(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 095 334 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.11.2022 Bulletin 2022/48

(21) Application number: **21195974.7**

(22) Date of filing: **10.09.2021**

(51) International Patent Classification (IPC):
E04C 2/34 *(2006.01)* ***E04C 2/38*** *(2006.01)*
E04C 2/284 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E04C 2/284; E04C 2/34; E04C 2/38; E04C 2/384;
E04C 2002/3488

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **26.05.2021 IT 202100013688**

(71) Applicant: **Algorixon S.r.l.**
43121 Parma PR (IT)

(72) Inventor: **Montali, Jacopo**
43121 Parma PR (IT)

(74) Representative: **Perani & Partners S.p.A.**
Piazza Armando Diaz, 7
20123 Milano (IT)

(54) **A PREFABRICATED ELEMENT FOR A BUILDING**

(57) The present invention relates to a prefabricated element (1) for a building, comprising:
- two parallel walls (2), spaced apart in a thickness direction (X-X), a cavity (3) delimited between the two walls (2),
- a plurality of connecting members (4) extending through the cavity (3) to fix the two walls (2), and
- a plurality of tension cables (5) arranged in the cavity (3) and having two ends (50) secured to two distinct connecting members (4).

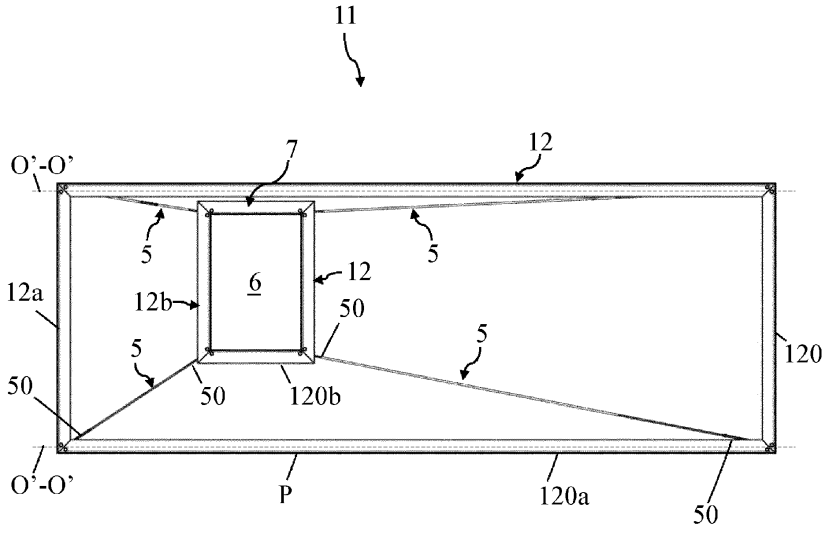

Fig. 2

EP 4 095 334 A1

Description

Field of the invention

[0001] The present invention relates to a prefabricated element for the construction of buildings, which finds use in civil engineering, construction engineering and architecture.

Prior Art

[0002] Building prefabrication, i.e. the process of constructing buildings from elements manufactured in outsourcing factories and subsequently assembled on site with strongly codified procedures, has been long known.

[0003] By performing part of the manufacturing processes beforehand, building prefabrication speeds up construction and reduces uncertainties in manufacturing times as compared with conventional on-site construction techniques.

[0004] In particular, highly prefabricated systems are known in the art for building facades. In detail, these highly prefabricated systems use a plurality of modules, manufactured in outsourcing factories, and ready for on-site installation. In certain cases, the modules require operations for affixing joint systems between modules, when these are not part of the module itself. This type of systems for prefabrication of building facades encompasses, for example, "cell" systems, "prefabricated concrete panel" systems, or "timber frame wall" systems.

[0005] Also, systems that are not strictly prefabricated are known in the state of the art, which are defined by their name as having a substantially lower prefabrication level as compared with the above-described highly prefabricated systems. That is, systems that are not strictly prefabricated require significant component assembly and finishing operations on site. This type of systems encompasses, for example: stick curtain wall systems, dry construction systems and the more conventional wet construction systems, such as semi-solid brick block walls with external insulation finished and joined with mortars.

[0006] Nevertheless, prefabricated facade systems of known type very often have strong limits in terms of maximum module size, since large modules are not able to ensure the structural stiffness required for the construction of a building. In particular, large modules are particularly responsive to forces acting outside the wall plane, such as wind.

[0007] Prefabricated systems for building facades, such as prefabricated concrete panels, are known, which are adapted to impart adequate stiffness even if they are made of large modules; however, they are extremely heavy due to the high density of the materials and the considerable thickness in use.

Summary of the invention

[0008] The object of the present invention is to provide a prefabricated element for the construction of buildings which is both light and rigid outside and within the plane of the facade. In other words, an object of the present invention is to provide a prefabricated element for the construction of buildings which has a high stiffness-to-weight ratio, to enable the construction of large prefabricated elements which have a sufficient stiff and light structure.

[0009] Furthermore, an object of the present invention is to provide a prefabricated element for the construction of buildings that allows the integration of a thermally insulating layer with a reduced presence of thermal bridges without losses in terms of stiffness and loading capacity.

[0010] This and other objects are fulfilled by a prefabricated element for the construction of buildings as defined in any of the accompanying claims.

[0011] In particular, the prefabricated element of the present invention comprises a pair of walls arranged parallel to each other and spaced apart, in a thickness direction, by a cavity.

[0012] The walls are fixed to each other by means of a plurality of connecting members, which extend in the thickness direction inside the cavity.

[0013] The prefabricated element further comprises a plurality of tension cables arranged in the cavity, and having two ends respectively secured to distinct connecting members.

[0014] Advantageously, the plurality of tension cables, when suitably pretensioned, can increase the stiffness of the prefabricated element outside the facade plane, without causing a significant increase in the weight of the prefabricated element itself. In detail, the tension cables cause various components of the structural element to cooperate in increasing stiffness according to the principle of tensile structures. Therefore, the size of the prefabricated element may be increased as compared with the prior art.

[0015] Advantageously, the high stiffness achieved by pretensioning the cables avoids the introduction of additional stiffening material, which would entail a considerable increase in the weight of the prefabricated element. The reduction of the weights of the prefabricated element further provides considerable advantages in terms of logistics, environmental friendliness and easy installation.

