinal extension of the panel element. The groove 24 may be provided by cutting, countersinking or milling the core layer, or by forming the panel element using a core layer of smaller dimension than the face sheets. The dimensions of the groove 24 correspond to the outer dimensions of the connector element 16 (see fig 5).

[0036] Fig. 3 illustrates an exploded view of two panel elements 9a, 9b with a joining connector element 16. The connector element 16 joins the panel elements 9a, 9b by being placed in the groove 24 between them. The panel sheets 25, 26 of the connector element 16 are in contact with the face sheets 10, 11 of the panel elements 9a, 9b and the core layer 27 of the connector element 16 are in contact with the core layer 12 of the panel elements 9a, 9b.

[0037] In fig. 4 the construction panel system 1 with two panel elements 9a, 9b joined by a connector element 16 is illustrated. The connector element 16 may be fixated in the groove 24 by using a fire resistant fixating means 17, such as glue, tape, paste or foam. The fixating means 17 provides additional strength to the structure and seal to the joint in order to reduce the risk of air pockets.

[0038] In fig. 4 is further the width W of the groove 24 indicated, corresponding to the distance between the face sheets 10, 11 of the panel elements 9. The connector element 16 has the overall corresponding width W in order to fit in the groove 24.

[0039] In fig. 5 a top view of a fire resistant construction panel system is illustrated with joined panel elements 9a, 9b. A first panel element 9a and a second panel element 9b are arranged side by side, with one edge arranged against the other in order to create a bigger wall or system. Each panel element 9, 9a, 9b comprises a first face sheet 10, 10a, 10b and a second face sheet 11, 11 a, 11 b, which are arranged on one side each of a core layer 12, 12a, 12b. These three parts the face sheets and the core layer 10, 11, 12 together forms a so-called sandwich panel or element. The face sheets 10, 11 can be made of magnesium oxide. This gives the face sheets stability and fireproofing properties. The face sheets can also be made of other materials, such as polymer concrete, alkaline polymer or polyester mixed with a filler material such as sand, lime, potash or some ceramic material. The core layer 12 may be made of a foamed plastics material, for example polyurethane foam or an EPS plastic (Expanded Polystyrene). The function of the core layer 12 is to contribute to the strength and insulating capacity of the construction panel 1. The core layer 12 has a function of transmitting load to the face sheets 10, 11.

[0040] According to one embodiment each of the panel elements comprises a groove 15. As can be seen in Figs 5 and 6, the groove 15 may be provided, in the core layer 12 adjacent to face surfaces 13, 14, or even directly in the face surfaces, of the core layer and running along a rim 21 a, 21 b of the core layer 12. According to one embodiment the groove 15 runs along the entire length of the panel element 9 (as seen in Fig. 9). According to another embodiment (not shown) the groove runs partially or alternatively intermittently slotted along the length of the panel element.

[0041] The groove 15 may be provided by cutting, countersinking or milling the core layer.

[0042] The face surface 13, 14 is the surface onto which the face sheet 10, 11 is arranged. Each panel element 9 to be joined comprises at least one groove 15, and the grooves 15 of two panel elements 9 are arranged next to each other, forming a larger indentation the panel elements 9. Further, in Fig. 5 a connector element 16 is illustrated. The connector element 16 is adapted to be arranged inside, inserted, received or provided in the groove 15, and adapted such that when it is inserted in the respective grooves 15 of the core layers, it extends between and overlaps a gap 19 between the panel elements 9a, 9b, such that the gap or joint 19 between the panel elements 9a, 9b is covered. Through this connector element 16 a strong joint, which is resistive to the outside environment may be achieved.

[0043] According to one embodiment the connector element 16 may be fixated in the groove 15 by using a fire resistant fixating means 17, such as glue, tape, paste or foam. The fixating means 17 provides additional strength to the structure and seal to the joint in order to reduce the risk of air pockets. Further, in Fig. 9 the seam 18 of the face sheets 10a, 10b, 11a, 11b is shown. The face sheets 10, 11 of the panel elements 9 are arranged such that the seam 18 between two first face sheets 10a, 10b are located at a distance from, or non-linear with, the joint or gap 19 of the panel elements 9a, 9b. This construction may reduce the number of weak spots in the construction panel and load may be absorbed throughout the entire construction panel.

Fig. 6 illustrates an exploded view of the two joint panel elements 9a, 9b, forming the system according to an embodiment of the invention.

[0044] As illustrated in fig. 7 the groove 15, and connector element 16, extend along the entire length of the side of the panel element 9 to be connected or joined with another panel element 9.

[0045] Fig. 7 shows the core layer 12 of two panel elements 9a, 9b and the connector element 16 when joined together. From fig. 7 it is clear that the groove 15 in one embodiment is arranged substantially in, or as a depression in, the face surface 13, 14 of the core layer 12. In fig. 7, it is also shown that the groove 15 and thereby the connector element 16 is provided along a length of the edge of the panel element 9a, 9b in a direction Y.

[0046] In fig. 8 another embodiment of the invention is illustrated, where the at least one groove 15 have been provided in the core layer, at a distance from the respective face sheet surfaces, i.e. the connector elements 16 are located inside the core layer 12 when the two panel elements 9a, 9b have been joined together. As in other embodiments, this groove 15 may also be cut along the entire length of the edge, or rim 21 a, 21 b of the panel element 9a, 9b. The groove 15 can be cut anywhere be-

tween the face surfaces 13, 14, as long as required strength is obtained to the structure. According to another embodiment several parallel grooves may be cut out in the core layer and provided with connector element 16.

