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(54) **CONSTRUCTION METHOD AND MASONRY PANEL**

(57) This construction method includes a step for moving, to a predetermined position in a building, a masonry panel in which a plurality of masonry materials are arranged inside a frame body, the masonry panel

having a reinforcing coating layer formed on a wall surface of a masonry wall formed of the plurality of masonry materials.

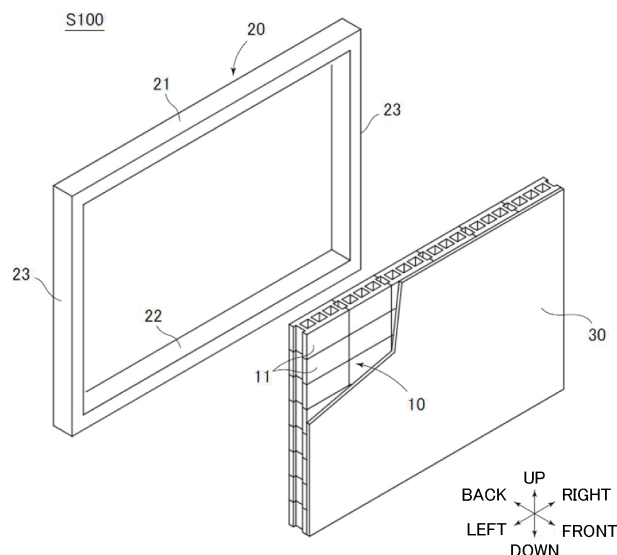


FIG. 1

Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a construction method and a masonry panel.

BACKGROUND OF THE INVENTION

10 **[0002]** Conventionally, there is a known construction method in which a masonry wall formed by stacking a plurality of concrete blocks is provided in an arrangement space surrounded by a floor surface, a beam, and a pair of left and right pillars (e.g., see Patent Document 1).

PRIOR ART

15 PATENT DOCUMENT

[0003] Patent Document 1: Japanese Patent Application Publication No. 2011-220060.

SUMMARY OF INVENTION

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PROBLEMS TO BE SOLVED BY THE INVENTION

25 **[0004]** In conventional construction methods, a masonry wall needs to be formed at a position where the masonry wall is installed. However, in conventional construction methods, there is room for improvement in the work efficiency of the construction of a masonry wall.

[0005] The present invention has been made in view of the matters described above, and an object thereof is to provide a construction method and a masonry panel that enable construction and installation of a masonry material wall with good work efficiency.

30 MEANS FOR SOLVING THE PROBLEMS

35 **[0006]** A construction method according to an aspect of the present invention includes: a step of moving, to a predetermined position in a building, a masonry panel in which a plurality of masonry materials are arranged inside a frame body, and a reinforcement coating layer is formed on a wall surface of a masonry wall formed by the plurality of masonry materials.

[0007] The construction method according to the aspect of the present invention may further include: a step of arranging the plurality of masonry materials inside the frame body and fixing the frame body and the masonry wall formed by the plurality of masonry materials to construct the masonry panel; and a step of forming the reinforcement coating layer on the wall surface of the masonry wall.

40 **[0008]** The step of forming the reinforcement coating layer may include forming the reinforcement coating layer in a region extending from the wall surface of the masonry wall to the frame body.

[0009] The step of moving the masonry panel may include: a step of disposing a holding apparatus that holds the frame body at a part of the frame body; and a step of pulling up the holding apparatus using a wire or a device.

45 **[0010]** The holding apparatus may be a clamp, the clamp may have: a pair of abutment members that sandwich the frame body from sides of both surfaces of the frame body; and a link mechanism coupled to the pair of abutment members, the link mechanism being configured to cause the pair of abutment members to move toward each other when the link mechanism is pulled up by the wire or the device and an upward force is applied to a part of the link mechanism, and the step of pulling up the holding apparatus using the wire or the device may include lifting the masonry panel in a state in which the part of the link mechanism is pulled up, and the frame body is sandwiched by the pair of abutment members.

50 **[0011]** The frame body may have a protrusion that is pre-formed on the frame body and protrudes in a thickness direction of the frame body or a protrusion that is formed by attaching a separate member to the frame body and protrudes in the thickness direction of the frame body, and the step of disposing the holding apparatus at the part of the frame body may include causing an opening or a recess formed in the abutment member to engage with the protrusion.

[0012] The protrusion may be formed by a member removably inserted into a hole formed through the frame body.

55 **[0013]** The step of moving the masonry panel may include moving the masonry panel in a state in which a protective plate is disposed on one surface or both surfaces of the masonry panel.

[0014] The step of moving the masonry panel may include moving the masonry panel in a state in which the protective plate is disposed on the masonry panel before drying time of a coating material of the reinforcement coating layer applied

onto the masonry wall elapses.

[0015] The step of moving the masonry panel may include moving the masonry panel in a state in which a part of the protective plate is pressed by the holding apparatus.

[0016] The step of forming the reinforcement coating layer on the wall surface of the masonry wall may include forming the reinforcement coating layer such that the reinforcement coating layer adheres to a protrusion or a depression of a filler material, the filler material filling a gap between mutually adjacent masonry materials so as to form the protrusion protruding from wall surfaces of the masonry materials or so as to form the depression concave from the wall surfaces.

[0017] The construction method further include: a step of installing the masonry panel at a predetermined installation position of the building, and the step of installing the masonry panel may include fixing a latching member provided at an upper section of the frame body to a part of a structure of the building.

[0018] A masonry panel according to an aspect of the present invention includes: a frame body; a masonry wall that is formed by a plurality of masonry materials arranged inside the frame body and is fixed to the frame body; and a reinforcement coating layer formed on a wall surface of the masonry wall.

[0019] A projection which is a protrusion protruding in a thickness direction of the frame body and engages with a part of a holding apparatus that holds the frame body may be provided at an upper section of the frame body.

[0020] A construction method according to an aspect of the present invention includes: a step of arranging a plurality of masonry materials to construct a masonry wall formed by the plurality of masonry materials; a step of forming a reinforcement coating layer on a wall surface of the masonry wall; and a step of moving the masonry wall to a predetermined position in a building.

[0021] A construction method according to an aspect of the present invention includes: a step of arranging a plurality of masonry materials inside a frame body and fixing the frame body and a masonry wall formed by the plurality of masonry materials to construct a masonry panel; and a step of disposing the masonry panel on a floor structure, the masonry panel being disposed such that a post member protruding upward from the floor structure is inserted into a part of the masonry panel.

[0022] The step of disposing the masonry panel on the floor structure may include: disposing a first masonry panel such that the first masonry panel extends in a first direction; and disposing a second masonry panel such that the second masonry panel extends in a second direction crossing the first direction, and the construction method according to the aspect of the present invention may further include a step of fixing the first masonry panel and the second masonry panel to a support installed on the floor structure at a position where the first masonry panel and the second masonry panel are adjacent to each other.

[0023] The step of fixing the first masonry panel and the second masonry panel to the support may include forming a reinforcement coating layer in: a region extending from the first masonry panel to a part of the support; and a region extending from the second masonry panel to another part of the support.

EFFECT OF THE INVENTION

[0024] The present invention achieves an effect that a construction method and a masonry panel that enable construction and installation of a masonry material wall with good work efficiency can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is an exploded perspective view illustrating the configuration of a masonry panel constructed by a construction method according to a first embodiment.

FIG. 2 is a drawing illustrating the masonry panel illustrated in FIG. 1 as seen from the front side.

FIG. 3 is a schematic diagram for explaining the relationship between a masonry wall and a frame body.

FIG. 4 is a perspective view illustrating an example of the shape of a reinforcement coating layer.

FIG. 5 is a flowchart illustrating an example of the construction method according to the present invention.

FIG. 6 is a perspective view illustrating the masonry panel and a holding apparatus used in a construction method according to a second embodiment.

FIG. 7 is a drawing illustrating the holding apparatus in an opened state.

FIG. 8 is a drawing illustrating the holding apparatus in a closed state.

FIG. 9 is a drawing for explaining a first modification example.

FIG. 10 is a drawing for explaining a construction method according to a second modification example.

FIG. 11 is a drawing for explaining a construction method according to a third modification example.

FIG. 12 is a perspective view for explaining a modification example of the holding apparatus.

FIG. 13 is a drawing illustrating another configuration example of the frame body.

FIG. 14 is a drawing illustrating a use example of the holding apparatus illustrated in FIG. 12 and the frame body illustrated in FIG. 13.

FIG. 15 is a drawing for explaining a construction example of the masonry panel, illustrating a state in which reinforcing bars are provided to the frame body.

FIG. 16 illustrates a state in which masonry materials are arranged in the frame body in the state illustrated in FIG. 15.

FIG. 17 illustrates a state in which an upper frame of the frame body is disposed.

FIG. 18 illustrates a state in which the reinforcement coating layer is provided.

FIG. 19 is a drawing illustrating an example of a building structure.

FIG. 20 is a drawing illustrating another example of the building structure.

FIG. 21 is a perspective view of a floor structure.

FIG. 22 is a drawing illustrating a state in which supports are attached to the floor structure.

FIG. 23 is a drawing illustrating a state in which the masonry panel is attached to the structure in the state illustrated in FIG. 22.

FIG. 24 is a drawing illustrating still another example of the building structure.

FIG. 25 is a drawing illustrating the floor structure and supports.

DETAILED DESCRIPTION OF THE INVENTION

<First Embodiment>

[0026] Hereinbelow, embodiments of the present invention are explained with reference to the drawings. First, a masonry panel used in a construction method according to the present invention is explained with reference to FIG. 1 and FIG. 2. FIG. 1 is an exploded perspective view illustrating the configuration of the masonry panel constructed by the construction method according to the first embodiment. FIG. 2 is a drawing illustrating the masonry panel illustrated in FIG. 1 as seen from the front side. FIG. 1 illustrates a reinforcement coating layer in a partially cut-out state. FIG. 2 illustrates the masonry panel in a state in which the reinforcement coating layer is omitted such that the configuration can be understood more easily. The up-down direction in the drawing corresponds to the vertical direction.

[0027] As illustrated in FIG. 1, a masonry panel S100 according to the present embodiment includes a masonry wall 10, a frame body 20, and a reinforcement coating layer 30. The masonry panel S100 is used as an interior wall or an exterior wall of a building.

(Masonry Wall)

[0028] The masonry wall 10 has a plurality of masonry materials 11 arranged in the horizontal direction and the vertical direction. The masonry materials 11 are bricks or block materials for construction and have a rectangular parallelepiped shape, as an example. For example, the density of the masonry materials 11 is equal to or greater than 1.5 g/cm^3 . As an example, the masonry materials 11 are not lightweight materials like polyurethane-foam block materials, for example, and are block materials of relatively greater weight. For example, the masonry materials 11 are fixed to each other by a filler material such as mortar and form the one masonry wall 10. Note that certainly the masonry materials 11 are fixed to each other also by reinforcement members such as reinforcing bars, by plaster applied onto the surfaces, by joint mortar, and/or the like.

[0029] In the present invention, masonry materials with a density of 0.3 g/cm^3 or greater may be used. The masonry materials 11 may be made of wood, AAC foamed concrete, or the like.

[0030] The masonry wall 10 is disposed inside the frame body 20. The masonry wall 10 is fixed to the frame body 20. Thereby, a wall in which the masonry wall 10 and the frame body 20 are integrated is formed. In order to fix the masonry wall 10 to the frame body 20, mortar filling gaps between the masonry wall 10 and the frame body 20 may be used, or a coupler that mechanically couples the masonry wall 10 and the frame body 20 may be used. Whereas FIG. 2 illustrates the inner periphery of the frame body 20 as flat planes, a recessed groove may be formed in the inner periphery of the frame body 20, and the outer periphery of the masonry wall 10 may be configured to fit into the groove.

[0031] For example, the amount of the reinforcement members (e.g., reinforcing bars) in the masonry panel S100 is greater than 0 kg and equal to or smaller than 50 kg per 1 m^3 of the volume of the masonry wall 10. For example, the amount of the filler material in the masonry panel S100 is greater than 0 t and equal to or smaller than 2.5 t (preferably, greater than 0 t and equal to or smaller than 1.7 t) per 1 m^3 of the volume of the masonry wall 10. By adjusting the amount(s) of the reinforcement members and/or the filler material to fall within such a range(s), it is possible to enable a weight reduction of the wall while aiming for an enhancement of the strength of the wall.

(Frame Body)

[0032] The frame body 20 is a member formed in a quadrangular shape that surrounds the masonry wall 10. The frame body 20 has an upper frame 21, a lower frame 22, and a pair of side frames 23. The upper frame 21 and the lower frame 22 extend in the horizontal direction. The side frames 23 extend in the vertical direction. These frames may be coupled with each other by fixing members such as screws or may be fixed to each other by welding or the like. The material of the frame body 20 can be any material and may be PC (precast concrete), metal, or wood, for example.

[0033] In addition, the frame body 20 may be formed by stacking a plurality of masonry materials and bonding masonry materials along the outermost four sides with a highstrength resin to create a frame.

[0034] FIG. 3 is a schematic diagram for explaining the relationship between the masonry wall 10 and the frame body 20. A thickness dimension d2 of the frame body 20 is longer than a thickness dimension d1 of the masonry wall 10 (although the illustration is omitted in FIG. 3, the thickness dimension d1 includes also the thickness(es) of the reinforcement coating layer and/or plaster; in a case in which mortar is applied onto the wall surface, the thickness dimension d1 includes also the thickness of the mortar). In a case in which the thickness dimension d2 of the frame body 20 is longer than the thickness dimension d1 of the masonry wall 10, and the masonry wall 10 is disposed inside the frame body 20 as illustrated in FIG. 3, advantages like the ones below are achieved. In the configuration illustrated in FIG. 3, the masonry wall 10 is disposed inside the frame body 20 such that the front surface of the masonry wall 10 is positioned on the inner side of the front surface of the frame body 20, and the rear surface of the masonry wall 10 is positioned on the inner side of the rear surface of the frame body 20. According to such a configuration, the masonry wall 10 is disposed inside the frame body 20, the front surface of the masonry wall 10 does not protrude outward from the front surface of the frame body 20, and also the rear surface of the masonry wall 10 does not protrude outward from the rear surface of the frame body 20. Accordingly, it is possible to achieve an effect that the masonry wall 10 is unlikely to be damaged during work or transportation. Note that the configuration illustrated in FIG. 3 is merely an example of the present invention, and preferably the wall surface of the masonry wall 10 and the surfaces of the frame body 20 are also flush with each other in an aspect.

(Reinforcement Coating Layer)

[0035] The reinforcement coating layer 30 is a coating layer that is provided on the wall surface of the masonry wall 10 to reinforce the masonry wall 10. The reinforcement coating layer 30 may be formed on both surfaces of the masonry wall 10 or may be formed on one surface of the masonry wall 10. In the present embodiment, the reinforcement coating layer 30 is formed on one surface. The reinforcement coating layer 30 may be formed only on a part of the wall surface of the masonry wall 10 or may be formed on the entire surface of the masonry wall 10.