[0016] Furthermore, thermal insulation panels may be advantageously inserted in the cavity formed between the two walls without affecting the structural stiffness of the prefabricated element, which is mainly provided by the structure of the pair of walls and the cable pretensioning value.

[0017] Further characteristics and advantages of the invention will be recognizable by a skilled person from the following detailed description of exemplary embodiments of the invention.

Brief description of figures

[0018] To facilitate understanding of the following detailed description, certain embodiments of the invention are shown in the accompanying drawings, in which:

- Figure 1 shows a front view of a prefabricated element for the construction of buildings according to the present invention;
- Figure 2 shows a front view of the prefabricated element for the construction of buildings of Figure 1 with certain parts omitted to better show other parts;
- Figure 3 shows a perspective view of a detail of Figure 2;
- Figure 4 shows an exploded view of Figure 3;
- Figure 5 shows a partially sectional perspective view of the prefabricated element for the construction of buildings of Figure 1.

DETAILED DESCRIPTION

[0019] Even when not expressly stated, the individual features as described with reference to the particular embodiments shall be intended as auxiliary to and/or interchangeable with other features described with reference to other exemplary embodiments.

[0020] Referring to the accompanying figures, the present invention relates to a prefabricated element 1 for the construction of buildings, namely for the construction of facades of prefabricated buildings.

[0021] As used herein, prefabricated buildings refer to all those building constructions formed by assembling a plurality of prefabricated elements 1, i.e. manufactured in outsourcing factories and subsequently installed on site.

[0022] Moreover, it should be noted that prefabricated element 1 is meant to refer to a prefabricated module adapted to be placed next and to be fixed to other modules similar thereto, to define the facade of a prefabricated building.

[0023] The prefabricated element 1 comprises a frame 11 and a plurality of panels, mounted to the frame 11, which will be further described below.

[0024] With reference to Figure 1, the prefabricated element 1 of the present invention extends 1 in a first direction V-V between a top edge S and a bottom edge I, and in a second direction O-O, orthogonal to the first direction V-V, between a pair of side edges L. The top edge S and the bottom edge I are connected to the side edges L to define an outer perimeter C_{ext} of the prefabricated element.

[0025] Preferably, but without limitation, the top edge S and the bottom edge I extend parallel to the second direction O-O, and the side edges L extend parallel to the first direction V-V. In other words, the outer perimeter C_{ext} preferably has a quadrangular shape, more preferably a rectangular shape. It should be noted that in alternative embodiments the outer perimeter may have any other geometric shape.

[0026] The frame 11 and the panels of the prefabricated element 1 define two walls 2 arranged parallel to each other. In particular, the two walls 2 are arranged on respective levels of at least two parallel levels and spaced apart from each other in a thickness direction X-X.

[0027] Each wall 2 extends in the first direction V-V between the top edge S and the bottom edge I, and in the second direction O-O between the pair of side edges L. Moreover, each wall 2 has a plurality of corner regions 20 arranged at the intersections of the top edge S and the bottom edge I with the side edges L.

[0028] Preferably, each wall 2 has a surface finishing layer or panel 200 which acts as a support for the application of the final finish that is visible to an external user. This surface finishing layer or panel 200 extends from the top edge S to the bottom edge I in the first direction V-V, and from one side edge L to the other in the second direction O-O. For example, such finishing layer or panel 200 may be a base for a plaster coat, a panel of wooden or synthetic material or an additional frame for supporting the finish to form a ventilated facade.

[0029] Preferably, each wall 2 is flat and extends parallel to a main extension plane of the facade in which the prefabricated element 1 lies.

[0030] In detail, as shown in Figures 2 and 3, the frame 11 comprises a plurality of support structures 12, namely at least one support structure 12 per wall 2, included in the wall 2. The support structures 12 are configured to support respective panels of the prefabricated element 1. The support structures 12 are configured to support at least one respective surface finishing layer or panel 200. More in detail, each support structure 12 is composed of a plurality of main beams 120 connected to each other.

[0031] Preferably, as shown in Figure 2 and in greater detail in Figure 3, the support structures 12 comprise at least perimeter support structures 12a, composed of perimeter-main beams 120a. These perimeter-main beams 120a are arranged along the outer perimeter C_{ext} of the prefabricated element 1 and thus define its top edge S, its bottom edge I, and its pair of side edges L.

[0032] Furthermore, in the embodiment of Figure 1, each wall 2 has an opening 6 for positioning a fixture, such as a door or a window. This opening 6 is delimited by an opening perimeter portion C_{int} which defines its boundary. The wall 2 has a plurality of opening corner regions 60 arranged along the opening perimeter portion C_{int}.

[0033] More preferably, the support structures 12 comprise opening support structures 12b composed of opening-main beams 120b. These opening-main beams 120b are arranged along the opening perimeter portion C_{int}, i.e. surround the opening 6, and define its boundary.

[0034] As shown in Figure 3, each support structure 12 is arranged on a respective one of the levels on which the walls 2 are arranged. The support structures 12 are configured to support at least one panel of the prefabri-

cated element 1 for each level, namely at least one panel for each wall 2.

[0035] In the embodiment as shown in the annexed figures, the support structures 12 comprise at least a pair of homologous support structures 12, i.e. two support structures arranged on separate levels and facing each other in the thickness direction X-X. In particular, the perimeter support structures 12a of the two walls 2 are homologous to each other. Moreover, for each opening 6, two mutually homologous opening support structures 12b are provided in the distinct walls 2.

[0036] As shown in Figure 3, the walls 2 are spaced apart in the thickness direction X-X by a cavity 3. In other words, the cavity 3 is delimited on opposite sides, in the thickness direction X-X, by the two walls 2.

[0037] It should be noted that, in the embodiment as shown in Figures 3 and 4 the cavity 3 is arranged between the pair of homologous support structures 12 arranged on two distinct levels in the thickness direction X-X. In other words, the cavity 3 is at least partially enclosed between two homologous support structures 12 arranged on two distinct levels. Therefore, with reference to Figure 3, in the thickness direction X-X, the prefabricated element 1 will exhibit, in succession, a support structure 12, the cavity 3 and a support structure 12 homologous to the one on the other side of the cavity 3.