[0047] Fig. 9 shows a wall constructed using the fire resistant construction panel system 1 according to an embodiment. A plurality of panel elements 9 joined both vertically and horizontally against each other. Each panel has a groove cut out where each connector element is provided in order to achieve a wall, i.e. a system of panel elements, of any size. Connector elements are arranged to connect the panel elements in the wall, both horizontally and vertically, thereby providing a complete wall with high strength and fire resitance.

[0048] Possible dimensions for one embodiment of the invention are described below. The sandwich part 10, 11, 12 of the construction panel 1 is around 140 mm thick, or more specifically 136 mm thick. With a fire resistant construction panel 1 according to the invention, a U-value of 0.1 can be attained with a sandwich part thickness of around 140 mm. A U-value indicates the thermal conductivity of a material layer. The value is quoted in Watts per square meter and Kelvin. The better the insulating capacity, the lower the U-value. The cut out groove 15 may be any width w as required. According to one embodiment the dimension is around 25-100 mm wide and 5-15 mm deep for each groove 15 of each panel element 9. According to another embodiment a dimension width w is 50 mm and a depth d is 8 mm. The connector element 16 may thus be provided with any suitable dimension corresponding to the groove 15. The connector element 16 may, according to one embodiment be arranged to fill the entire length of the groove 15.

[0049] In the figures 1-9, it may be determined how to achieve a wall 20 using the system 1. The method of forming a wall 20 using the system 1 may be done in several ways and the steps to be carried out may be done in many alternative sequences.

[0050] A first and second panel element of a fireproof material and an insulating core layer arranged between the first and the second face sheet, forming a sandwich-type construction panel is provided.

Trial

[0051] A panel system or wall was constructed, i.e. two panel elements were joined using the connector element as described above. The system or wall measured 3 x 3 m. In the trial, following the measuring protocol for the fire resistance class EI60, the system was able to withstand fire for more than 60 minutes (63 minutes and 41 seconds). This means that a system, as described above provides the desired fire resistance, while being able to be constructed as a larger wall.

[0052] In the drawings and specification, there have been disclosed preferred embodiments and examples of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for the purpose of limitation, the scope of the invention being set forth in the following claims.

Claims

1. A fire resistant construction panel system (1), comprising at least a first and a second panel element (9a, 9b), each panel element comprising
a first face sheet (10a, 10b) and a second face sheet (11 a, 11 b),
an insulating core layer (12a, 12b) arranged between the first and the second face sheet, wherein
the first face sheet, the second face sheet, and the core layer together form a sandwich-type construction panel, and wherein
at least one of the first and the second face sheet consists of a fireproof material,
characterized in that
said construction panel system further comprises at least one longitudinally extending connector element (16), adapted to fit into a groove (24) in each panel element, wherein said groove in each panel element extends along a longitudinal direction and is formed by each first and second panel element comprising a recess (23a, 23b), wherein the recess extends between the first and second face sheets along a rim of the core layer, and
the connector element comprises a first panel sheet (25), a second panel sheet (26), and an insulating core layer (27) arranged between the first and second panel sheet, where in the first panel sheet, the second panel sheet, and the core layer together form a sandwich-type connector element,
wherein at least one of the first panel sheet (25) and the second panel sheet (26) consists of a fireproof material, and
wherein the outer dimension of the connector element corresponds to the width of the groove between the face sheets of the panel elements.

2. Fire resistant construction panel system (1) according to claim 1, wherein the width of the panel sheet (25, 26) of the connector element (16) equals the width of the connector element core layer (27) and wherein the longitudinal extension of the panel sheet of the connector element equals the longitudinal extension of the connector element core layer.

3. Fire resistant construction panel system (1) according to any one of the above claims, wherein at least one of the first (10) and the second (11) face sheet consists of magnesium oxide.

4. Fire resistant construction panel system (1) according to any of the preceding claims, wherein the panel sheet (25, 26) of the connector element (16) is made from magnesium oxide.

5. Fire resistant construction panel system (1) according to any of the claims 1-4, wherein the panel sheet (25, 26) of the connector element (16) and the face sheet is made from the same material.

6. Fire resistant construction panel system (1) according to any of the preceding claims, wherein the connector element (16) is fixated in the groove (24) by a fixating means (17).

7. Fire resistant construction panel system (1) according to claim 6, wherein the fixating means (17) is a fire resistant adhesive glue.

8. Fire resistant construction panel system (1) according to any one of the above claims, wherein the core layer (12) consists of a plastics material, preferably a foamed plastics material.

9. Fire resistant construction panel system (1) according to any one of the above claims, wherein the core layer (27) of the connector element (16) consists of a plastics material, preferably a foamed plastics material.