[0036] A coating material that forms the reinforcement coating layer 30 is applied onto the masonry wall 10 and is dried, thereby forming the reinforcement coating layer 30 with a predetermined thickness on the masonry wall 10. By being formed to adhere to the wall surface, the reinforcement coating layer 30 enhances at least one of the rigidity, strength, and deformability of the masonry wall 10. For example, the reinforcement coating layer 30 is a layer of fiber-reinforced resin. Specifically, the reinforcement coating layer 30 includes one type or a plurality of types of fibrous material. The reinforcement coating layer 30 is fluid before being cured and is applied onto the masonry wall 10 by a roller, a trowel, a brush, or a spray, for example. Note that the curing of the coating material may be curing by a curing agent, may be curing by drying, or may be curing by the combined use of drying and a curing agent.

(Specific Example of Reinforcement Coating Layer 30)

[0037] Specifically, the material of the reinforcement coating layer 30 may be like the one below. The reinforcement coating layer 30 is a coating material in which glass fibers are mixed and exhibits slurry-like characteristics. The coating material may be a so-called elastic coating material that causes an application surface to exhibit rubber-like characteristics in a single layer. For example, the coating material is preferably an acrylic coating material whose principal component is a crosslinkable acrylic emulsion. For example, the diameter of the glass fibers is 1 μm to 20 μm (equal to or greater than 1 μm and equal to or smaller than 20 μm). For example, the length of glass fibers falls within the range of 1 mm to 20 mm. By mixing the glass fibers in an acrylic coating material, a slurry in which the glass fibers are suspended in the coating material can be obtained. For example, the weight ratio of the glass fibers to the weight of the coating material is 1% to 40%.

[0038] At a process of applying the reinforcement coating layer 30, as an example, a primer material may be applied onto the masonry wall 10. The coating material in which the glass fibers are suspended is applied after drying of the primer. After being applied, the crosslinkable acrylic emulsion coating material forms a single layer that rigidly adheres to the masonry wall 10 regardless of the surface configuration of the wall. The thus-formed layer excels in water resistance. Note that, as the coating material, instead of an acrylic coating material, a urethane-based coating material may be used.

[0039] The reinforcement coating layer 30 may be formed such that a plurality of layers with different properties are stacked one on another. Instead of being directly formed on the front surfaces of the masonry materials 11, the

reinforcement coating layer 30 may be formed on a layer of mortar or the like formed on the front surfaces of the masonry materials 11.

[0040] A part (preferably, a majority on a mass basis) or the whole of the resin contained in the fiber-reinforced resin that can form the reinforcement coating layer 30 is preferably an elastic resin and is preferably acrylic resin, silicone resin, acrylic silicone resin, urethane resin, or natural resin (latex coating material).

[0041] The content amount of the resin relative to the total mass of the reinforcement coating layer 30 is preferably 30 to 99 mass %, is more preferably 40 to 96 mass %, and is further preferably 55 to 93 mass %.

[0042] The fibrous material contained in the fiber-reinforced resin that can form the reinforcement coating layer 30 may be inorganic fibers (the glass fibers mentioned above, carbon fibers, boron fibers, etc.) or organic fibers (aramid fibers, plant fibers, etc.) and is preferably inorganic fibers. A part (preferably, a majority on a mass basis) or the whole of the fibrous material is preferably inorganic fibers and is more preferably glass fibers. The fibrous material may be surface-treated for adjusting the adhesion to the resin.

[0043] The content amount of the fibrous material relative to the total mass of the reinforcement coating layer 30 is preferably 0.3 to 6 mass %.

[0044] FIG. 4 is a perspective view illustrating an example of the shape of the reinforcement coating layer. The reinforcement coating layer 30 may be formed only on the wall surface of the masonry wall 10, and may be formed in a region extending from the wall surface of the masonry wall 10 to the frame body 20. Specifically, as illustrated in FIG. 4, the reinforcement coating layer 30 may be formed across the wall surface of the masonry wall 10, the upper frame 21, and the side frames 23. Although not illustrated in FIG. 4, the reinforcement coating layer 30 may be formed to be in contact with the entire periphery of the wall surface of the frame body 20. By the reinforcement coating layer 30 being in contact with the masonry wall 10 and the frame body 20 in this manner, it becomes unlikely for the masonry wall 10 to come off from the frame body 20. The reinforcement coating layer 30 may be formed across the wall surface of the masonry wall 10 and a part (e.g., the upper frame 21) of the frame body 20.

(Construction Method)

[0045] FIG. 5 is a flowchart illustrating an example of the construction method according to the present invention. Hereinbelow, a process in which an operator installs the masonry panel S100 mentioned above in a building is explained.

[0046] First, at Step S1, the operator constructs the masonry panel S100. This step is a step of preparing the masonry panel S100. The operator sequentially arranges the plurality of masonry materials 11 inside the frame body 20. For example, the operator fills gaps between the masonry materials 11 with mortar. Reinforcing bars may be arranged in the vertical direction or the horizontal direction. The operator also fixes the frame body 20 and masonry materials 11 positioned at the outer periphery of the masonry wall 10. For the fixation of the masonry materials 11 and the frame body 20, mortar may be used as mentioned before, or a material other than mortar may be used. By such a process, the masonry panel S100 in which the masonry wall 10 is fixed to the frame body 20 is constructed.

[0047] Step S1 may be performed in or near the building where the masonry panel S100 is to be installed or may be performed at a location such as a factory different from the building.

[0048] Next, at Step S2, the operator forms the reinforcement coating layer 30 on the wall surface of the masonry wall 10. Specifically, for example, the operator applies the coating material onto the wall surface of the masonry wall 10 by a roller, a trowel, or a spray. A plurality of the masonry panels S100 on which the reinforcement coating layer 30 is not formed may be prepared, and the coating material may be applied sequentially onto the wall surface of the masonry wall 10 of each panel.

[0049] In a case in which the masonry panel S100 like the one illustrated in FIG. 4 is constructed, at Step S2, the operator may form the reinforcement coating layer 30 also in a region extending from the wall surface of the masonry wall 10 to the frame body 20. For example, this process may be performed by a procedure in which the coating material is applied onto the entire region of the reinforcement coating layer 30 illustrated in FIG. 4 (a region extending from the wall surface of the masonry wall 10 to the frame body 20) or may be performed by a procedure in which first the coating material is applied onto the wall surface of the masonry wall 10, and then the coating material is applied onto the region connecting the wall surface of the masonry wall 10 and the frame body 20.

[0050] Next, at Step S3, the operator moves the masonry panel S100 on which the reinforcement coating layer 30 is formed to a predetermined position in the building. The "predetermined position" may be an installation position in the building where the masonry panel S100 is to be installed, and, as an example, the "predetermined position" is a material storage area where the masonry panel S100 is temporarily placed before the masonry panel S100 is transported to the installation position in the present embodiment.

[0051] The means for moving the masonry panel S100 can be any means, and, for example, the operator moves the masonry panel S100 in a state in which the frame body 20 of the masonry panel S100 is held with a wire or a predetermined device. By moving the masonry panel S100 in a state in which not the masonry wall 10 but the frame body 20 is held, the masonry panel S100 can be moved favorably without applying an excessive force to the masonry wall 10. In addition, by such a movement process, the masonry panel S100 can be moved even when mortar or the reinforcement coating layer 30

is not dried sufficiently, and the strength of the masonry wall 10 is insufficient as a building material. Accordingly, the work efficiency can be enhanced.

[0052] Next, at Step S4, the operator installs the masonry panel S100 at the target installation position. For example, the installation of the masonry panel S100 is performed by fixing the frame body 20 to a beam or a pillar which is a structure section of the building.

(Effects)

[0053] Through the series of processes described above, the masonry panel S100 is constructed, and the constructed masonry panel S100 is installed at the predetermined installation position in the building. In the construction method according to the present embodiment, the plurality of masonry materials 11 are not directly provided at the target installation position unlike in conventional construction methods, but the masonry panel S100 constructed at a location different from the installation position is moved. Accordingly, the construction and installation of the masonry material wall can be performed with good work efficiency.

[0054] In the masonry panel S100, the reinforcement coating layer 30 is provided on the wall surface of the masonry wall 10, and the reinforcement coating layer 30 enhances the fixation strength between the masonry materials 11. In a structure in which such a reinforcement coating layer 30 is not provided, and, for example, many reinforcing bars or the like are arranged in the masonry wall 10 to enhance the fixation strength between the masonry materials 11, the weight of the masonry panel S100 increases. In contrast, in the configuration according to the present embodiment that uses the reinforcement coating layer 30, the weight of the masonry panel S100 is reduced. Therefore, it is possible to achieve an effect that the handleability of the masonry panel S100 becomes favorable. Note that this description about the effects does not preclude the use of reinforcing bars in the present invention.

[0055] Whereas the flowchart illustrated in FIG. 5 includes the step of construction the masonry panel S100, the step of forming the reinforcement coating layer 30, and the step of installing the masonry panel S100, these steps are not essential in the construction method according to the present invention.

<Second Embodiment>

[0056] FIG. 6 is a perspective view illustrating the masonry panel and a holding apparatus used in a construction method according to a second embodiment. FIG. 7 is a drawing illustrating the holding apparatus in an opened state. FIG. 8 is a drawing illustrating the holding apparatus in a closed state. As explained in the first embodiment, the masonry panel S100 is moved in the present invention. The masonry panel S100 may be moved by being pulled up by a holding apparatus 50 like the one illustrated in FIG. 6.

[0057] The frame body 20 illustrated in FIG. 6 has protrusions 25 at the central portion of the upper frame 21. The protrusions 25 are provided on the side surfaces of the upper frame 21. The protrusions 25 protrude in the thickness direction of the frame body 20. As an example, the protrusions 25 are rod-like members. In the example illustrated in FIG. 6, a protrusion 25 is provided on each of both side surfaces of the upper frame 21.

[0058] Note that, whereas a pair of the protrusions 25 are provided at one location of the upper frame 21 in FIG. 6, a plurality of protrusions 25 may be provided at a plurality of locations. The protrusions 25 may be provided at a position in the frame body 20 other than the upper frame 21.

(Holding apparatus)

[0059] The holding apparatus 50 is a clamp that holds the frame body 20 of the masonry panel S100. The holding apparatus 50 has a pair of abutment members 51 and a link mechanism 55.

[0060] As illustrated in FIG. 7, the pair of abutment members 51 are arranged opposite to each other such that the frame body 20 can be sandwiched from the sides of both surfaces. Since the structure of each abutment member 51 is the same, the following explains only one abutment member 51. An abutment member 51 is formed in a U shape in the present embodiment and has an abutment section 52 and sides 53.

[0061] The abutment section 52 is a portion where an abutment surface that abuts on a side surface of the frame body 20 is formed. For example, the abutment surface is a flat plane. A through-hole 52h into which a protrusion 25 is inserted formed through the abutment section 52.

[0062] Each side 53 is formed integrally with the abutment section 52. As illustrated in FIG. 7, the side 53 is supported by a second link member 57 (details are described below) using a support pin P3. Specifically, the side 53 is supported to be pivotable about the support pin P3. The pivoting range of the abutment member 51 is limited by an arc-like long hole 53h of the side 53 and a projection 57a that is provided on the second link member 57 and positioned in the long hole 53h. Specifically, the pivoting range is limited to an orientation in which the abutment surface of the abutment section 52 faces the side surface of the frame body 20.

[0063] As illustrated in FIG. 7, as an example, a central angle α_1 of the arc of the long hole 53h with respect to a horizontal plane may be formed to be equal to or smaller than 60° , and the central angle α_1 is preferably formed to be equal to or smaller than 45° . In the case of such a configuration, even when the abutment member 51 rotates about the support pin P3 due to its own weight, the surface of the abutment section 52 does not face the vertically upward direction or the vertically downward direction, and, for example, the surface of the abutment section 52 inclines by 45° with respect to the horizontal plane. Accordingly, there is an advantage that the abutment members 51 can be attached easily when the pair of abutment members 51 in the state illustrated in FIG. 7 sandwich the frame body 20 as in the state illustrated in FIG. 8.

[0064] The link mechanism 55 supports the pair of abutment members 51. As illustrated in FIG. 7 and FIG. 8, the link mechanism 55 is configured to be capable of expanding and contracting. In the state illustrated in FIG. 7 in which the link mechanism 55 is contracted, the abutment members 51 are separated from each other. In the state illustrated in FIG. 8 in which the link mechanism 55 is expanded, the abutment members 51 are close to each other.

[0065] Specifically, the link mechanism 55 has first link members 56 and the second link members 57. A pair of the first link members 56 and a pair of the second link members 57 are provided.

[0066] The first link members 56 are plate-like members. The first link members 56 have straight contour shapes. The first link members 56 are pivotably coupled to each other by a support pin P1. A wire S is fixed to the support pin P1.

[0067] The second link members 57 also are plate-like members. The second link members 57 have J-shaped contour shapes. The second link members 57 are coupled to the first link members 56 by support pins P2. In addition, one second link member 57 and the other second link member 57 are pivotably coupled to each other by a support pin P3. The abutment members 51 are attached to ends of the second link members 57.

[0068] The thus-configured holding apparatus 50 operates in the following manner. The operation performed by the holding apparatus 50 is explained below along with a procedure in which the operator uses the holding apparatus 50.

[0069] First, the operator disposes the holding apparatus 50 at a part of the frame body 20. Specifically, the operator attaches the holding apparatus 50 to the upper frame 21 such that the protrusions 25 of the frame body 20 are inserted into the through-holes 52h.

[0070] Next, when the operator operates an unillustrated device for moving the wire S, and the wire S is pulled up, an upward force is applied to the support pin P1, and also the link mechanism 55 is pulled up. Then, the link mechanism 55 is deformed as in FIG. 8, and the pair of abutment members 51 move toward each other. In this manner, in the link mechanism 55 according to the present embodiment, when an upward force is applied to a part of the link mechanism 55, the pair of abutment members 51 sandwich the frame body 20 from the sides of both surfaces. According to the present configuration, the protrusions 25 are prevented from disengaging from the through-holes 52h, and additionally the pair of abutment members 51 sandwich the frame body 20. By the process in which the panel is lifted in a state in which the pair of abutment members 51 sandwich the frame body 20 in this manner, it is possible to favorably move the masonry panel S100 while preventing the masonry panel S100 from falling.

[0071] In particular, the holding apparatus 50 in this example does not use a driving source such as, for example, a motor or hydraulic pressure to cause the pair of abutment members 51 to sandwich the frame body 20, but the holding apparatus 50 has a structure that uses force to pull up the masonry panel S100 to move the pair of abutment members 51. Accordingly, the holding apparatus 50 can be enabled with a simple configuration and does not require a driving source such as a motor also.

[0072] Whereas the description above illustrates an example in which the holding apparatus 50 is pulled up by the wire S, not the wire S but, for example, a part of a device (e.g., an arm section of the device) used at a construction site may be coupled to a part of the link mechanism 55, and the holding apparatus 50 may be pulled up by the device.

[0073] Whereas FIG. 7 and FIG. 8 illustrate an example in which the protrusions 25 are inserted into the through-holes 52h (i.e. through-holes (openings) engage with the protrusions 25), for example, the holding apparatus may have configuration in which the protrusions 25 are inserted not into the through-holes 52h but into recesses formed in the abutment members 51, and the protrusions 25 engage with the recesses.