[0038] The prefabricated element 1 comprises a plurality of connecting members 4 configured to connect and fix the walls 2 together in the thickness direction X-X. The connecting members 4 form a part of the frame 11 that connects the two walls 2.

[0039] In detail, each connecting member 4 extends through the cavity 3 between the two walls 2 in the thickness direction X-X. At least some of the connecting members 4 are arranged along the outer perimeter C_{ext}, and preferably, if the wall 2 has an opening 6, at least some more of them are arranged along the perimeter portion C_{int} of the opening 6. The connecting members 4 arranged along the outer perimeter C_{ext} are referred to as corner connecting members 4a, whereas the connecting members 4 arranged along the perimeter portion C_{int} of the opening are referred to as opening connecting members 4b.

[0040] Referring to Figures 3 and 4, each connecting member 4 has a first portion 41 connected to one support structure 12, and a second portion 42 connected to another support structure 12, distinct from and homologous to the one to which the first portion 41 is connected. More in detail, the first portion 41 and the second portion 42 are respectively connected to two perimeter- or opening-main beams 120a, 120b belonging to distinct homologous support structures 12.

[0041] Preferably, the perimeter- and/or opening-main beams 120a, 120b each comprise a connecting wall 121 and a supporting wall 122, oriented transverse to its respective connecting wall 121. For example, the perimeter- and/or opening-main beams 120a, 120b have an L-shaped profile obtained by hot rolling of steel bars.

[0042] As shown in Figure 3, the connecting walls 121 of homologous support structures 12 partially delimit the cavity 3 in the thickness direction X-X. More preferably, the connecting members 4 are connected to the connecting walls 121 of perimeter- or opening-main beams 120a, 120b belonging to distinct support structures 12.

[0043] In the embodiment as shown in Figures 3 and 4, the connecting members 4 comprise a plurality of bolts configured to be introduced into holes specially formed in the connecting walls 121 of main beams 120 belonging to distinct homologous support structures 12. Once the bolts have been introduced into their respective holes of the connecting walls 121 and appropriately tightened, they are configured to fix the distinct homologous support structures 12 in the thickness direction X-X and hence the two walls 2 associated therewith.

[0044] Preferably, the connecting members 4 comprise plates 40, 80, connected to the bolts. The plates 40, 80 are arranged in the cavity 3 between the pair of homologous support structures 12. More preferably, first plates 40 are arranged at the corner regions 20 of the walls 2, and second plates 80 are arranged at the opening-corner regions 60. The plates 40, 80 are interposed between the pair of homologous support structures 12 in direct or indirect contact with each of them on opposite sides. It should be noted that the plates 40, 80 space the homologous support structures 12 apart in the thickness direction X-X, thereby forming the cavity 3 between the two walls 2.

[0045] The plates 40, 80 are preferably oriented perpendicular to the thickness direction X-X. In detail, each plate 40, 80 has at least one through hole adapted to receive a respective bolt, and to be aligned with the holes of the connecting walls 121 of main beams 120 of distinct homologous support structures 12. In detail, each bolt, when inserted in the respective holes of the connection walls 121 and in the respective hole of a plate 40,80, is configured to clamp the plate to which it is connected between the homologous support structures 12 in the thickness direction X-X. Preferably, each plate 40, 80 comprises a pair of holes, each having a respective bolt extending therethrough.

[0046] More in detail, each plate comprises annular protuberances 45 extending in the thickness direction X-X and surrounding respective through holes. Preferably, said annular protuberances 45 are provided on both sides of the plate, and each contacts directly or indirectly a respective homologous support structure 12. These annular protuberances are configured to further space apart the homologous support structures 12, to increase the extent of the cavity 3 in the longitudinal direction X-X.

[0047] Preferably, as shown in Figures 3 and 4, the connecting members 4 comprise thermal insulating elements 43, i.e. elements adapted to prevent or limit heat transfer between the homologous support structures 12. At least some of the thermal insulating elements 43 are arranged in the cavity 3 between the homologous support structures 12 to prevent direct contact therebetween, and

hence heat transfer from one support structure 12 to the other homologous thereto.

[0048] More preferably, at least some of the thermal insulating elements 43 are interposed between the plates 40, 80 and the homologous support structures 12. By this arrangement, heat transfer between the support structures 12 through the plates 40, 80 may be limited. In the embodiment as shown in Figure 4, the thermal insulating elements 43 comprise washers formed from a low thermal conductivity material, arranged on both sides of at least one plate 40, 80, each at a respective annular protuberance. In other words, at least some of the thermal insulating elements 43 are compressed between a plate 40, 80 and the support wall 122 of a main beam 120. It should be noted that, as used herein, thermal conductivity is meant to be low when below 0.2 W/mk.

[0049] In an alternative embodiment, not shown, some of the thermal insulating elements 43 are constituted by the plates 40, 80 themselves.

[0050] In order to further hinder heat flow from one support structure 12 to the other through the connecting members 4, the latter comprise additional thermal insulating elements 44 arranged outside the cavity 3, between a respective connecting member 4 and a respective supporting wall 122 of a main beam 120. More in detail, these additional thermal insulating elements 44 may be interposed between a head portion of the bolt and/or a nut portion of the bolt, and the corresponding support wall 122 of the main beam 12.

[0051] The prefabricated element 1 further comprises a plurality of tension cables 5 configured to cause the frame 11 to act as a tensile structure, thereby increasing the out-of-plane stiffness of the prefabricated element 1. Therefore, the cables 5 are part of the frame 11 and are configured to tension it to stiffen the prefabricated element 1. It should be noted that the stiffness of the prefabricated element 1 increases as the pretensioning value of the cables 5 increases. In other words, the stiffness of the prefabricated element 1 and the pretensioning value of the cables 5 are proportional. In operation, each cable 5 is tensioned to the design tension, which is determined, for example, based on the limits imposed on maximum out-of-plane displacements of the prefabricated element. Furthermore, the support structures 12 oppose the tension induced by the cables 5 to the required extent.