10. Method for forming a wall (20) using a fire resistant construction panel system (1) according to any of the claims 1-9, comprising the steps of:

providing a first and second panel element, each panel element comprising a first face sheet (10a, 10b) and a second face sheet (11 a, 11 b), an insulating core layer (12a, 12b) arranged between the first and the second face sheet, wherein the first face sheet, the second face sheet, and the core layer together form a sandwich-type construction panel, and wherein at least one of the first and the second face sheet consists of a fireproof material,
providing a first longitudinal recess (23a) between the first (10a) and second (11 a) face sheet of the first panel element (9a) along a rim of the core layer (12a),
providing a second longitudinal recess (23b) between the first (10b) and second (11 b) face sheet of the second panel element (9b) along a rim of the core layer (12b),
arranging a first and second panel element (9) such that a longitudinal groove (24) is formed from the first and second recesses,
providing a connector element (16) of a fire resistant material in the groove, the connector element joining the first and second panel element together, the connector element comprising a first panel sheet (25), a second panel sheet (26), and an insulating core layer (27) arranged between the first and second panel sheet, where in the first panel sheet, the second panel sheet, and the core layer together form a sandwich-type connector element, wherein at least one of the first panel sheet (25) and the second panel sheet (26) consists of a fireproof material, and wherein an outer dimension of the connector element corresponds to the width of the groove between the face sheets of the panel elements.