<First Modification Example>

[0074] FIG. 9 is a drawing for explaining a first modification example. A masonry panel S101 illustrated in FIG. 9(a) has a filler material 18 and the reinforcement coating layer 30. The filler material 18 fills gaps between mutually adjacent masonry materials 11 and is mortar, for example.

[0075] The filler material 18 fills the gaps so as to form protrusions 18a protruding from the surfaces of the masonry materials 11. For example, the protrusion length of the protrusions 18a from the surfaces of the masonry materials 11 is equal to or greater than 5% of the thickness of the masonry materials 11. As a specific example, in a case in which the thickness of the masonry materials 11 is 150 mm, the protrusion length of the protrusions 18a is equal to or greater than 7.5 mm. In addition, for example, the protrusion length of the protrusions 18a is equal to or smaller than 20% of the thickness of the masonry materials 11. As a specific example, in a case in which the thickness of the masonry materials 11 is 150 mm, the protrusion length of the protrusions 18a is equal to or smaller than 30 mm. Since the protrusion length is not too short,

the sufficient anchoring effect of the reinforcement coating layer 30 can be easily achieved. In addition, since the protrusion length is not too long, the work efficiency of a process of disposing the filler material 18 is unlikely to lower.

[0076] The reinforcement coating layer 30 is formed to adhere to the protrusions 18a. In a case in which the reinforcement coating layer 30 is formed to adhere to the protrusions 18a in this manner, it becomes unlikely for the reinforcement coating layer 30 to peel off from the masonry wall 10 due to the anchoring effect.

[0077] As in a masonry panel S102 illustrated in FIG. 9(b), the filler material 18 may fill gaps so as to form depressions 18b concave from the wall surface of the masonry wall 10. Then, the reinforcement coating layer 30 may be formed to adhere to the depressions 18b. In the case of such a configuration also, it becomes unlikely for the reinforcement coating layer 30 to peel off from the masonry wall 10 since parts of the reinforcement coating layer 30 are formed to fit into the depressions 18b.

<Second Modification Example>

[0078] FIG. 10 is a drawing for explaining a construction method according to a second modification example. In a construction method according to an aspect of the present invention, at a step of moving the masonry panel S100, the masonry panel S100 may be moved in a state in which protective plates 70 are arranged on the wall surface of the masonry panel S100. In the example illustrated in FIG. 10, a protective plate 70 is disposed on each of both surfaces of the masonry panel S100.

[0079] The protective plates 70 are formed in a size that covers the wall surface of the masonry wall 10. The structure that fixes the protective plates 70 is not limited to a particular structure. For example, the protective plates 70 are fixed to the frame body 20 by unillustrated fixing members (e.g., screws). Recesses 70a are formed at the upper sections of the protective plates 70, and the horizontal positions of the protective plates 70 may be defined by the protrusions 25 fitting to the recesses 70a. Whereas FIG. 10 illustrates an example in which one location protrusion 25 defines the position of each protective plate 70, the position of each protective plate 70 may be defined by a plurality of protrusions 25. In addition, each protective plate 70 may be fixed by fixing members at a plurality of positions.

[0080] Since the pair of abutment members 51 of the holding apparatus 50 are configured to sandwich the frame body 20 as illustrated in FIG. 8, the protective plates 70 may be formed in a shape that allows the protective plates 70 to be sandwiched by the pair of abutment members 51 together with the frame body 20. The configuration in which the holding apparatus 50 serves also as a member that presses the protective plates 70 in this manner allows omission of a member that presses the protective plates 70 or allows reduction of the number of members.

[0081] The masonry panel S100 may be moved before the drying time of the coating material of the reinforcement coating layer 30 applied onto the masonry wall 10 elapses, that is, before the coating material is dried and cured. Even in a case in which the masonry panel S100 is moved in this manner, since the protective plates 70 are provided, a problem is unlikely to occur in which, for example, some member hits the masonry wall 10 being moved, and the masonry wall 10 is damaged.

<Third Modification Example>

[0082] FIG. 11 is a drawing for explaining a construction method according to a third modification example. A masonry panel S103 according to an aspect of the present invention may include latching members 21a formed at parts of the frame body 20. The latching members 21a are protrusions protruding upward from the upper frame 21.

[0083] At a step of installing such a masonry panel S103 at a predetermined installation position of a building, the latching members 21a of the frame body 20 may be fixed to parts of a structure of the building. Specifically, the latching members 21a may be fixed to parts of a beam or a ceiling (in a case in which there is an upper floor, the ceiling may be the floor of the upper floor). According to such a configuration, since the latching members 21a are fixed to parts of a structure of a building, it becomes unlikely for the masonry panel to fall over even in the event of an earthquake or the like.

<Fourth Modification Example>

[0084] FIG. 12 is a perspective view for explaining a modification example of the holding apparatus. FIG. 13 is a drawing illustrating another configuration example of the frame body. FIG. 14 is a drawing illustrating a use example of the holding apparatus illustrated in FIG. 12 and the frame body illustrated in FIG. 13. Whereas FIG. 12 illustrates only an abutment member 51 of the holding apparatus, the configuration of the holding apparatus is similar to that of the holding apparatus mentioned above in other respects.

[0085] As illustrated in FIG. 12, the abutment member 51 may be provided with a movement restriction member 54. The movement restriction member 54 is provided at a position spaced apart from the abutment section 52. The shape of the movement restriction member 54 can be any shape and is a plate-like shape in this example. The movement restriction member 54 is a plate-like member disposed parallel to the abutment section 52.

[0086] As illustrated in FIG. 13, for example, the frame body 20 may have a through-hole 21h at a position corresponding to the positions where the protrusions 25 illustrated in FIG. 10 are provided. The through-hole 21h extends in the thickness direction of the upper frame 21. A member 27 which is a member separate from the frame body 20 is inserted into the through-hole 21h. The shape of the member 27 can be any shape and is a rod-like shape in this example, for example. The member 27 is removably inserted into the through-hole 21h.

[0087] As illustrated in FIG. 14, by the member 27 being inserted into the through-hole 21h of the upper frame 21, portions protruding from both surfaces of the upper frame 21 function as protrusions (see the protrusions 25 illustrated in FIG. 10). Then, the abutment members 51 of the holding apparatus are attached to the upper frame 21 in which the member 27 is disposed in this manner. In the case of configuration like the one illustrated in FIG. 13, there is a possibility that the member 27 falls out if there are no members that restrict the movement of the member 27. However, the movement restriction members 54 are provided in the abutment members 51, and the movement of the member 27 in the horizontal direction is restricted by the action of the movement restriction members 54 in a holding state like the one illustrated in FIG. 14. Accordingly, the member 27 is prevented from accidentally falling out while the frame body 20 is being pulled up. In addition, since configuration like the one illustrated in FIG. 13 and FIG. 14 allows removal of the member 27 after the movement of the masonry panel, it is not necessary to form projections on the frame body 20 in advance, and the frame body 20 does not become bulky.

<Fifth Modification Example>

[0088] Although the pair of abutment members 51 are provided in the holding apparatus, for example, it is conceivable that the pair of abutment members 51 open undesirably due an unexpected factor while the holding apparatus 50 is being pulled up. In order to prevent such an occurrence, a coupling member such as a hook that couples the opposing abutment members 51 may be provided.

<Example of Construction of Masonry Panel>

[0089] The masonry panel may be constructed by a process like the one below. FIG. 15 is a drawing for explaining a construction example of the masonry panel, illustrating a state in which reinforcing bars are provided to the frame body. FIG. 16 illustrates a state in which the masonry materials are arranged in the frame body in the state illustrated in FIG. 15. FIG. 17 illustrates a state in which the upper frame of the frame body is disposed. FIG. 18 illustrates a state in which the reinforcement coating layer is provided.

[0090] As an example, FIG. 15 illustrates a frame body 120' in a state in which the upper frame is removed. The frame body 120' may be a concrete member formed at a construction site or may be precast concrete. The operator first arranges reinforcing bars 141 in such a frame body 120'. The reinforcing bars 141 are rod-like reinforcement members. The reinforcing bars 141 are longer than the length in the height direction of the inside of the frame body 120 (FIG. 17). In this example, the lower ends of the reinforcing bars 141 are fixed to the lower frame of the frame body. The reinforcing bars 141 extend in the vertical direction.

[0091] Next, as illustrated in FIG. 16, the operator arranges the masonry materials 11 in the frame body 120'. As an example, the operator fills gaps between mutually adjacent masonry materials 11 with mortar. Note that filling with mortar is not essential, and the plurality of masonry materials 11 may be arranged without filling gaps with mortar. At least one reinforcing bar 141 is inserted through a plurality of masonry materials 11 that are stacked in the vertical direction.

[0092] Next, as illustrated in FIG. 17, the operator attaches an upper frame 121 to the frame body 120'. In this example, the upper frame 121 is placed on the upper sections of left and right side frames 123. Thereby, the one closed frame body 120 is formed.

[0093] A plurality of holes into which a plurality of the reinforcing bars 141 are inserted may be formed in the upper frame 121. The configuration in which the upper ends of the plurality of reinforcing bars 141 fit into the holes in the upper frame 121 in a state in which the upper frame 121 is disposed as illustrated in FIG. 17 provides an advantage that the plurality of reinforcing bars 141 are stably fixed, and the strength and rigidity of the masonry panel are enhanced.

[0094] Next, as illustrated in FIG. 18, the operator forms a reinforcement coating layer 130 on one surface or both surfaces of the masonry wall formed by the plurality of masonry materials. In an aspect, preferably, the reinforcement coating layer 130 is formed to contact both the masonry wall and the frame body 120 (i.e., the reinforcement coating layer 130 is formed in a region extending from the masonry wall to the frame body 120). The material of the reinforcement coating layer 130 is identical to the one according to the embodiment mentioned above.

[0095] Note that, whereas the reinforcing bars 141 are arranged in the example explained above, the plurality of masonry materials 11 may be stacked within the frame body without using the reinforcing bars 141. In this case, mortar may fill gaps between the masonry materials 11 and/or gaps between masonry materials 11 and the frame body 120. However, such mortar may not be used.

[0096] In a case in which, for example, ready-made blocks whose height dimension and widthwise dimension have been

set to predetermined values in advance are used as the masonry materials, it is conceivable that gaps are generated between blocks and the frame body in a state in which a plurality of the blocks are arrayed inside the frame body. The reason for this is because, for example in the width direction, the length of the inside of the frame body is not a length which is an integer multiple of the blocks, and gaps which are smaller than the length of one block are generated between the ends of blocks and the inside of the frame body when the plurality of blocks are arrayed. In such a case, the gaps may be filled with mortar or the material of the reinforcement coating layer, or the width may be adjusted by increasing the amount of mortar that fills gaps between adjacent blocks to increase the joint dimension. Note that a filler such as a fibrous material may be disposed between a block and a block to adjust the gap, and the material of the reinforcement coating layer may be applied to the fibrous material.

<Example of Building Structure>

[0097] FIG. 19 is a drawing illustrating an example of a building structure. The building structure illustrated in FIG. 19 includes the masonry panel S100 and a floor structure 80.

[0098] When the masonry panel S100 is installed, there is a possibility that the masonry panel S100 falls over undesirably. In view of this, in the configuration illustrated in FIG. 19, a member that supports the masonry panel S100 is provided (details are described below). As an example, the floor structure 80 is a slab floor. The floor structure 80 may be a portable member or may be a part of a building. The floor structure 80 is provided with a plurality of post members 85.

[0099] The post members 85 are provided to protrude from the upper surface (floor surface) of a flooring 81. As an example, the post members 85 are rod-like members. The post members 85 need not be provided integrally with the flooring 81 and may be members inserted into holes formed in the flooring 81.

[0100] As illustrated in FIG. 19, holes 101h into which the post members 85 fit are formed in the lower surface of the masonry panel S100. The masonry panel S100 is installed on the upper surface of the floor structure 80 such that each post member 85 fits into a hole 101h. According to such a configuration, since the post members 85 fit into parts of the masonry panel S100 to support the masonry panel S100, the masonry panel S100 is prevented from falling over.

[0101] Note that, whereas FIG. 19 illustrates a state in which the post members 85 fit into the holes 101h near the sides of the masonry panel S100, the post members 85 need not fit into the masonry material panel S100 near the sides of the masonry panel S100 in a case in which supports 90 are arranged at the corners of the floor structure 80 as mentioned later.

[0102] In a case in which the building structure described above is constructed, for example, the operator performs the following steps. The operator first performs a step of arranging the plurality of masonry materials inside the frame body and fixing the frame body and the masonry wall formed by the plurality of masonry materials to construct the masonry panel. Next, the operator performs a step of disposing the masonry panel on the floor structure, the masonry panel being disposed such that the post members protruding upward from the floor structure are inserted into parts of the masonry panel. As a post-process, for example, the reinforcement coating layer may be formed in a region extending from the masonry panel to the floor structure, thereby more rigidly fixing both members.

(Building Structure in Which Corners are Reinforced By Supports)

[0103] FIG. 20 is a drawing illustrating another example of the building structure. FIG. 21 is a perspective view of a floor structure. FIG. 22 is a drawing illustrating a state in which supports are attached to the floor structure. FIG. 23 is a drawing illustrating a state in which the masonry panel is attached to the structure in the state illustrated in FIG. 22.

[0104] A building structure S200 includes the masonry panels S100, the floor structure 80, and the supports 90. Whereas the masonry panels are denoted with the reference character S100, the masonry panels are not necessarily limited to the masonry panels S100 illustrated in FIG. 1, FIG. 2, and the like as long as they are masonry panels according to the present invention. The reinforcement coating layer may be formed on one surface of each masonry panel S100, or the reinforcement coating layer may be formed on both surfaces of each masonry panel S100.

[0105] The floor structure 80 has the flooring 81 (FIG. 21). As an example, the flooring 81 has a quadrangular shape. The masonry panels S100 are arranged along the sides of the flooring 81 on the upper surface of the flooring 81.

[0106] The supports 90 are members arranged at the corners of the floor structure 80. Since the supports 90 arranged at the individual corners have mutually the same structure, the following explains the structure of a corner at one location. As an example, a support 90 is a member having a L-shaped horizontal cross-sectional shape. As can be understood by looking at a support 90-1 illustrated in FIG. 20, the support 90 is in contact with and supports a first masonry panel S100-1 and a second masonry panel S100-2 at the portion where the first masonry panel S100-1 and the second masonry panel S100-2 are adjacent to each other. Specifically, the first masonry panel S100-1 and the support 90 may be fixed to each other by the reinforcement coating layer being formed in a region extending from the first masonry panel S100-1 to the support 90. For example, the first masonry panel S100-1 and the support 90 may be fixed to each other by mortar filling a gap between the first masonry panel S100-1 and the support 90. The same applies also to the second masonry panel

S100-2 and the support 90.

[0107] In this manner, according to the configuration in which the supports 90 that support mutually adjacent masonry panels are provided, the structure can be reinforced favorably. That is, since stress concentration is likely to occur at locations where panels cross, by providing supports 90 like the ones according to the present embodiment, it becomes unlikely for the corners of the building structure S200 to be damaged.