[0052] Each cable 5 is arranged in the cavity 3 and has two ends 50 respectively secured to two distinct connecting members 4. Preferably, as shown in Figure 3, at least some cables 5 are secured, at least at one of their ends 50, to respective corner connecting members 4a, by means of respective first plates 40. Furthermore, preferably, at least some tension cables 5 are secured, for at least one of their ends 50, to respective opening connecting members 4b, by means of respective second plates 80.

[0053] In the embodiment of Figures 2 and 3, the two ends 50 of each tension cable are respectively connected to a respective corner connecting member 4a and to a respective opening-connecting member 4b. It should be noted that, in the embodiment of Figures 2 and 3, each tension cable 5 is indirectly connected, on opposite sides, to the perimeter support structures 12a and to the opening support structures 12b respectively, by means of a respective corner connecting member 4a and a respective opening-connecting member 4b. When the cables 5 are pretensioned, they induce a state of compressive stress in the perimeter-main beams 120a of the support structures 12a, and a state of tensile stress in the opening-main beams 120b, there by generating the so-called "self-tensioning" state.

[0054] Furthermore, it should be noted that, as shown in Figures 2 and 3, each cable lies in a center plane of the prefabricated element 1. Also, each cable 5 is connected to its respective beam at the center of gravity of the cross section of the beam. The position of the tension cables 5 as set forth above ensures that the stress state induced by the pretensioning of the cables 5 is equally distributed on each homologous support structure 12, without causing imbalances in the prefabricated element 1, and that each beam is loaded mainly in the axial direction.

[0055] Preferably, at least one support structure 12 comprises a plurality of stiffening members 10 which are adapted to increase the out-of-plane stiffness of the prefabricated element 1. As shown in Figure 5, each stiffening member 10 is connected on opposite sides respective main beams 120 of the same support structure. In detail, each stiffening member 10 extends between the top edge S and the lower edge I of the prefabricated element 1 along the first direction V-V, i.e. perpendicular to main extension directions O'-O' of the main beams 120 to which it is connected. More in detail, at least some of the stiffening members 10 are connected to the supporting walls 122 of the opposite main beams of the same support structure 12.

[0056] Even more preferably, two homologous support structures 12 comprise respective stiffening members 10. It should be noted that, as shown in Figure 5, the stiffening means 10 of the homologous support structures 12 are arranged on opposite sides of the cavity 3, and hence on opposite sides of the plurality of tension cables 5. Therefore, the tension cables 5 are at least partially arranged between stiffening members 10 of distinct homologous support structures 12.

[0057] Referring to Figure 5, the stiffening members 10 of each support structure 12 comprise a plurality of secondary beams, i.e. uprights 10a, which are arranged in succession and spaced apart from each other, in the main extension direction O'-O' of the main beams 120 to which they are connected. Therefore, the uprights 10a of one support structure 12 face each other in the second direction O-O, and face respective uprights 10a of the support structure 12 homologous thereto in the thickness direction X-X.

[0058] At least one cable 5 is equipped with a plurality

of load transfer elements 13, which are adapted to transfer a load oriented transverse to the two walls 2, for example caused by the wind, from the stiffening members 10 to the respective cable(s) 5. In detail, each load transfer element 13 is arranged between a respective stiffening member 10 and at least one cable 5, and is connected thereto. More in detail, each load transfer element 13 comprises a first ring portion 13a adapted to fit onto its respective cable 5, and a protuberance 13b adapted to fit in a special seat (not shown) of the stiffening member 10.

[0059] As shown in Figure 4, each cable 5 is preferably equipped with a plurality of load transfer elements 13, arranged in succession along the extent of the cable, so that each one is located level with a respective stiffening member 10 with which it is connected by means of the protuberance 13b.

[0060] Preferably, referring to Figure 4, at least one cable has tensioning members 14 configured to move the ends 50 of the cable toward or away from each other to tension it.

[0061] For example, in the embodiment of Figure 4, the tensioning members 14 define one end 50 of at least one cable 5 and comprise a first body 14a, connected to a plate 40, 80, and a second body 14b connected to the cable 5. The first and second bodies 14a, 14b are fastened together, preferably, but without limitation, by means of a threaded connection, therefore, when they rotate relative to each other, they move toward or away from each other by varying the tension value of the cable 5 and the distance between the ends 50.

[0062] In alternative embodiments, the cable 5 may comprise at least two cable segments connected on opposite sides by the tensioning member 14. The latter moves the two cable segments toward or away from each other by varying its length, thereby adjusting the tension of the respective cable 5.

[0063] Preferably, as shown in Figure 5, the prefabricated element comprises a plurality of first insulating panels 9a which are configured to act as a heat shield between the two walls 2. In other words, the first insulating panels 9a limit heat transfer from one wall 2 to the other. These first insulating panels 9a may be made, for example, of mineral fibers (rock wool, glass fiber), natural fibers (wood wool, cork) or polyurethane-based insulation plates.

[0064] In detail, the first insulating panels 9a lie in the cavity 3 between the two walls 2, and at least some first panels 9a are arranged on opposite sides of at least one cable 5. Even more preferably, the first insulating panels 9a extend in the cavity 3 in the first direction V-V and the second direction O-O, thereby filling the portions of the cavity formed between the plurality of cables 5. In other words, at least some first insulating panels 9a have a first edge 90a arranged at a respective cable 5.

[0065] In the embodiment of Figure 5, each cable 5 is enclosed in the cavity in the first and second directions V-V, O-O by first edges 90a of distinct insulating panels 9a.

[0066] Furthermore, each wall 2 preferably comprises second insulating panels 9b, which are configured to limit heat transfer through the wall 2. These second insulating panels 9b can be made, for example, of conventional mineral fibers (rock wool, glass fiber), natural fibers (wood wool, cork) or conventional insulation plates (polyurethane).

[0067] As shown in Figure 5, the second insulating panels 9b of each wall 2 are arranged on opposite sides of the plurality of cables 5 along the thickness direction X-X. Therefore, the second insulating panels 9b at least partially enclose the first insulating panels 9a in the thickness direction X-X.