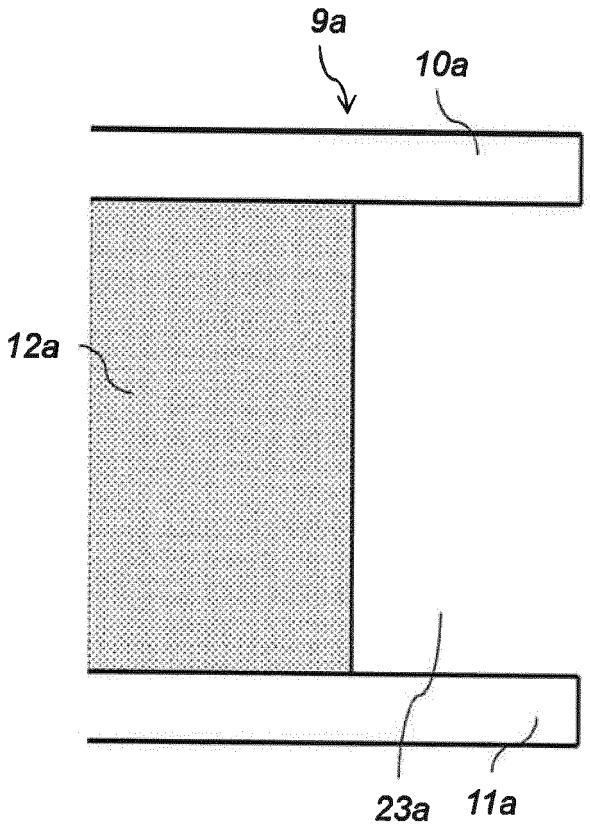

Fig. 1

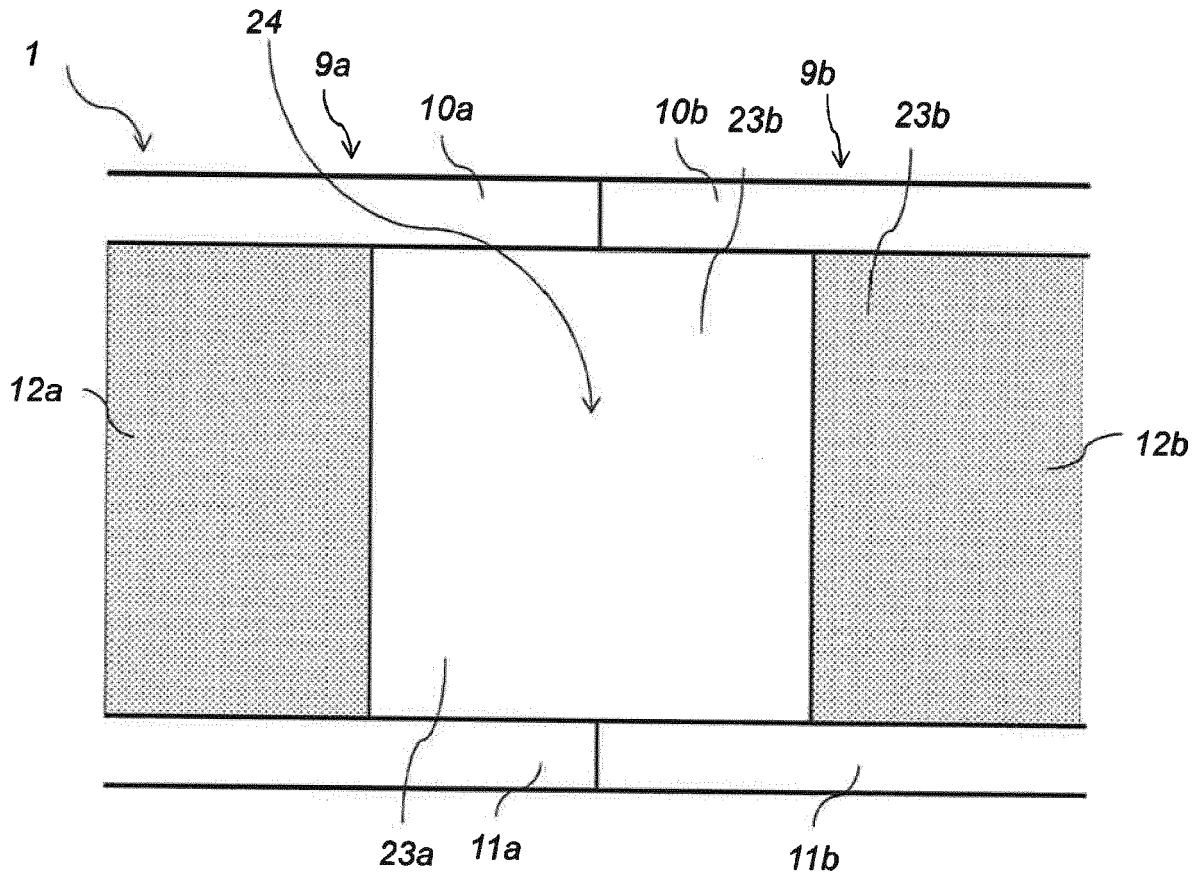

Fig. 2

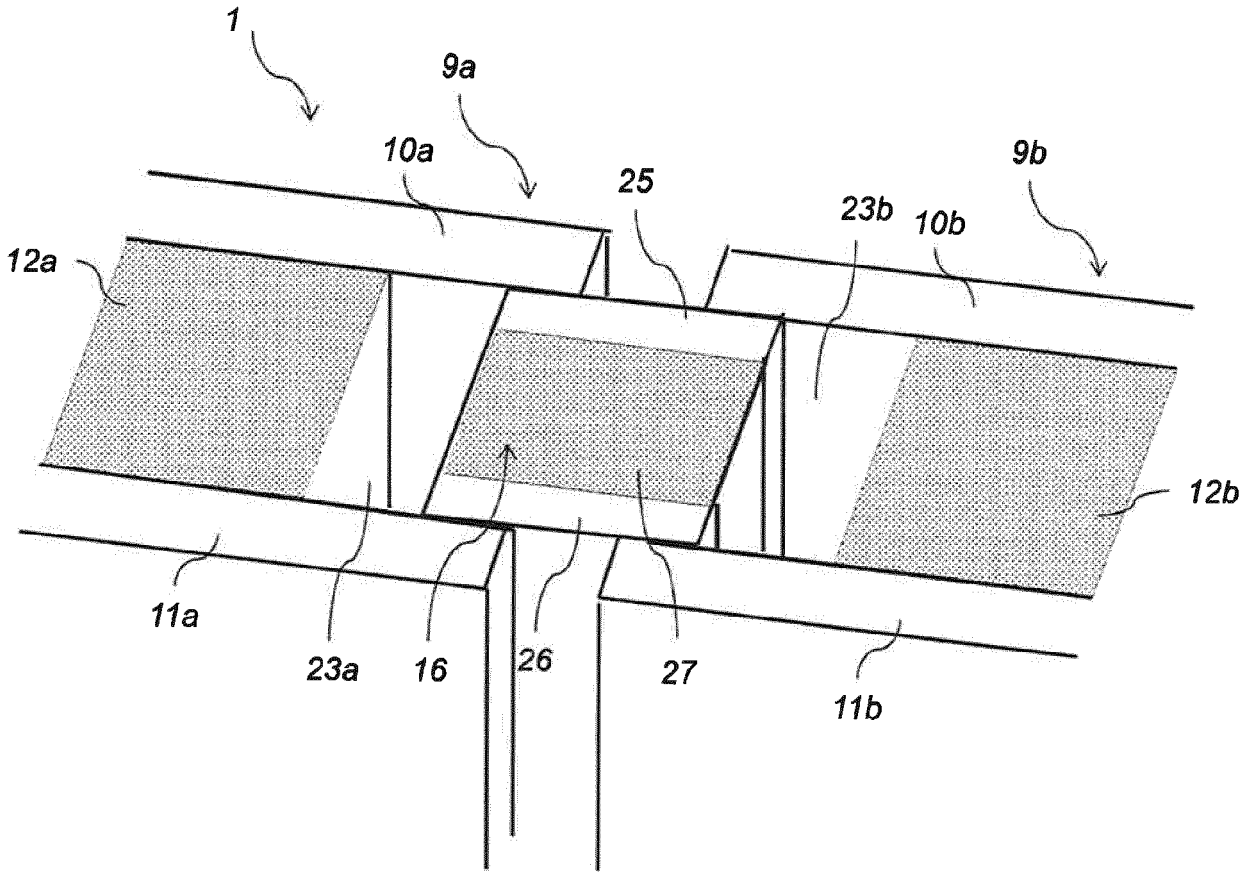