[0108] The supports 90 may be ones that have been constructed in advance and transported to a construction site, and, by using such supports 90, variations in quality due to differences in the skill levels of operators at the construction site can be prevented from occurring, and it is possible to aim for quality homogenization. The pre-formed supports 90 may be ones having lower surfaces where holes into which the post members 85 are inserted are formed. In addition, for example, the supports 90 may be ones formed by pouring concrete into a formwork at the construction site.

(Construction of Building Structure S200)

[0109] The building structure S200 may be constructed by the following process. Whereas the following illustrates an example in which the plurality of post members 85 are used, it is not essential in the present invention to use the plurality of post members 85.

[0110] First, the operator attaches the plurality of post members 85 to the floor structure 80 (FIG. 21). Next, the operator arranges the supports 90 at the corners of the floor structure 80 (FIG. 22).

[0111] Then, the operator arranges the masonry panels S100 on the floor structure 80. Specifically, as an example, the operator disposes the first masonry panel S100-1 such that the first masonry panel S100-1 extends in a first direction (the longer-side direction of the floor structure 80). In addition, the operator disposes the second masonry panel S100-2 such that the second masonry panel S100-2 extends in a second direction (shorterside direction). Similarly, the operator disposes the masonry panels S100 also along the two remaining sides.

[0112] Next, the operator fixes the first masonry panel S100-1 and the second masonry panel S100-2 to the support 90 at the position (corner) where the first masonry panel S100-1 and the second masonry panel S100-2 are adjacent to each other. As mentioned before, for example, the fixation may be fixation by mortar, may be fixation by the reinforcement coating layer, or may be fixation by the combined use of these.

[0113] As a work example of fixation by reinforcement coating, the operator may form the reinforcement coating layer in a region extending from a first masonry panel S100 to a part of the support 90 and form the reinforcement coating layer in a region extending from the second masonry panel S100-2 to another part of the support 90. Certainly, each masonry panel S100 and the supports 90 may be fixed by the reinforcement coating layer on both surfaces of the masonry panel S100.

(Modification Example Of Building Structure)

[0114] FIG. 24 is a drawing illustrating another example of the building structure. FIG. 25 is a drawing illustrating the floor structure and supports. A building structure S201 includes the floor structure 80 and supports 90'. Whereas the building structure S201 includes also masonry panels similarly to the building structure S200, the illustration is omitted in FIG. 24.

[0115] In the supports 90', post portions 93 (FIG. 25) extending in the up-down direction are formed thinner than those in the supports 90. The upper section of each post portion 93 is provided with a first lateral extension 91a and a second lateral extension 91b. The lower section of each post portion 93 is similarly provided with a first lateral extension 92a and a second lateral extension 92b.

[0116] As an example, the first lateral extension 91a and the second lateral extension 91b extend in mutually orthogonal directions. The first lateral extension 92a and the second lateral extension 92b also have similar configuration. For example, the protrusion length in the horizontal direction of the first lateral extension 91a from the post portion 93 is the same as or substantially the same as the length in the horizontal direction of each masonry material 11. The second lateral extension 91b also has similar configuration. The supports 90' have the post portions 93 which are formed thinner than those in the supports 90 and accordingly are advantageous in terms of weight reduction and cost reduction of members compared to the supports 90.

[0117] As illustrated in FIG. 24, a plurality of masonry materials 11 may be stacked in the vertical direction along the first lateral extension 91a and the second lateral extension 91b. For example, the plurality of stacked masonry materials 11 may be fixed to each other by mortar or the like. In addition, for example, the plurality of masonry materials 11 may be fixed also to the support 90' by mortar or the like or by the reinforcement coating layer.

[0118] A masonry panel is disposed such that the masonry panel is sandwiched by one support 90' in which a plurality of masonry materials 11 are arranged and another support 90' in which plurality of masonry materials 11 are arranged, and the masonry panel, the supports 90', and the masonry materials 11 are fixed, thereby enabling construction of a building structure with enhanced strength and rigidity. The fixation of the masonry panel, the supports 90', and the masonry materials 11 may be enabled by mortar or the reinforcement coating layer.

[0119] Whereas the present invention has been explained using embodiments thus far, the technical scope of the

present invention is not limited by the scope described in the embodiments described above, but various modifications and changes are possible within the scope of a gist of the present invention. For example, whereas a masonry wall is constructed inside a frame in examples described above, the use of a frame is not essential. For example, the construction method may be a construction method including: a step of arranging a plurality of masonry materials to construct a masonry wall formed by the plurality of masonry materials; a step of forming a reinforcement coating layer on a wall surface of the masonry wall; and a step of moving the masonry wall to a predetermined position.

[0120] A masonry wall may be constructed without using a frame, a reinforcement coating layer may be formed on the wall surface, and then the masonry wall may be stored or moved in a state in which the masonry wall (the masonry wall having the reinforcement coating layer) is laid down. When a plurality of masonry walls (which may be masonry panels already) are stored or moved, the plurality of masonry walls may be laid down in a stacked manner, either directly or with protective materials (sheets, plates, etc.) or the like being interposed therebetween.

[0121] In the present specification, for example, all or some of apparatuses can be configured functionally or physically distributed or integrated in any units. In addition, new embodiments that are generated by any combination of a plurality of embodiments are also included in embodiments of the present invention. Effects of the new embodiments generated by the combination combine effects of the original embodiments.

DESCRIPTION OF THE REFERENCE NUMERALS

[0122]

20	10	Masonry wall
	11	Masonry material
	18	Filler material
	18a	Protrusion
25	18b	Depression
	20	Frame body
	21	Upper frame
	21a	Latching member
	22	Lower frame
30	23	Side frame
	25	Protrusion
	30	Reinforcement coating layer
	31	Protrusion
	50	Holding apparatus
35	51	Abutment member
	52	Abutment section
	52h	Through-hole
	53	Side
	53h	Long hole
40	54	Movement restriction member
	55	Link mechanism
	56	First link member
	57	Second link member
	57a	Projection
45	70	Protective plate
	70a	Recess
	80	Floor structure
	81	Flooring
	85	Post member
50	85	Plurality of post members
	90	Support
	90'	Support
	90-1	Support
	91a	First lateral extension
55	91b	Second lateral extension
	92a	First lateral extension
	92b	Second lateral extension
	93	Post portion

101h	Hole
120	Frame body
120'	Frame body
121	Upper frame
5 123	Side frame
130	Reinforcement coating layer
141	Reinforcing bar
P1 to P3	Support pin
S	Wire
10 S100, S101, S102, S103	Masonry panel
S200, S201	Building structure

Claims

- 15 1. A construction method comprising a step of moving, to a predetermined position in a building, a masonry panel in which a plurality of masonry materials are arranged inside a frame body, and a reinforcement coating layer is formed on a wall surface of a masonry wall formed by the plurality of masonry materials.
- 20 2. The construction method according to claim 1, further comprising:
 - a step of arranging the plurality of masonry materials inside the frame body and fixing the frame body and the masonry wall formed by the plurality of masonry materials to construct the masonry panel; and
 - a step of forming the reinforcement coating layer on the wall surface of the masonry wall.
- 25 3. The construction method according to claim 2, wherein the step of forming the reinforcement coating layer includes forming the reinforcement coating layer in a region extending from the wall surface of the masonry wall to the frame body.
- 30 4. The construction method according to claim 1, wherein the step of moving the masonry panel includes:
 - a step of disposing a holding apparatus that holds the frame body at a part of the frame body; and
 - a step of pulling up the holding apparatus using a wire or a device.
- 35 5. The construction method according to claim 4, wherein
 - the holding apparatus is a clamp,
 - the clamp has:
 - 40 a pair of abutment members that sandwich the frame body from sides of both surfaces of the frame body; and
 - a link mechanism coupled to the pair of abutment members, the link mechanism being configured to cause the pair of abutment members to move toward each other when the link mechanism is pulled up by the wire or the device and an upward force is applied to a part of the link mechanism, and
 - 45 the step of pulling up the holding apparatus using the wire or the device includes lifting the masonry panel in a state in which the part of the link mechanism is pulled up, and the frame body is sandwiched by the pair of abutment members.
- 50 6. The construction method according to claim 5, wherein
 - the frame body has a protrusion that is pre-formed on the frame body and protrudes in a thickness direction of the frame body or a protrusion that is formed by attaching a separate member to the frame body and protrudes in the thickness direction of the frame body, and
 - the step of disposing the holding apparatus at the part of the frame body includes causing an opening or a recess
 - 55 formed in the abutment member to engage with the protrusion.
7. The construction method according to claim 6, wherein the protrusion is formed by a member removably inserted into a hole formed through the frame body.

8. The construction method according to claim 4, wherein the step of moving the masonry panel includes moving the masonry panel in a state in which a protective plate is disposed on one surface or both surfaces of the masonry panel.

9. The construction method according to claim 8, wherein the step of moving the masonry panel includes moving the masonry panel in a state in which the protective plate is disposed on the masonry panel before drying time of a coating material of the reinforcement coating layer applied onto the masonry wall elapses.

10. The construction method according to claim 8, wherein the step of moving the masonry panel includes moving the masonry panel in a state in which a part of the protective plate is pressed by the holding apparatus.

11. The construction method according to claim 1 or 2, wherein the step of forming the reinforcement coating layer on the wall surface of the masonry wall includes forming the reinforcement coating layer such that the reinforcement coating layer adheres to a protrusion or a depression of a filler material, the filler material filling a gap between mutually adjacent masonry materials so as to form the protrusion protruding from wall surfaces of the masonry materials or so as to form the depression concave from the wall surfaces.

12. The construction method according to claim 1 or 2, further comprising:

a step of installing the masonry panel at a predetermined installation position of the building, wherein the step of installing the masonry panel includes fixing a latching member provided at an upper section of the frame body to a part of a structure of the building.

13. A masonry panel comprising:

a frame body;
a masonry wall that is formed by a plurality of masonry materials arranged inside the frame body and is fixed to the frame body; and
a reinforcement coating layer formed on a wall surface of the masonry wall.

14. The masonry panel according to claim 13, wherein a projection which is a protrusion protruding in a thickness direction of the frame body and engages with a part of a holding apparatus that holds the frame body is provided at an upper section of the frame body.

15. A construction method comprising:

a step of arranging a plurality of masonry materials to construct a masonry wall formed by the plurality of masonry materials;
a step of forming a reinforcement coating layer on a wall surface of the masonry wall; and
a step of moving the masonry wall to a predetermined position in a building.

16. A construction method comprising:

a step of arranging a plurality of masonry materials inside a frame body and fixing the frame body and a masonry wall formed by the plurality of masonry materials to construct a masonry panel; and
a step of disposing the masonry panel on a floor structure, the masonry panel being disposed such that a post member protruding upward from the floor structure is inserted into a part of the masonry panel.

17. The construction method according to claim 16, wherein

the step of disposing the masonry panel on the floor structure includes:

disposing a first masonry panel such that the first masonry panel extends in a first direction; and
disposing a second masonry panel such that the second masonry panel extends in a second direction crossing the first direction, and

the construction method further comprises a step of fixing the first masonry panel and the second masonry panel to a support installed on the floor structure at a position where the first masonry panel and the second masonry panel are adjacent to each other.

- 18.** The construction method according to claim 17, wherein the step of fixing the first masonry panel and the second masonry panel to the support includes forming a reinforcement coating layer in:

5 a region extending from the first masonry panel to a part of the support; and
 a region extending from the second masonry panel to another part of the support.

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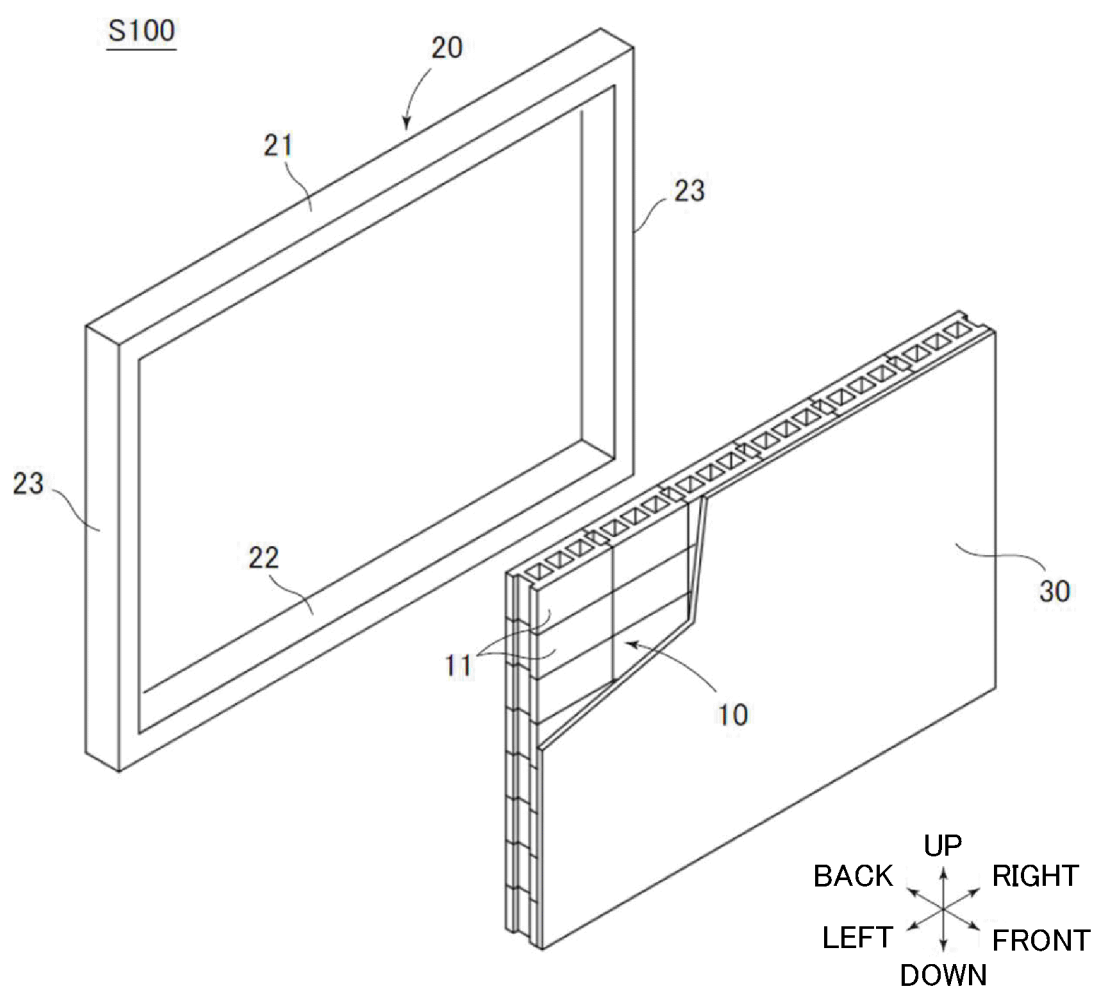