[0068] In the embodiment of Figure 5, at least some second insulating panels 9b are arranged between two respective stiffening members 10 in the second direction O-O. In detail, at least some second insulating panels 9b have a pair of second edges 90b arranged along two distinct uprights 10a of the stiffening members 10.

[0069] Preferably, at least some second insulating panels 9b extend between the top edge S and the bottom edge I in the first direction V-V. More preferably, at least some of the second insulating panels 9b of each wall 2 abut the supporting wall 122 of at least one main beam 120 of a support structure 12, to be supported thereby. In other words, at least some second insulating panels 9b have respective third edges 91b in contact with the supporting wall 122 of at least one main beam 120 of a support structure 12.

[0070] A skilled person may obviously envisage a number of equivalent changes to the above discussed variants, without departure from the scope of protection defined by the appended claims.

Claims

1. A prefabricated element (1) for a building, comprising:

   - two parallel walls (2), spaced apart in a thickness direction (X-X), a cavity (3) being delimited between the two walls (2),
   - a plurality of connecting members (4), each connecting member extending through the cavity (3), the two walls (2) being fixed to each other by means of the connecting members (4), and
   - a plurality of tension cables (5), each cable (5) being arranged in the cavity (3) and having two ends (50), the two ends (50) of each cable (5) being secured to two distinct connecting members (4).

2. A prefabricated element (1) as claimed in claim 1, wherein:

   - each wall (2) has a plurality of corner regions

(20) along an outer perimeter (C_{ext}) of the prefabricated element,
- the plurality of connecting members (4) comprises corner connecting members (4a), located at the corner regions (20) of the walls (2), and
- at least some tension cables (5) are secured, for at least one of their ends (50), to respective corner connecting members (4a).

3. A prefabricated element (1) as claimed in claim 2, wherein:

- each wall (2) has an opening (6) for positioning a door or window (7) therein,
- the plurality of connecting members (4) comprises opening connecting members (4b), arranged along an opening perimeter portion (C_{int}) of the walls (2), which surrounds the opening (6), and
- at least some tension cables (5) are secured, for at least one of their ends (50), to respective opening connecting members (4b).

4. A prefabricated element (1) as claimed in one of the preceding claims, wherein:

- the prefabricated element (1) comprises a plurality of first insulating panels (9a) arranged in the cavity (3);
- at least some first insulating panels (9a) are arranged on opposite sides of at least one of the cables (5).

5. A prefabricated element (1) as claimed in one of the preceding claims, wherein:
each wall (2) comprises second insulating panels (9b);

- the second insulating panels (9b) of each wall (2) being arranged on opposite sides of the plurality of cables (5) in the thickness direction (X-X).

6. A prefabricated element (1) as claimed in any of the preceding claims, delimited on opposite sides by a bottom edge (I) and a top edge (S), wherein each wall (2) comprises a plurality of stiffening members (10) extending between the bottom edge (I) and the top edge (S) and joining them.

7. A prefabricated element (1) as claimed in claims 5 and 6, wherein:

- the bottom edge (I) and the top edge (S) extend along a respective main extension direction (O'-O') oriented transverse to the thickness direction (X-X);
- the stiffening members (10) are successively arranged along the main extension direction (O'-O') in spaced apart relationship;
- at least some of the second insulating panels (9b) are arranged between two respective stiffening members (10).

8. A prefabricated element (1) as claimed in any of the preceding claims wherein:

- each wall (2) comprises at least one respective support structure (12);
- the support structures (12) of each wall (2) are arranged on two distinct levels in the in the thickness direction (X-X) in mutually facing relationship;
- the connecting members (4) mutually fix the support structures of each wall (2) in the thickness direction (X-X).

9. A prefabricated element (1) as claimed in claim 8, wherein:

- each support structure (12) is composed of a plurality of main beams (120) connected to each other;
- each main beam (120) comprises a connecting wall (121) partially delimiting the cavity (3) in the thickness direction (X-X), and a supporting wall (122) oriented transverse to its respective connecting wall (121) so as to project from the cavity (3);
- the connecting members (4) mutually fix the connecting walls (121) of main beams (120) of distinct support structures (12).

10. A prefabricated element (1) as claimed in claims 5 and 9, wherein at least some of the second insulating panels (9b) of each wall (2) abut the support wall (122) of at least one main beam (120) to be supported.

11. A prefabricated element (1) as claimed in claims 6 and 9, wherein at least some of the stiffening members (10) are connected to the supporting walls (122) of opposite main beams (120) of the same support structure (12).