Fig. 3

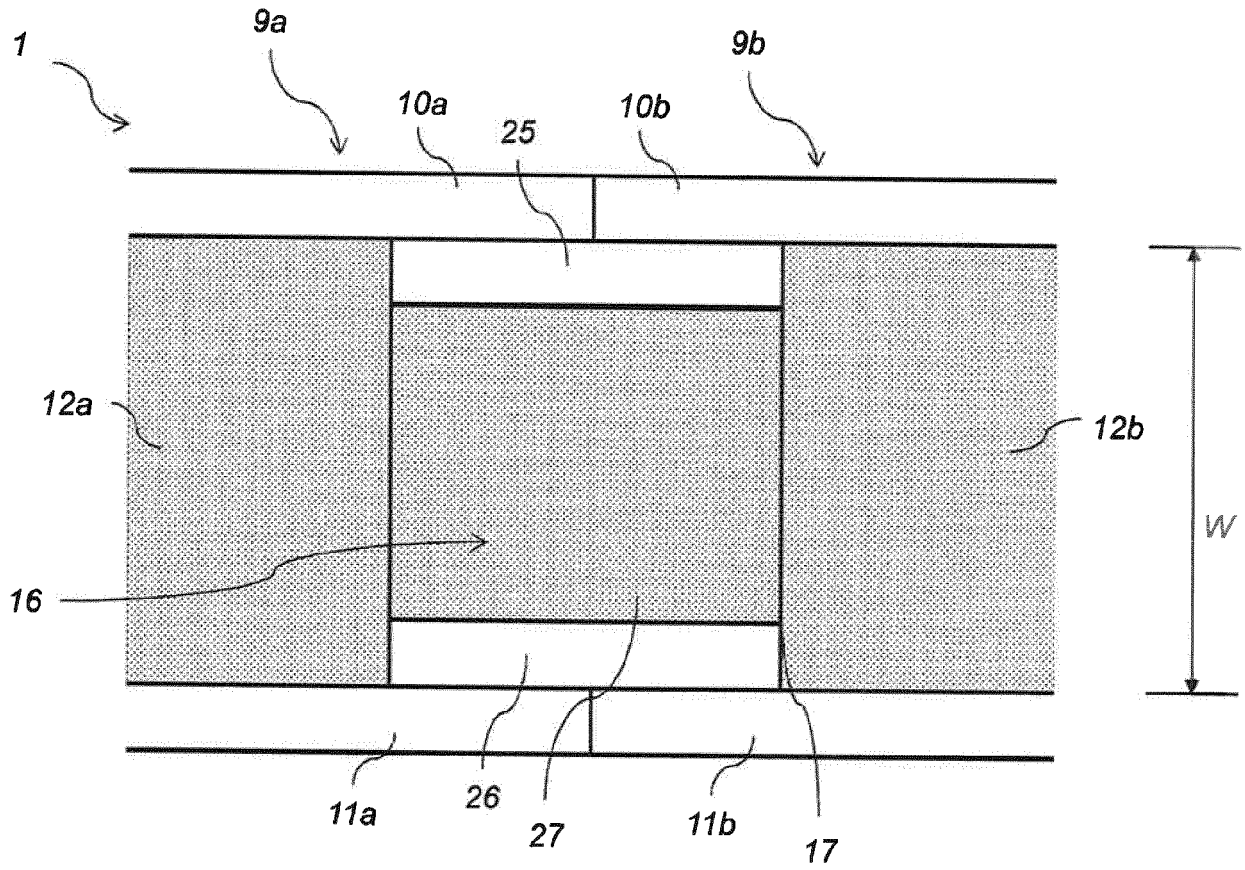

Fig. 4

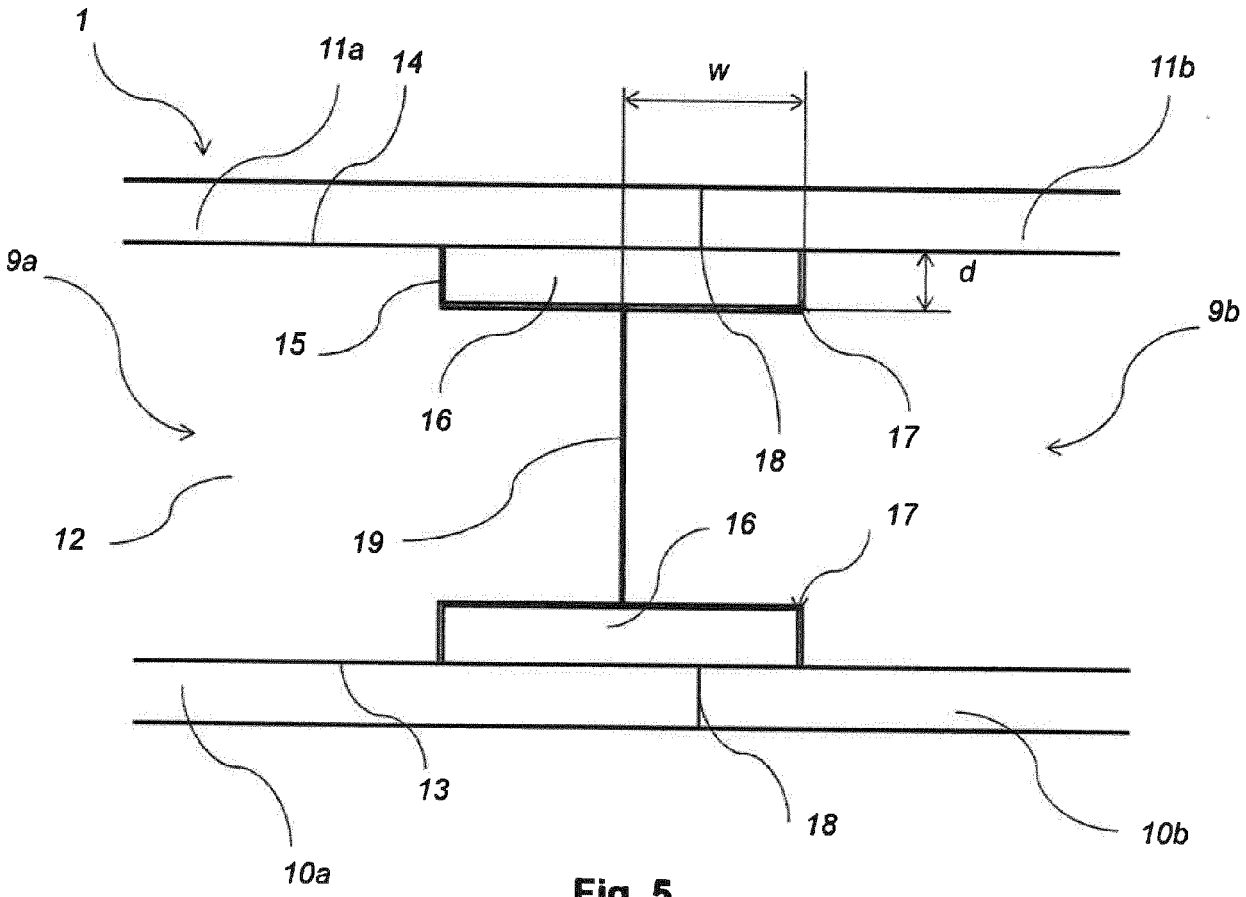

Fig. 5

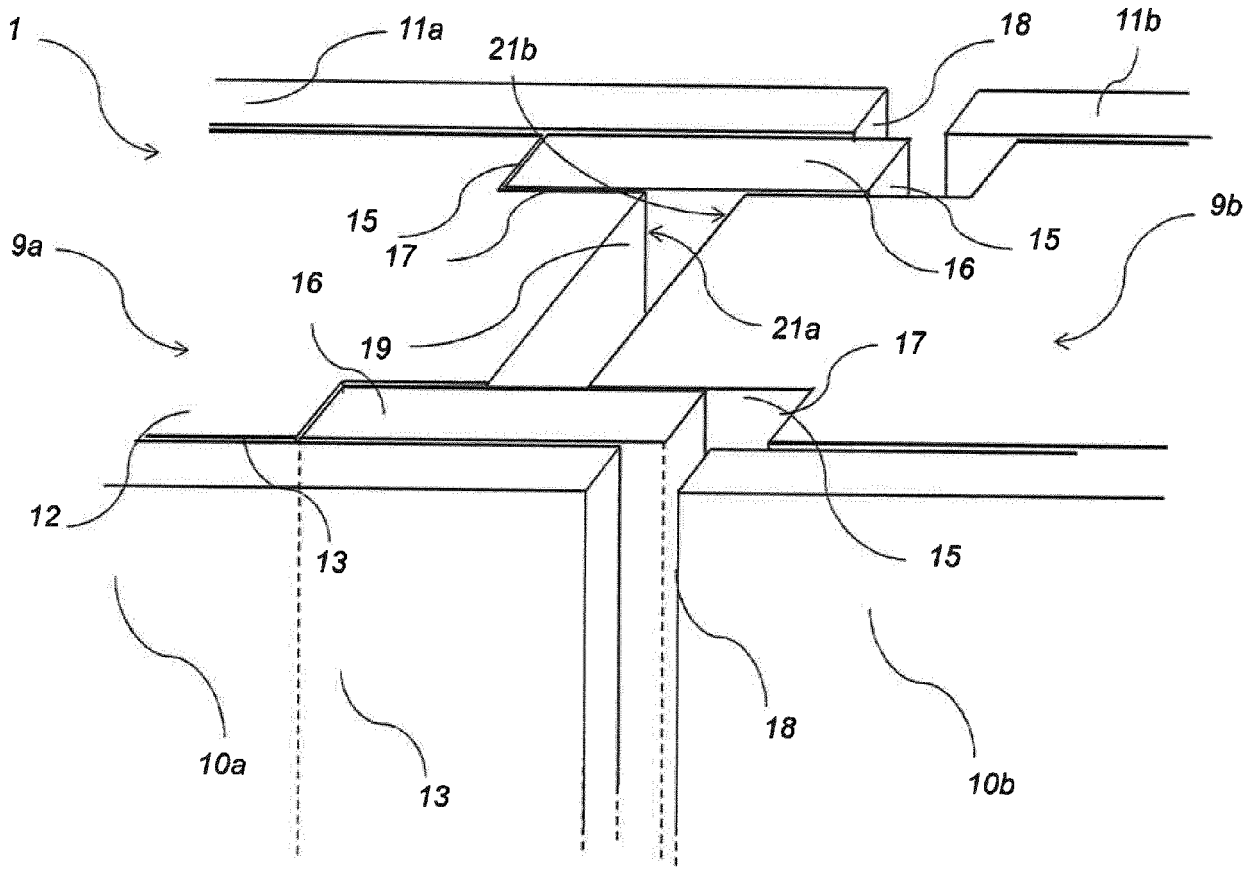