FIG. 1

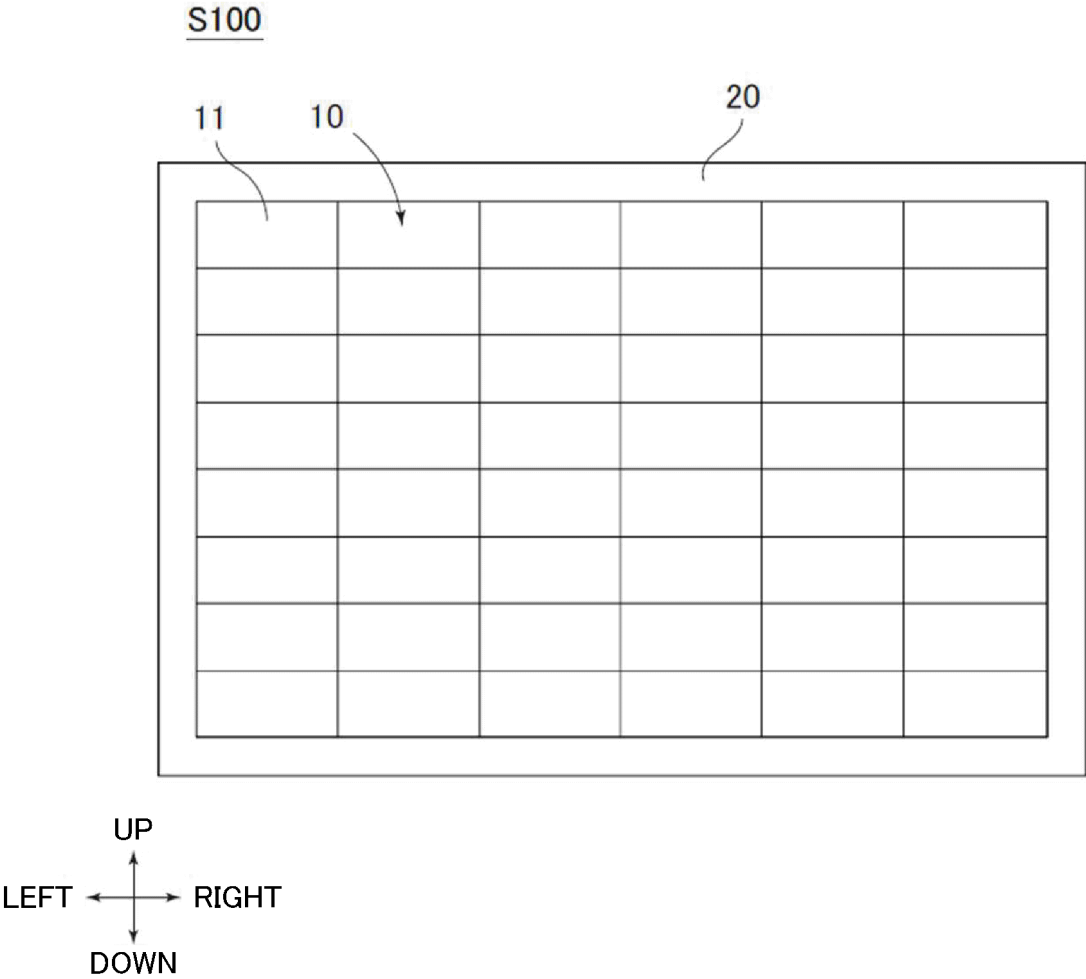


FIG. 2

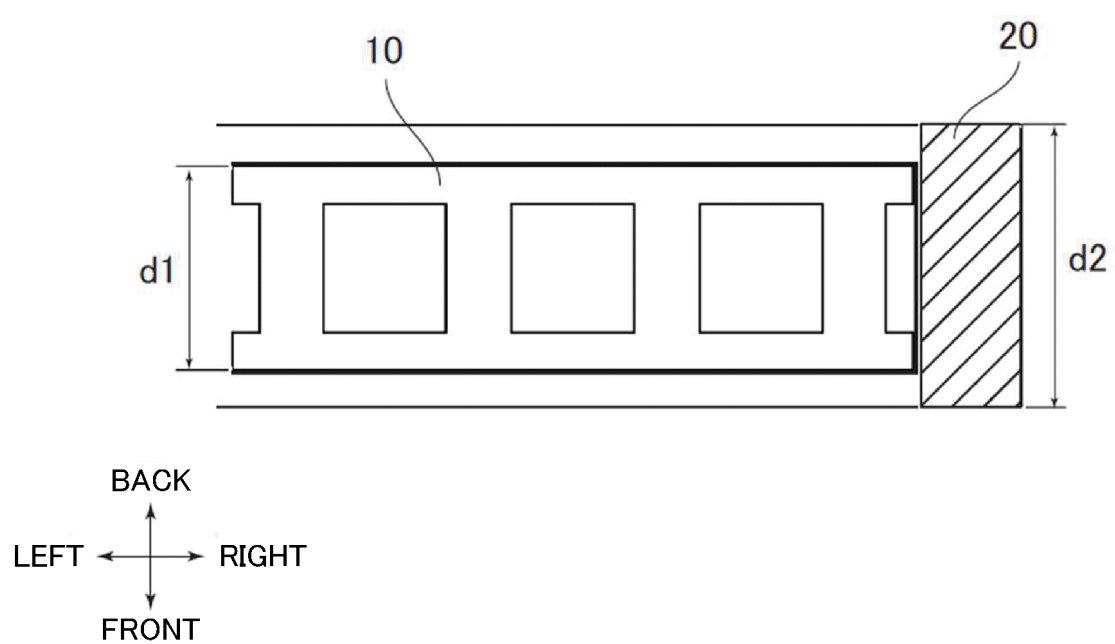


FIG. 3

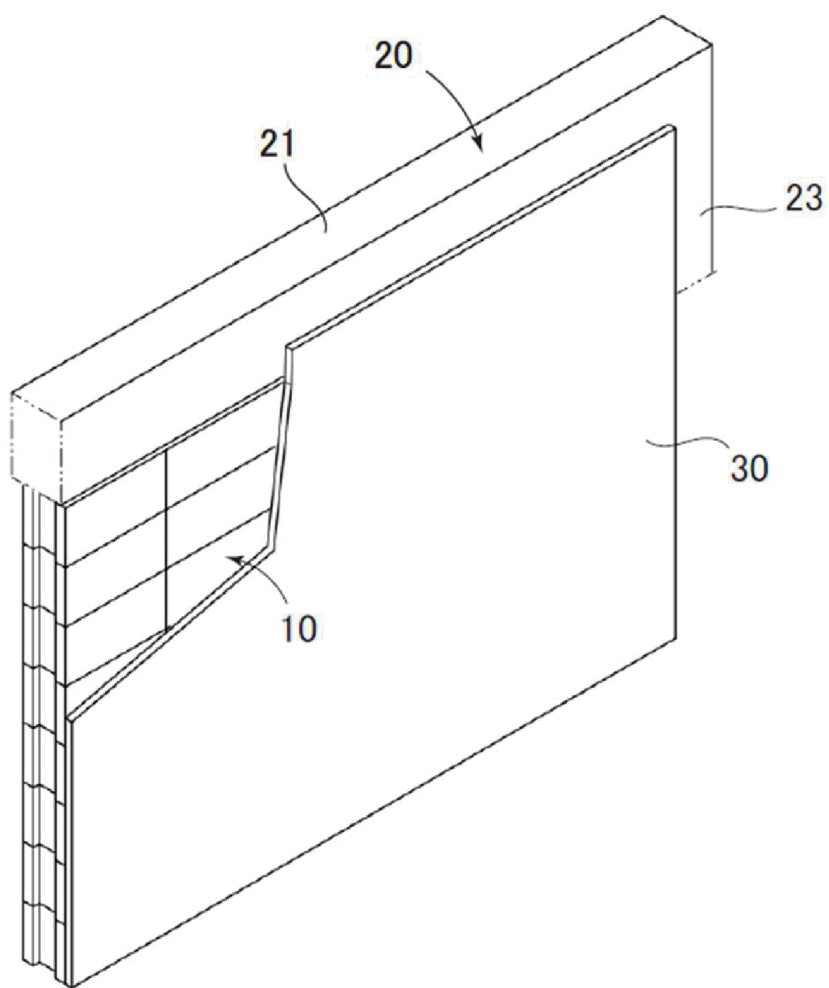


FIG. 4

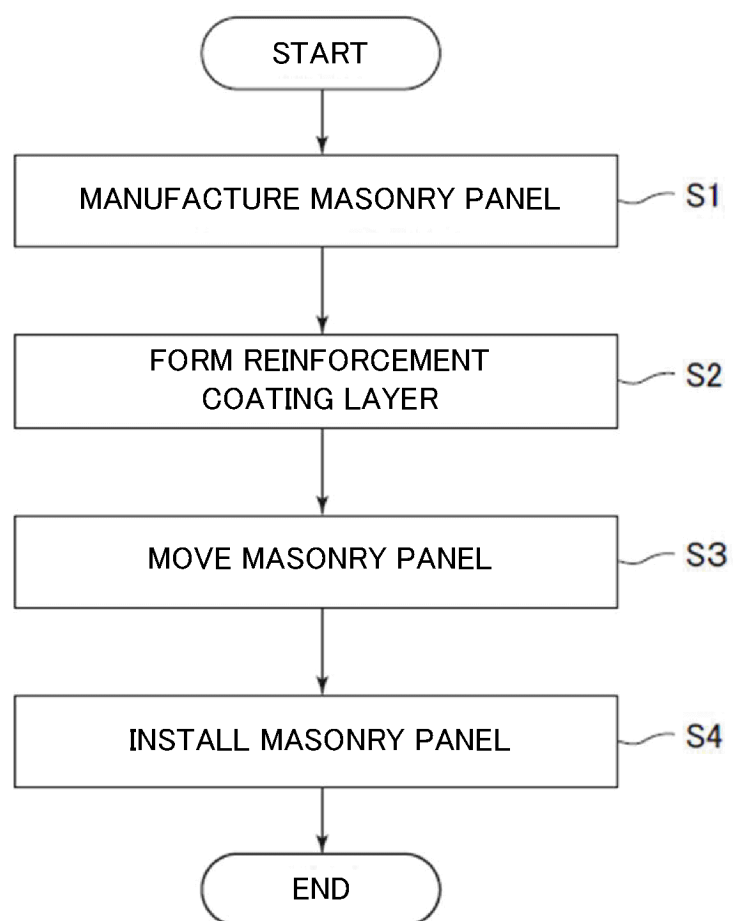


FIG. 5

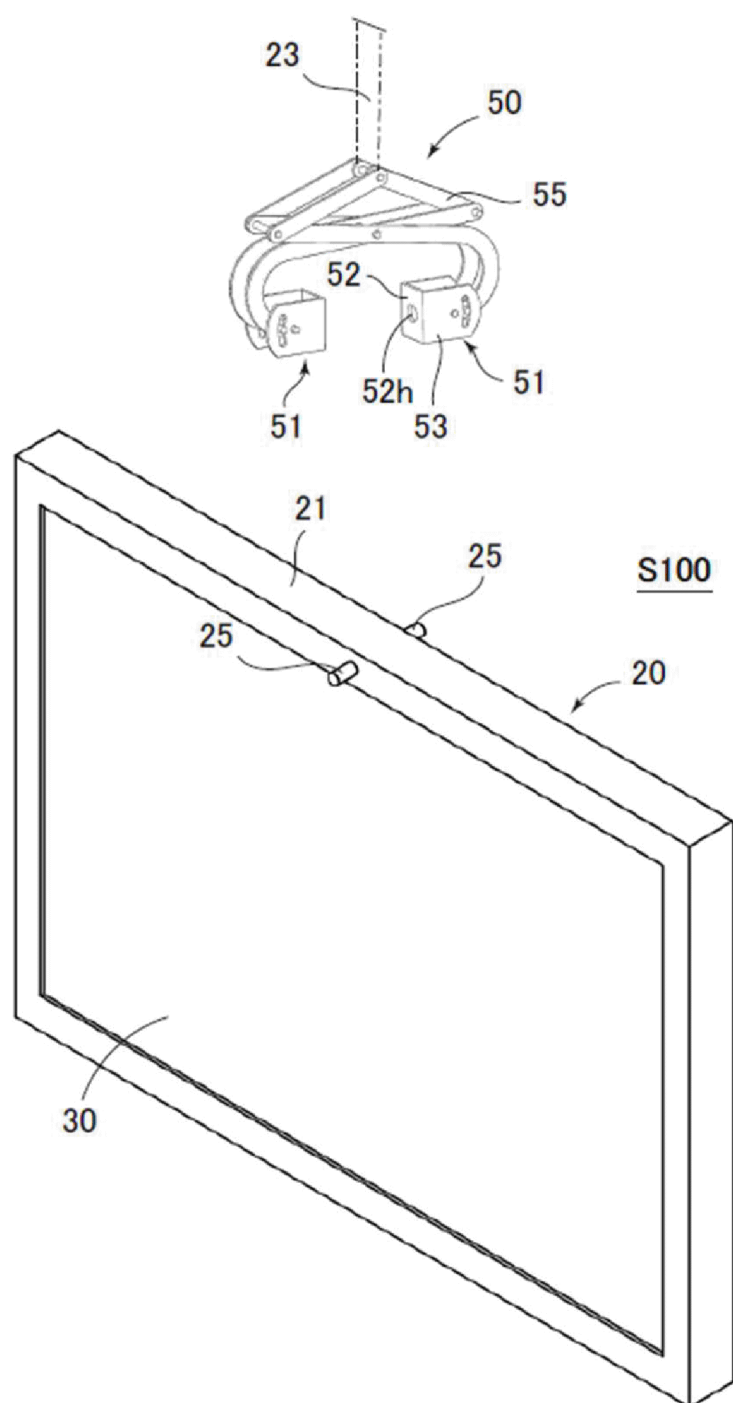


FIG. 6

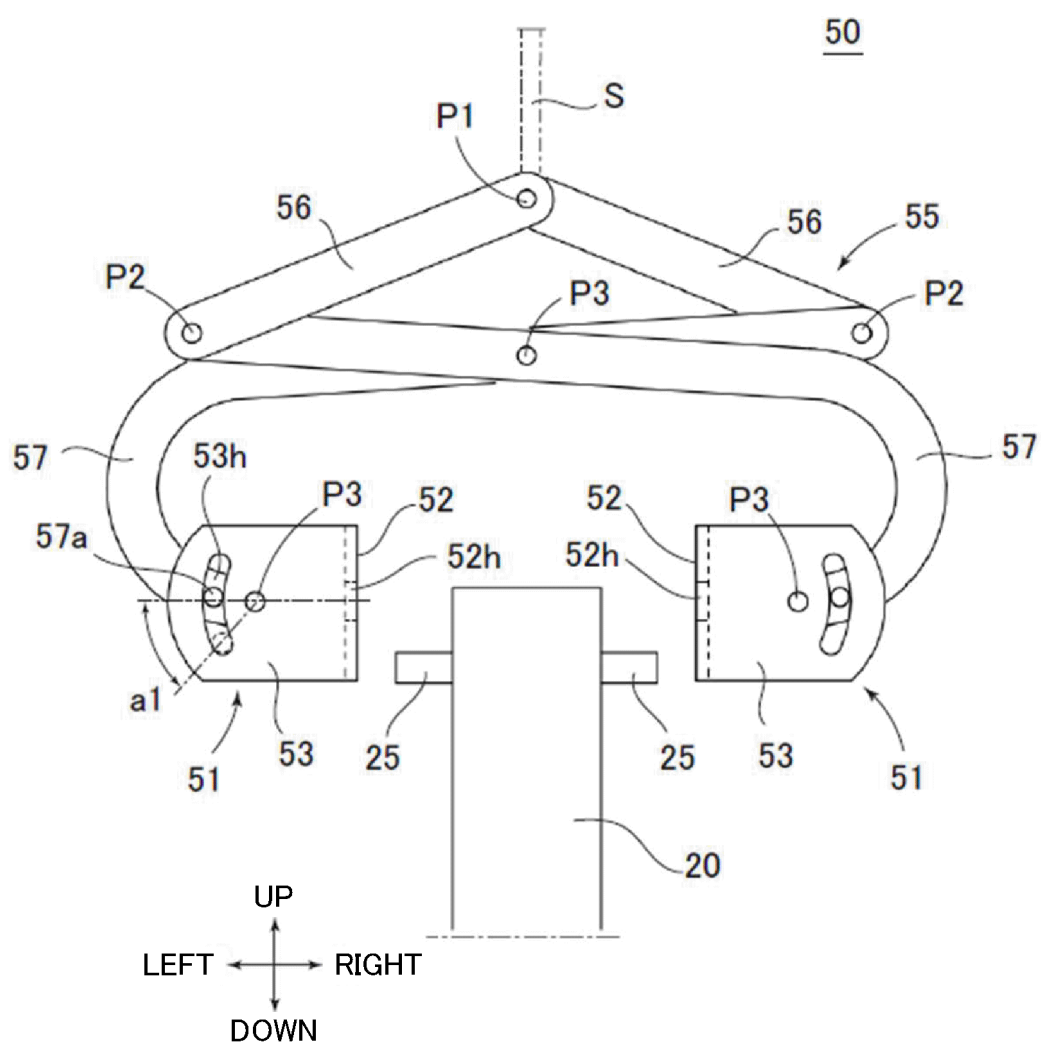


FIG. 7

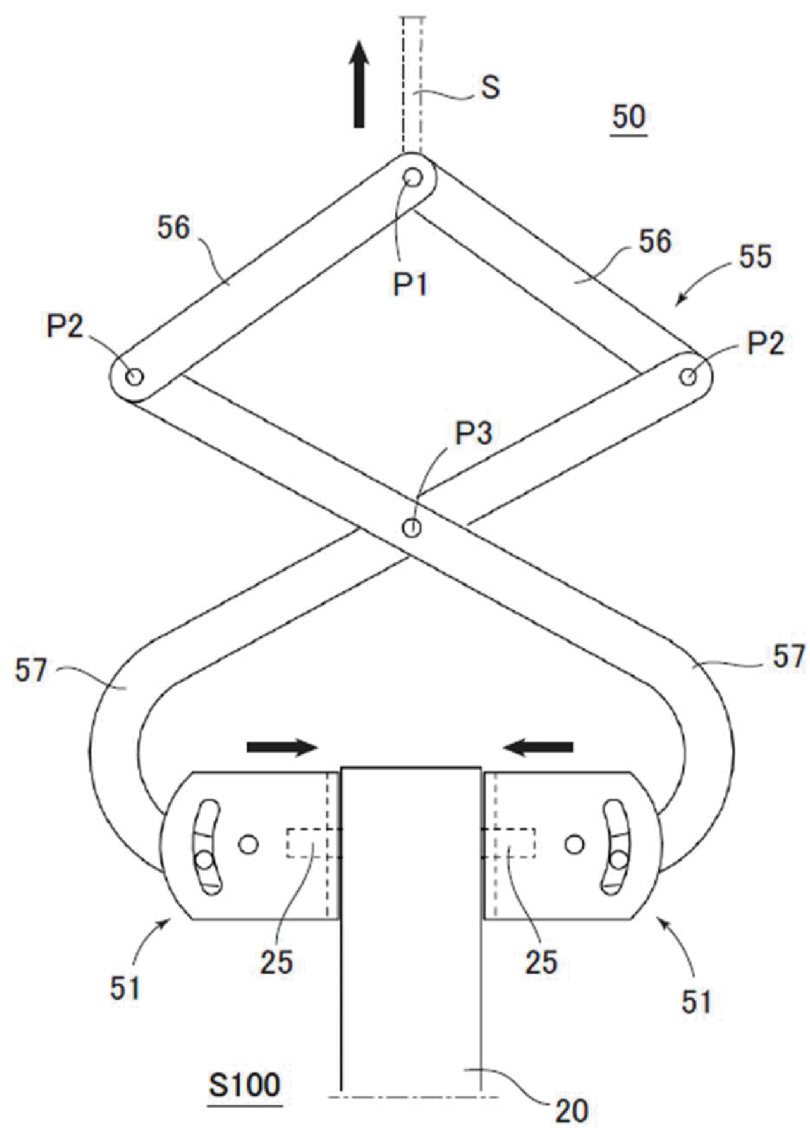


FIG. 8

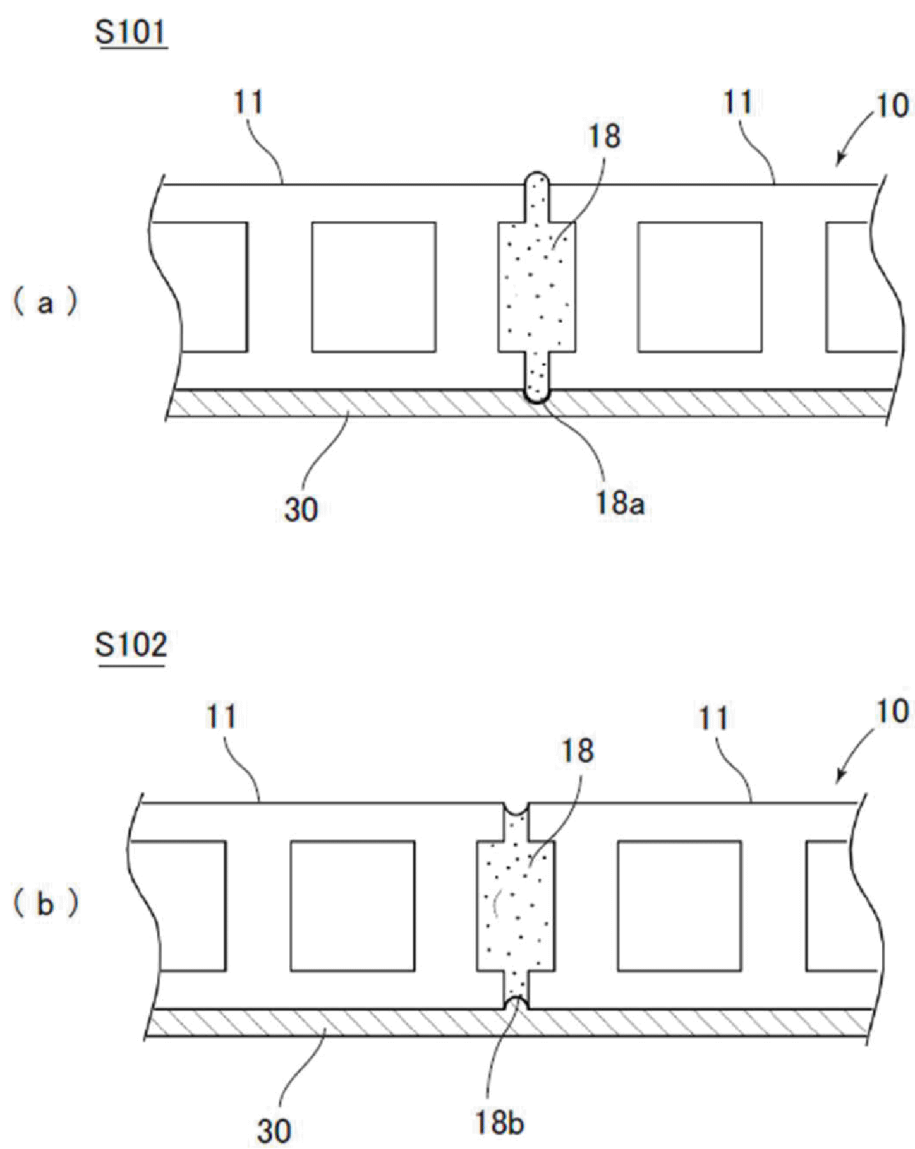


FIG. 9

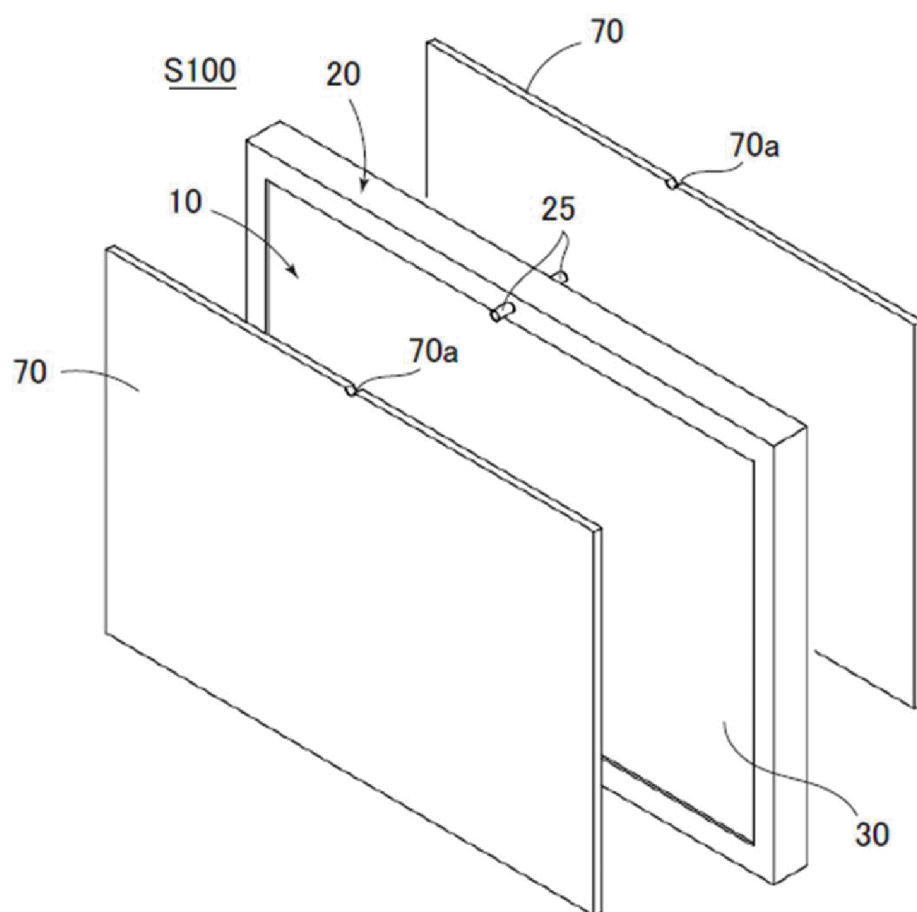


FIG. 10

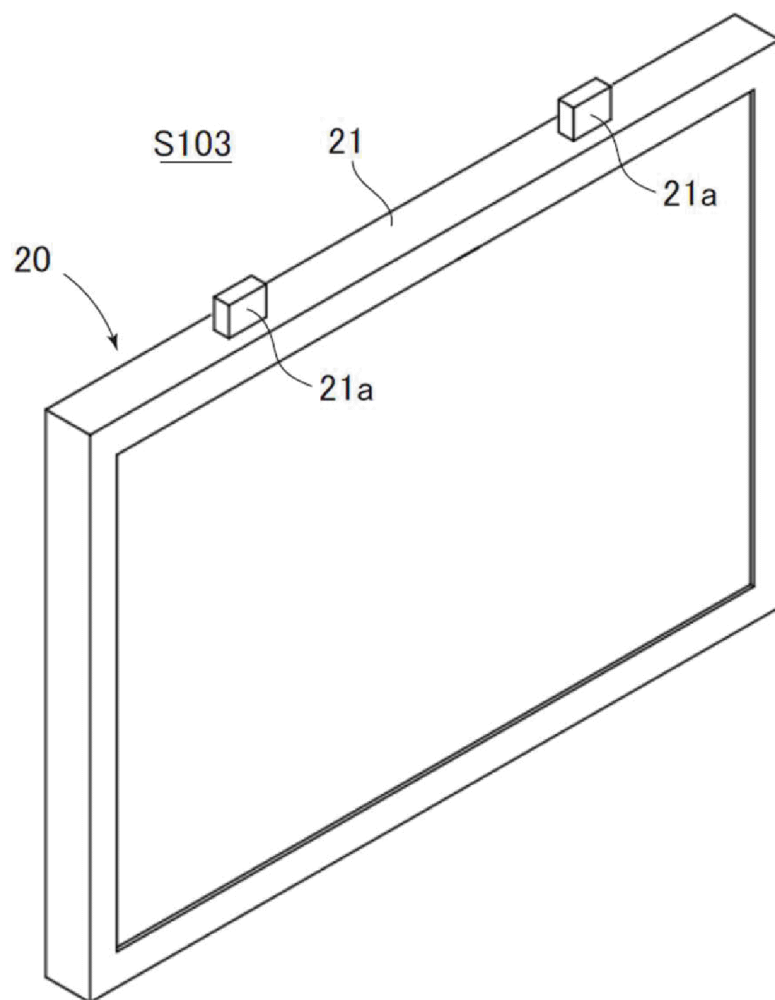


FIG. 11

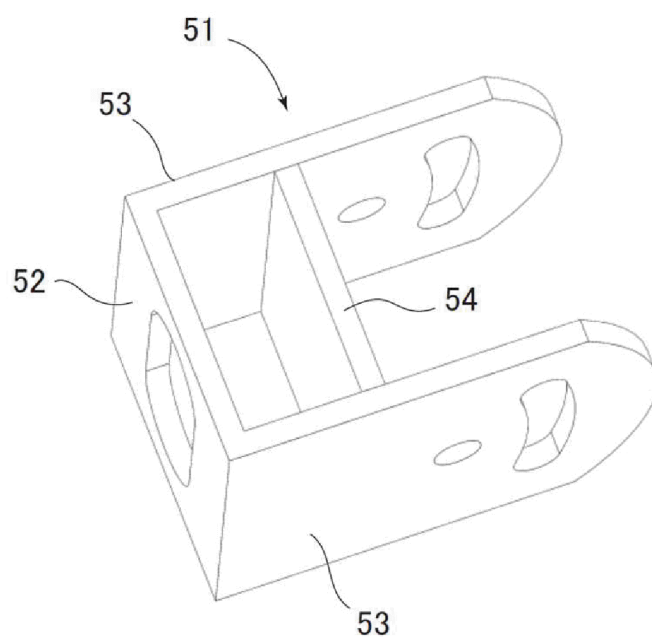


FIG. 12

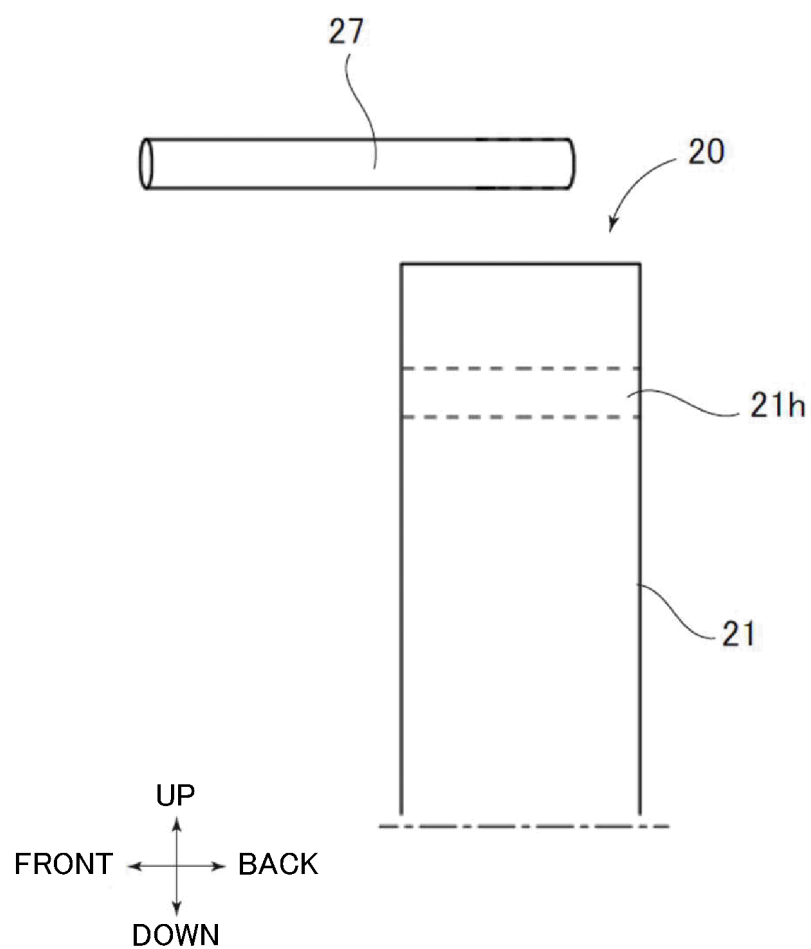


FIG. 13

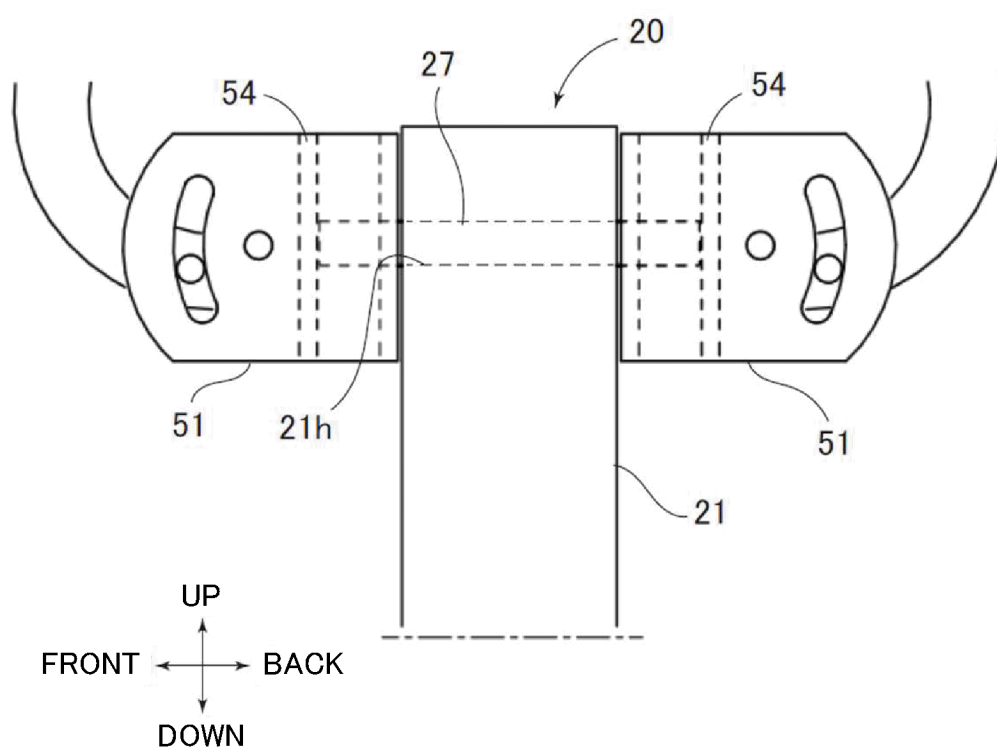


FIG. 14

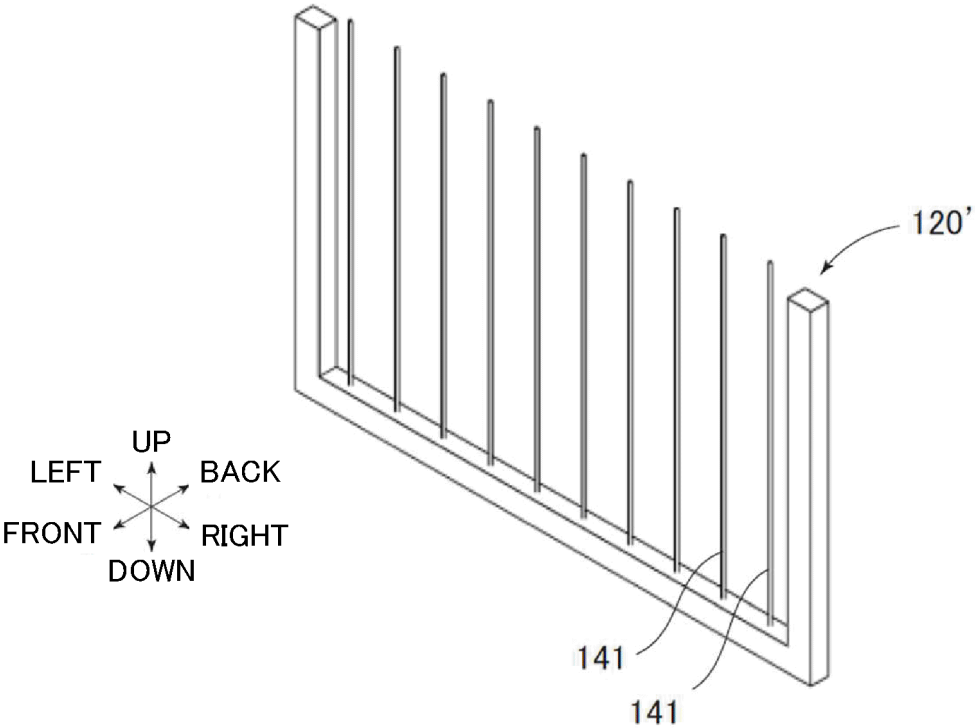


FIG. 15

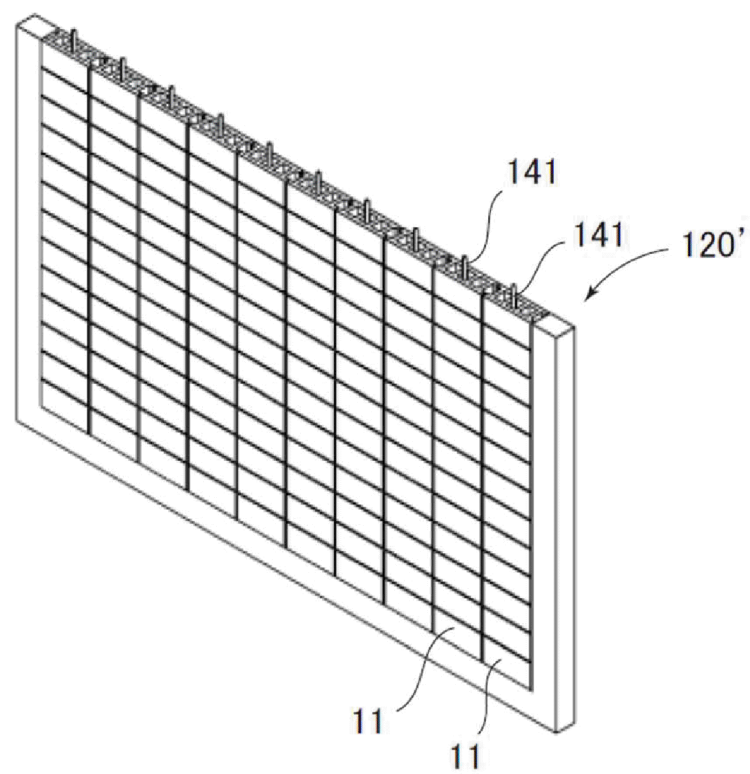


FIG. 16

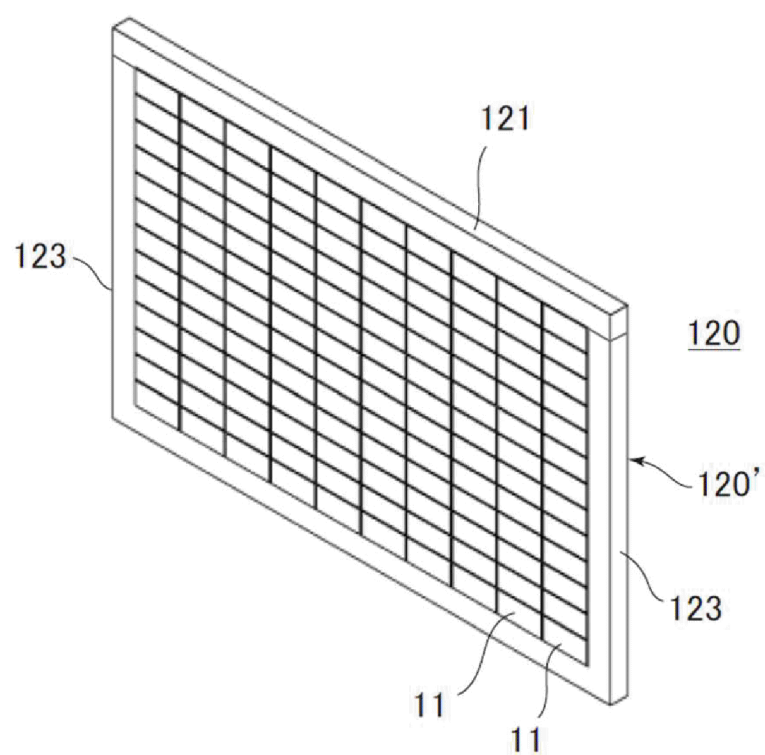


FIG. 17

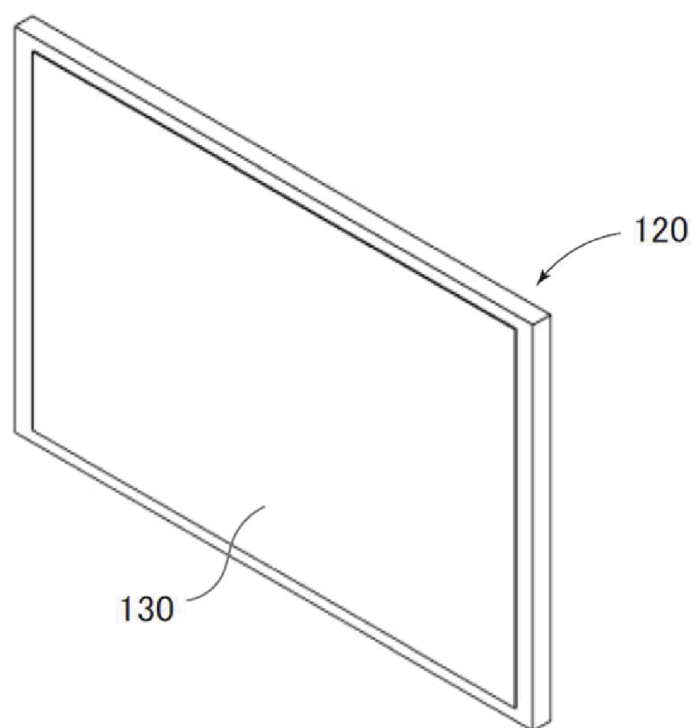


FIG. 18

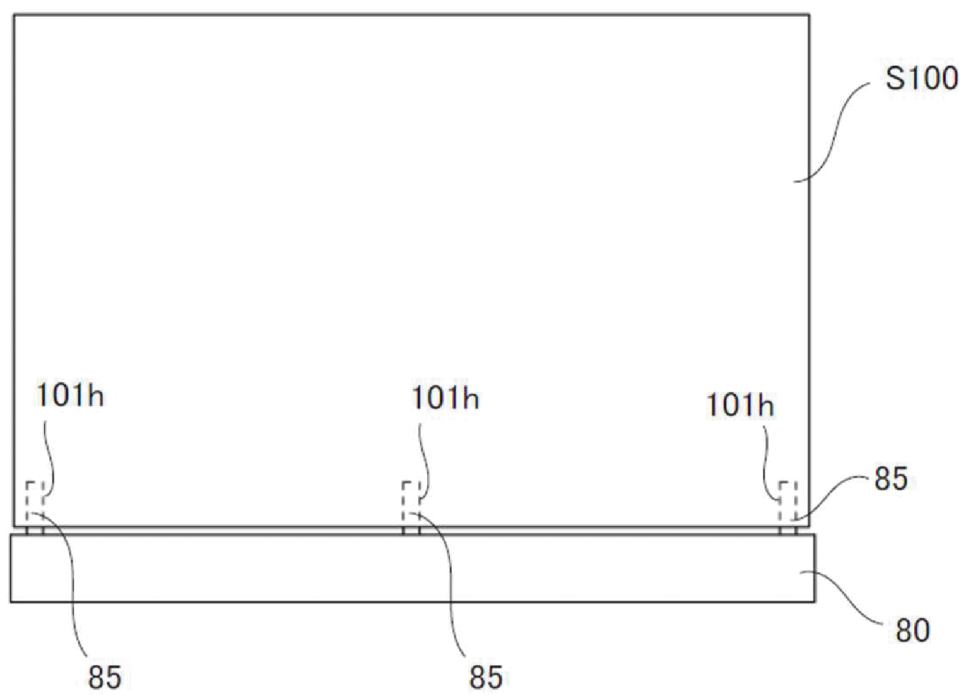


FIG. 19