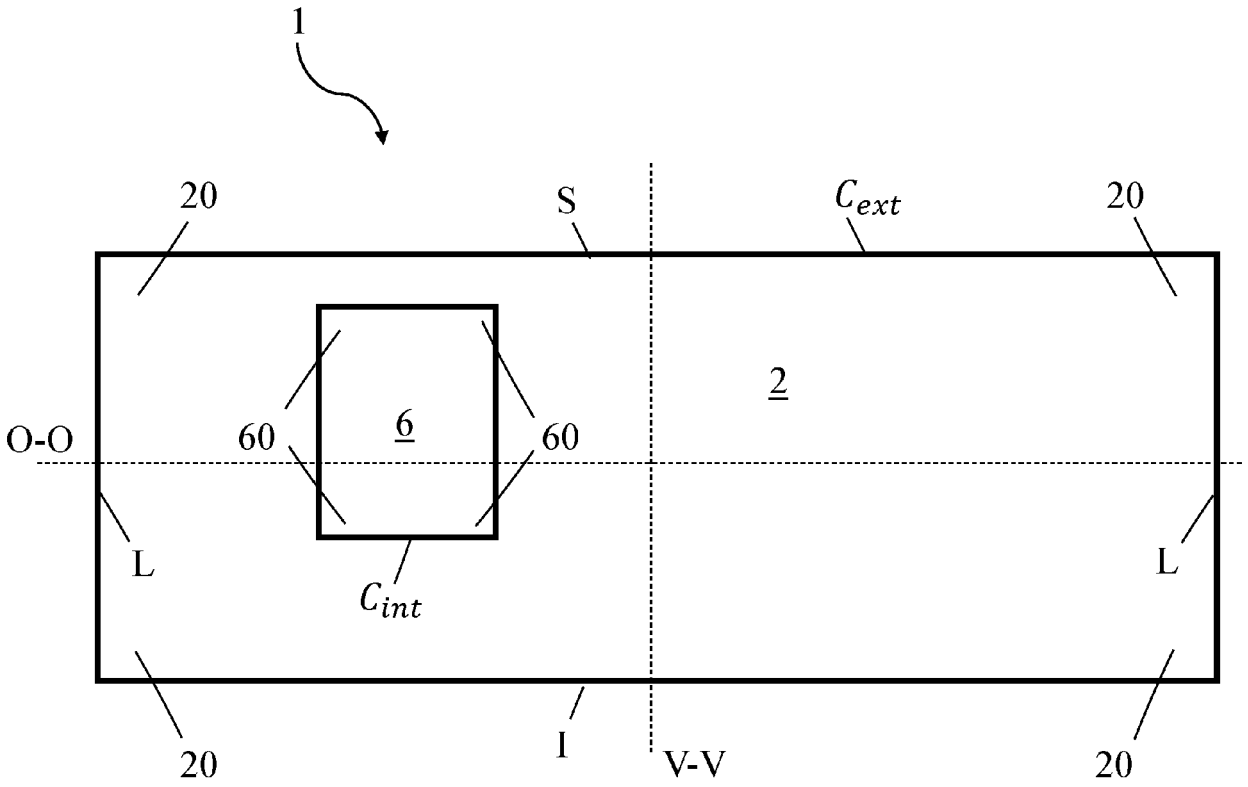

Fig. 1

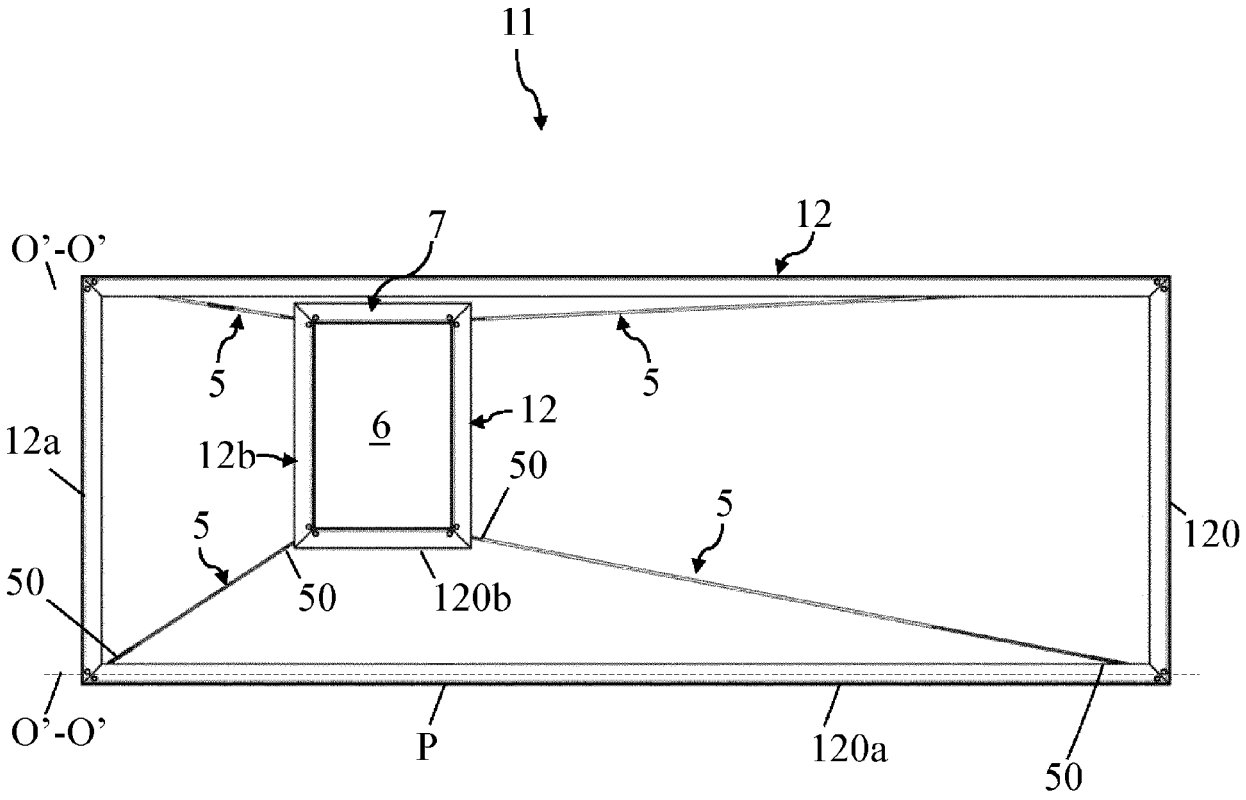

Fig. 2

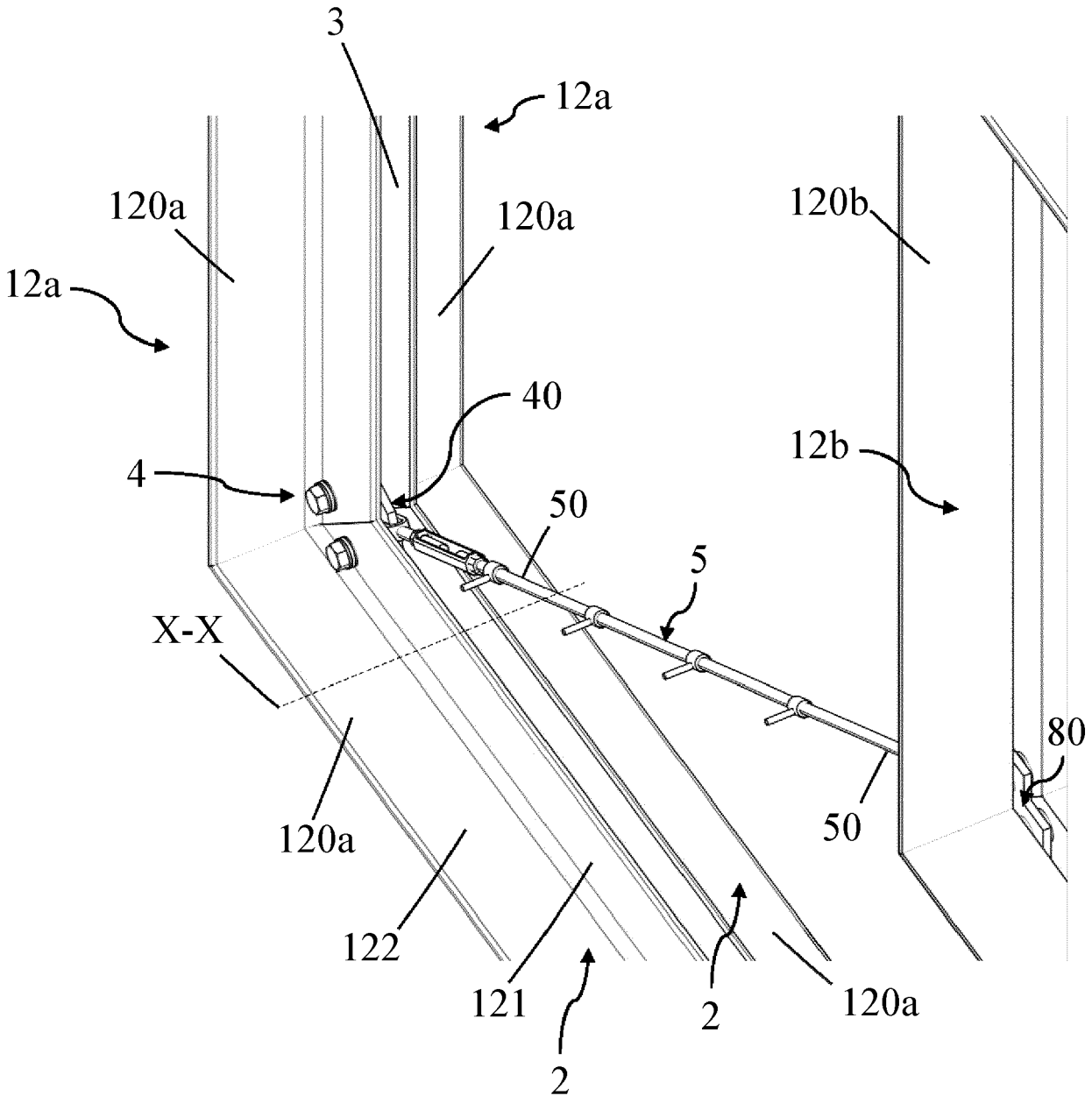
3
12a
120a
120a
120b
12a
40
4
12b