Fig. 6

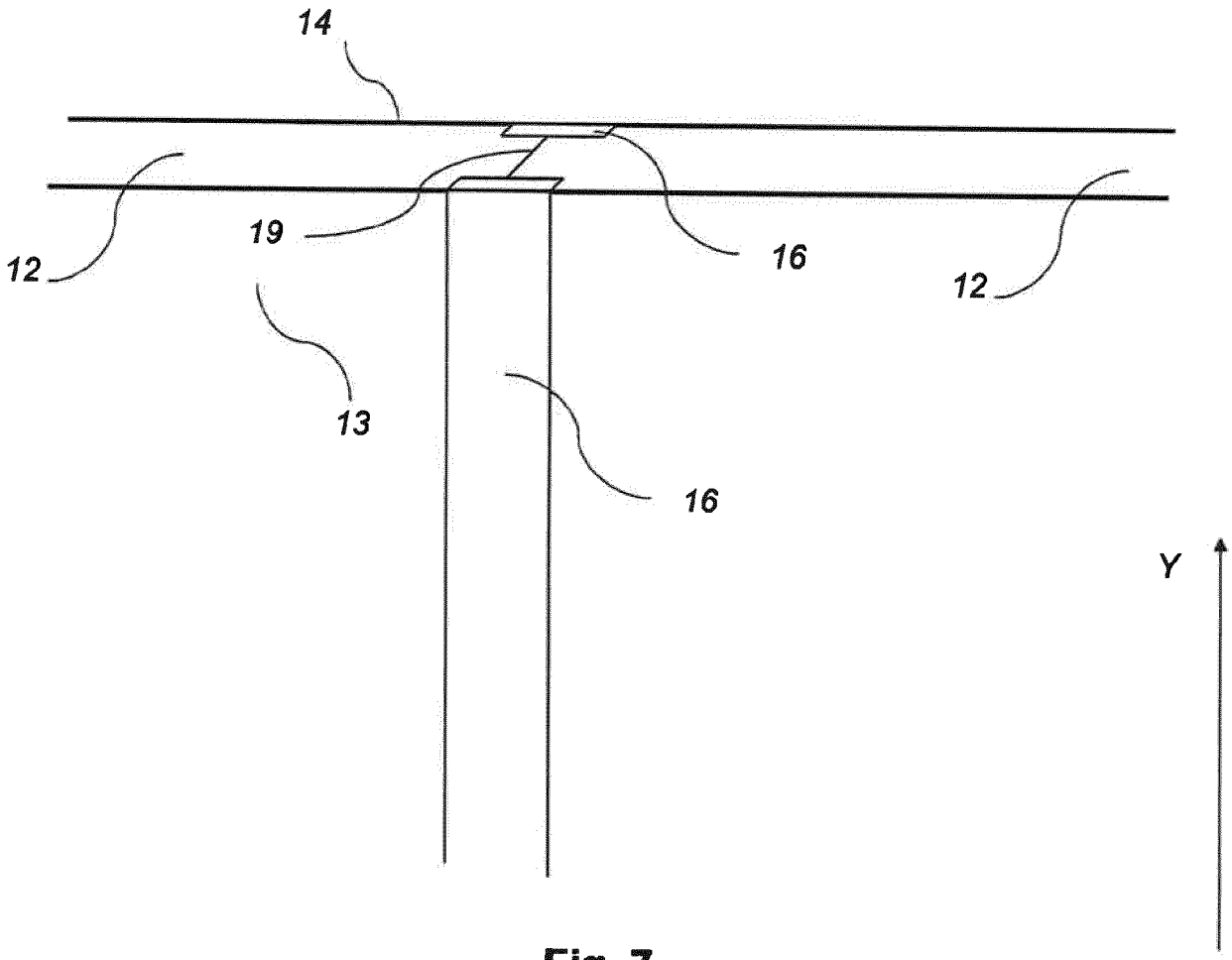

Fig. 7

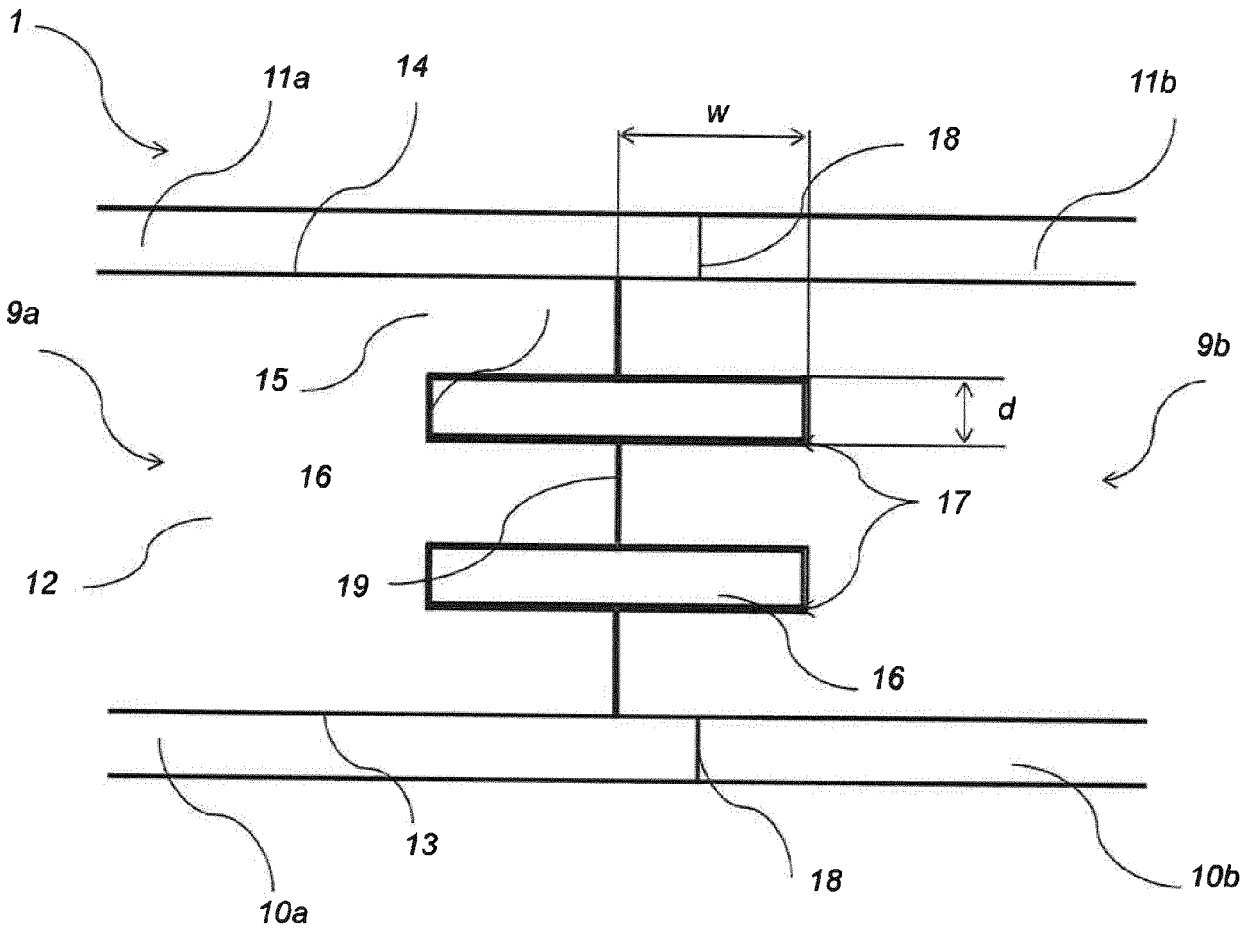

Fig. 8