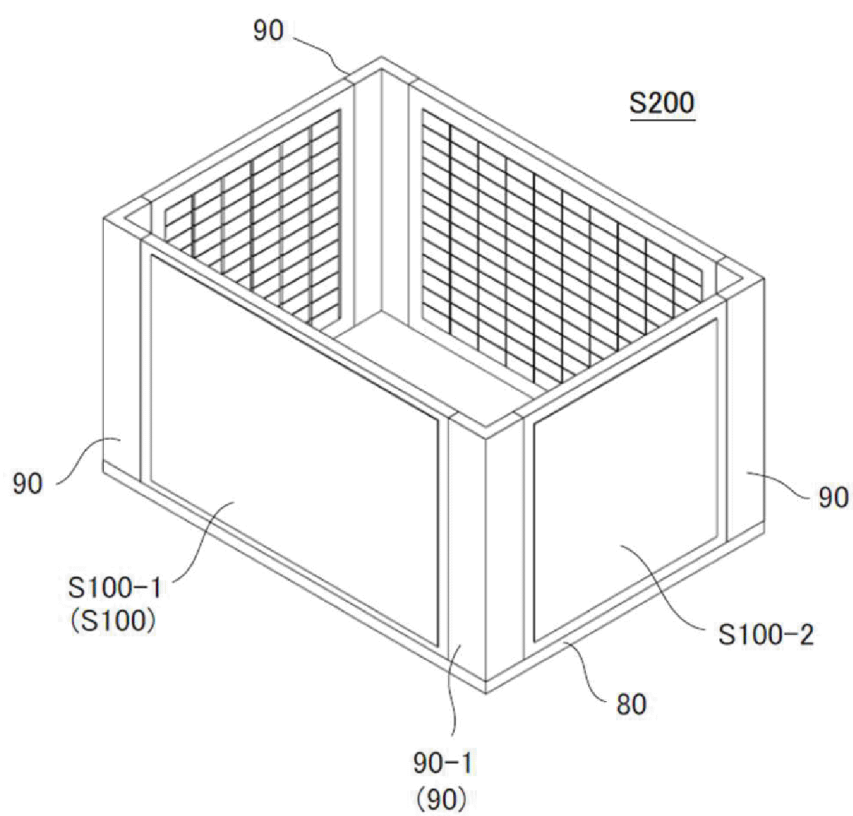


FIG. 20

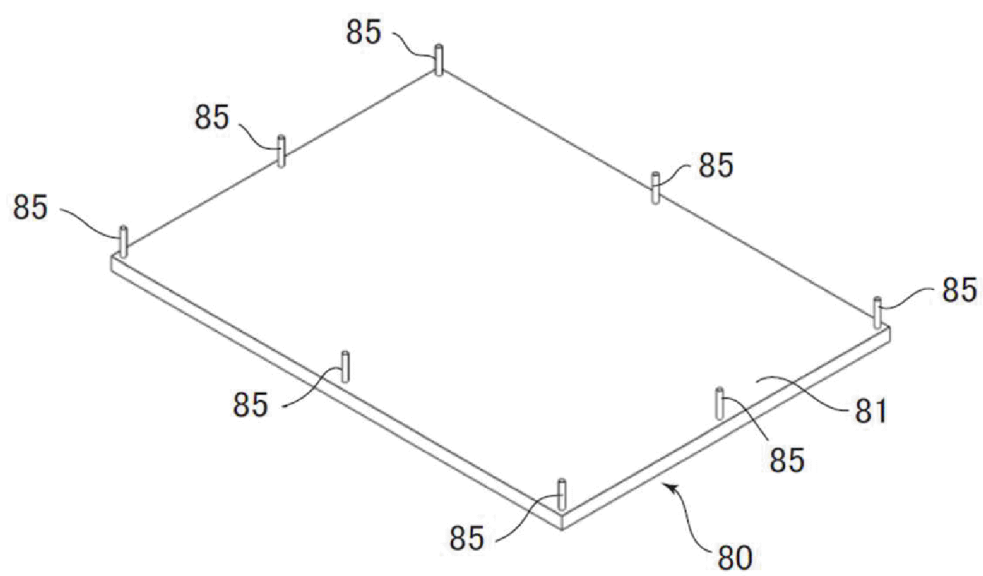


FIG. 21

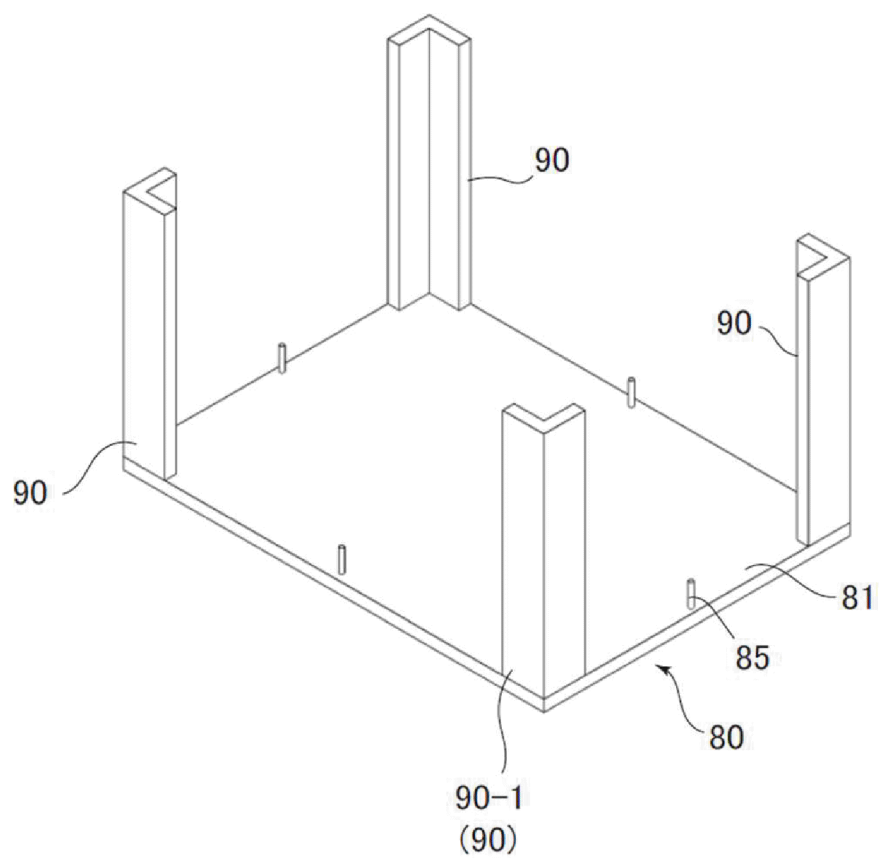


FIG. 22

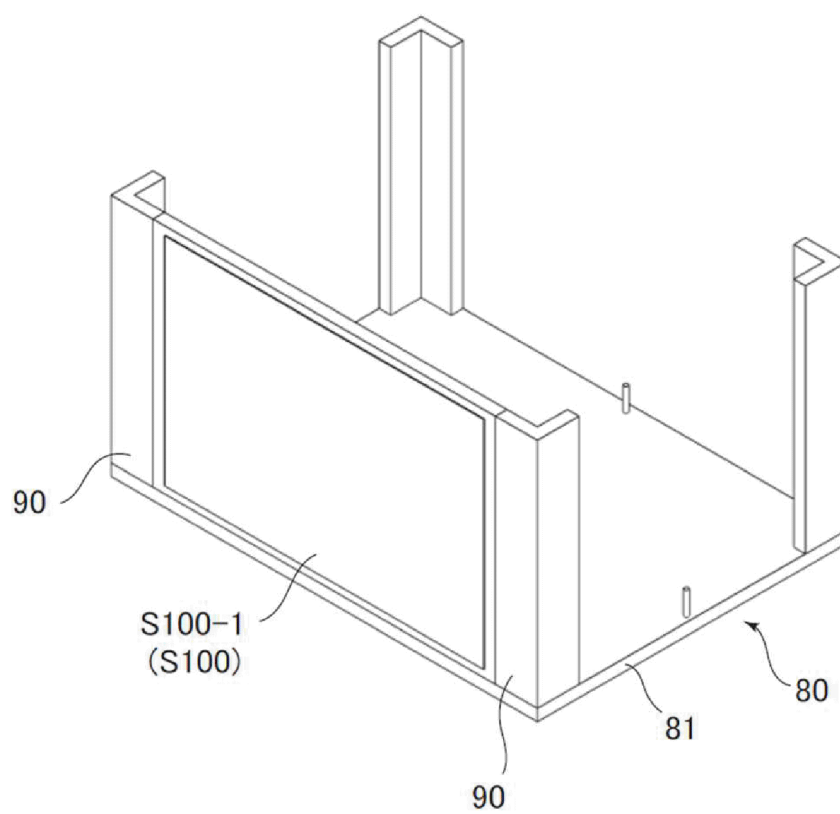


FIG. 23

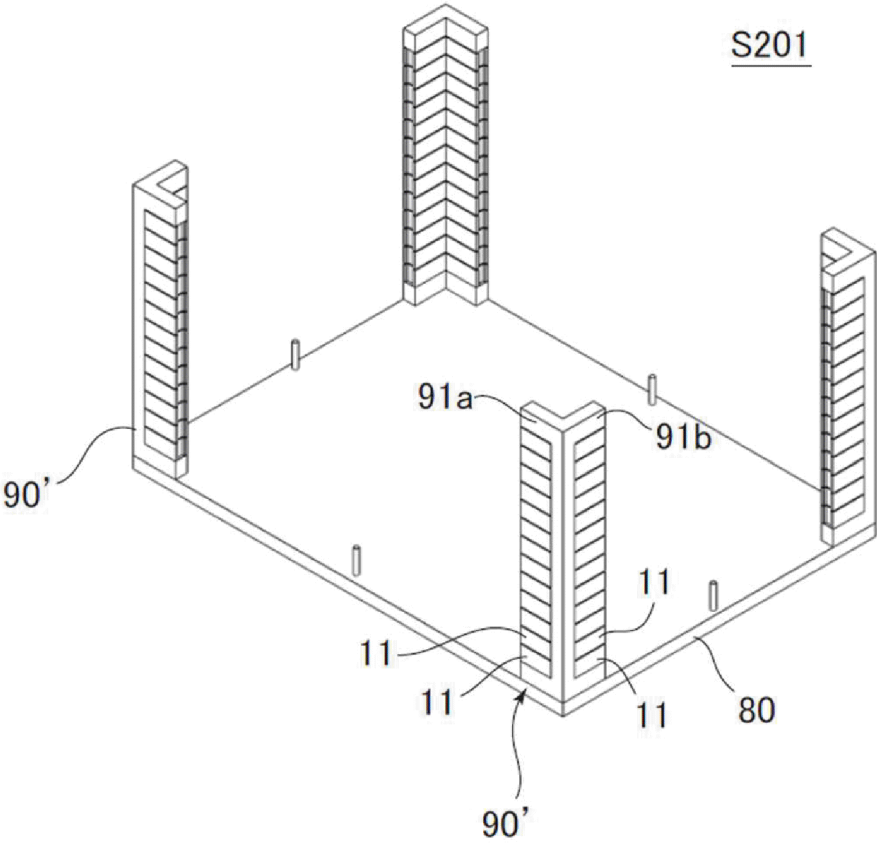


FIG. 24

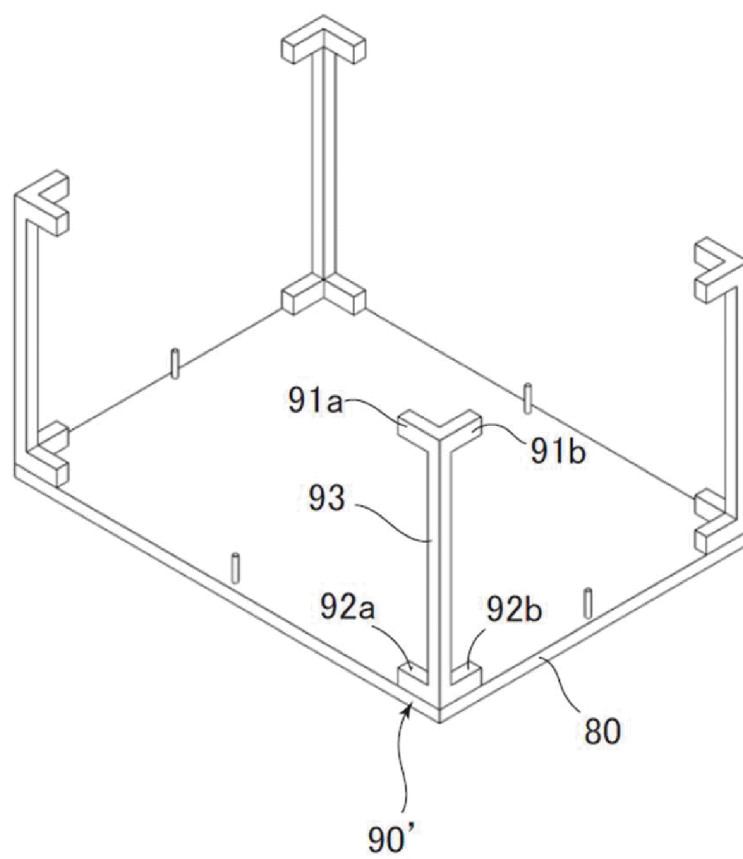


FIG. 25

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2024/027535

A. CLASSIFICATION OF SUBJECT MATTER

E04G 21/14(2006.01)i

FI: E04G21/14

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E04G21/14

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2024

Registered utility model specifications of Japan 1996-2024

Published registered utility model applications of Japan 1994-2024

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 4-99605 A (NIHON SERAMIKA KK) 31 March 1992 (1992-03-31) page 2, upper right column, line 10 - lower right column, line 14, page 3, upper left column, line 15 - page 4, lower left column, line 9, Figures 1-2 and 4	1-3, 13, 15