50
5
X-X
80
120a
50
122
121
2
120a
2

Fig. 3

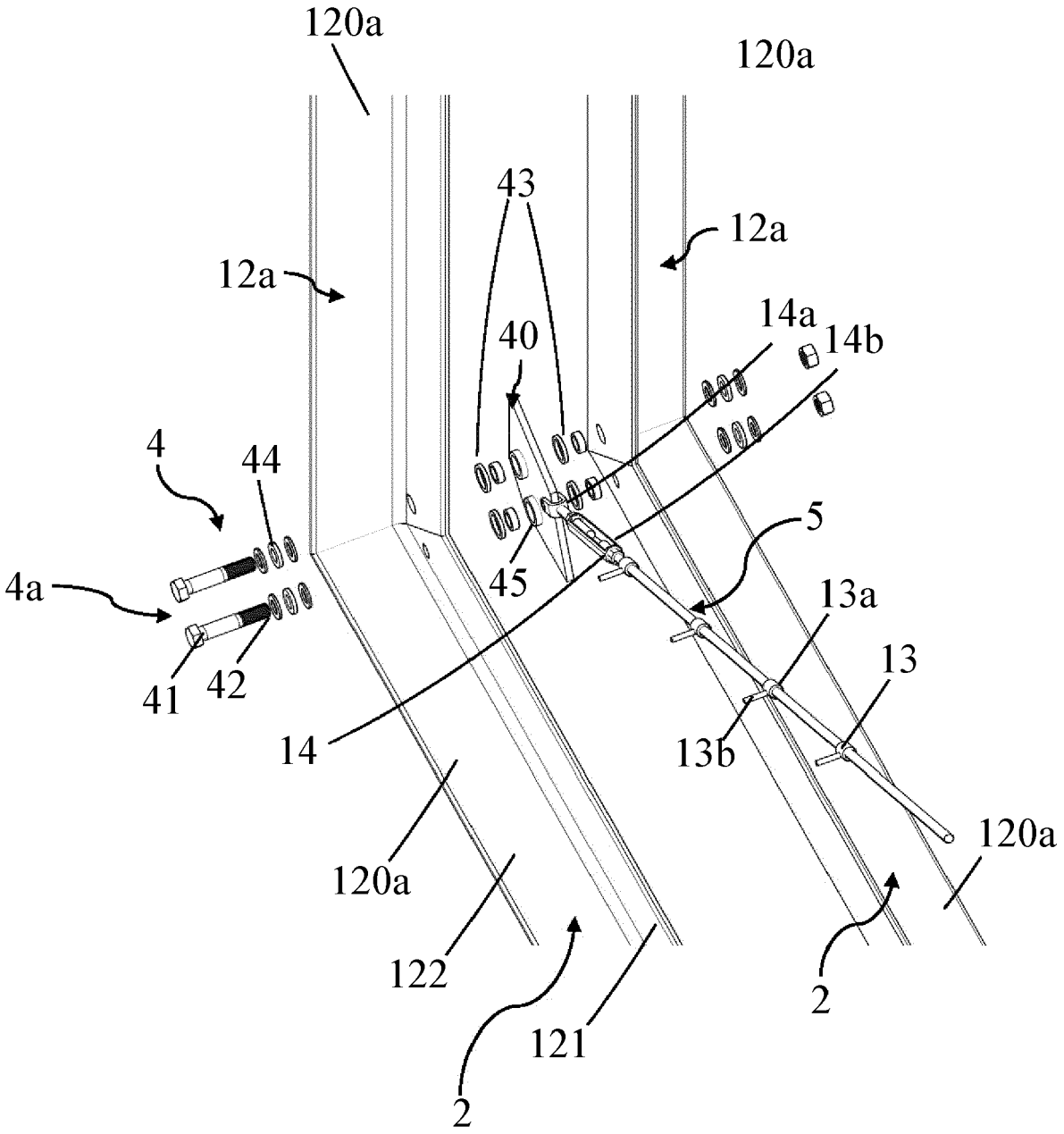
120a
120a
43
12a
12a
14a
14b
40
4
44
5
45
4a
13a
13
41
42
14
13b
120a
120a
122
2
121
2