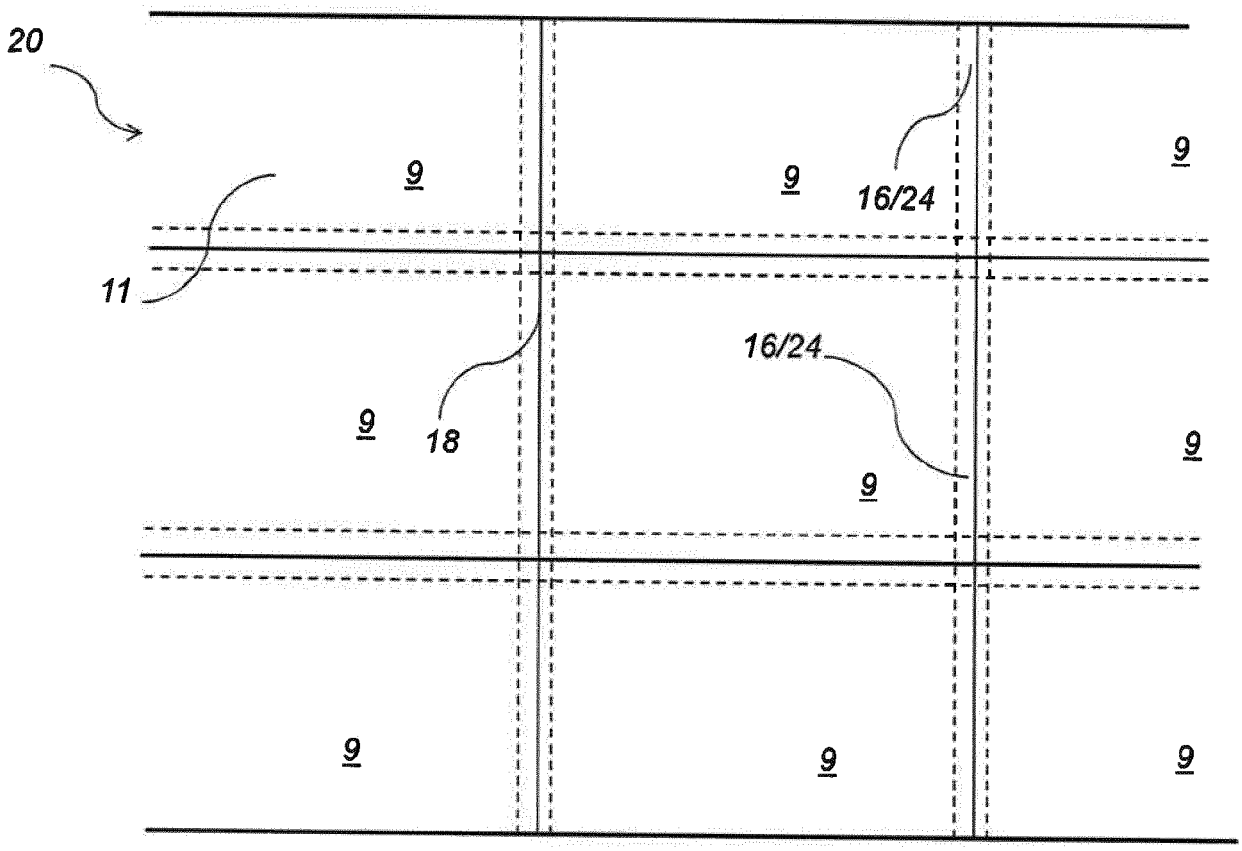

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 8458

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E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 September 2017	Galanti, Flavio

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