Y	page 2, upper right column, line 10 - lower right column, line 14, page 3, upper left column, line 15 - page 4, lower left column, line 9, Figures 1-2 and 4	4-5, 8, 10
A	page 2, upper right column, line 10 - lower right column, line 14, page 3, upper left column, line 15 - page 4, lower left column, line 9, Figures 1-2 and 4	6-7, 9, 11-12, 14, 16-18
Y	JP 4-315665 A (SUGII, Seiji) 06 November 1992 (1992-11-06) paragraph [0008], fig. 2	4-5, 8, 10
A	paragraph [0008], fig. 2	6-7, 9
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 643/1975 (Laid-open No. 86641/1976) (NANSIN CO LTD.) 12 July 1976 (1976-07-12), page 3, line 7 - page 5, line 10, fig. 1-4	4-5, 8, 10
A	page 3, line 7 - page 5, line 10, fig. 1-4	6-7, 9

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

10 October 2024

Date of mailing of the international search report

22 October 2024

Name and mailing address of the ISA/JP

Japan Patent Office (ISA/JP)

3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915

Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2024/027535

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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP 2015-81300 A (JFE STEEL CORPORATION) 27 April 2015 (2015-04-27)	1-18
A	JP 10-152803 A (TENRYU MOKUZAI KK) 09 June 1998 (1998-06-09)	1-18
A	JP 9-105231 A (KABUSHIKI KAISHA FUKUNAGAHIROSHI KENCHIKU KENKYUSHO) 22 April 1997 (1997-04-22)	1-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2024/027535

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 4-99605 A	31 March 1992	(Family: none)	
JP 4-315665 A	06 November 1992	(Family: none)	
JP 51-86641 U1	12 July 1976	(Family: none)	
JP 2018-70693 A	10 May 2018	(Family: none)	
JP 2015-81300 A	27 April 2015	(Family: none)	
JP 10-152803 A	09 June 1998	(Family: none)	
JP 9-105231 A	22 April 1997	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2011220060 A [0003]