Fig. 4

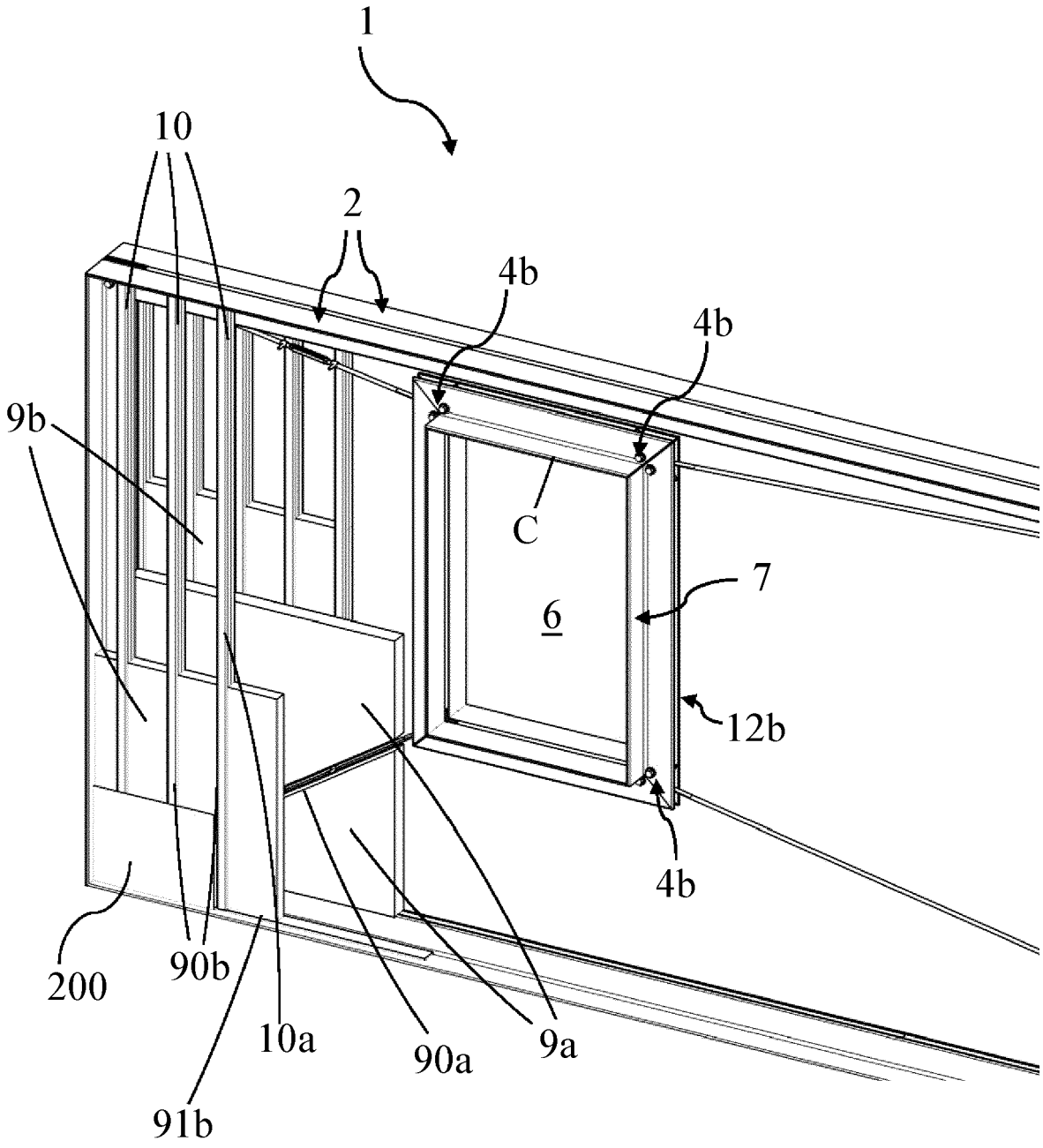

Fig. 5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 21 19 5974

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 956 957 A (VANDINI ALDO [IT]) 18 September 1990 (1990-09-18) * column 2, line 1 - column 3, line 33 *	1,2	INV. E04C2/34 E04C2/38 E04C2/284
X	WO 95/17561 A2 (R A R CONSULTANTS LTD [CA]; ABOU-RACHED ROGER GEORGES [CA]) 29 June 1995 (1995-06-29) * page 27, line 27 - page 43, line 13; figure 1 * * figures 22-54 *	1-11	
X	US 9 285 164 B2 (WILHELM STEFAN [DE]; LINDE AG [DE]) 15 March 2016 (2016-03-15) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04C

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 February 2022	Kremsler, Stefan

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 19 5974

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-02-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4956957 A	18-09-1990	EP 0364611 A1	25-04-1990
		ES 2028971 T3	16-07-1992
		US 4956957 A	18-09-1990
WO 9517561 A2	29-06-1995	AU 1270295 A	10-07-1995
		MD 960301 A	28-02-1999
		WO 9517561 A2	29-06-1995
US 9285164 B2	15-03-2016	AT 307944 T	15-11-2005
		AU 2003281278 A1	23-01-2004
		CN 1666001 A	07-09-2005
		DE 10229663 A1	22-01-2004
		EP 1520079 A1	06-04-2005
		JP 4291267 B2	08-07-2009
		JP 2005536667 A	02-12-2005
		KR 20050013666 A	04-02-2005
		US 2006162379 A1	27-07-2006
		WO 2004005651 A1	15-01-2004

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82