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(54) Prefabricated building, floor element for such a building and method for manufacturing a floor element

(57) The invention relates to a prefabricated building, comprising a system of floor elements (2) and columns (3), to which wall elements and roof elements can be mounted. The floor elements (2) are provided with coupling devices (9) and corners of the floor elements (2) rest on columns (3). The floor elements (2) are constructed as a sandwich, whereby ventilation air and wiring/piping may pass via a space between two layers.

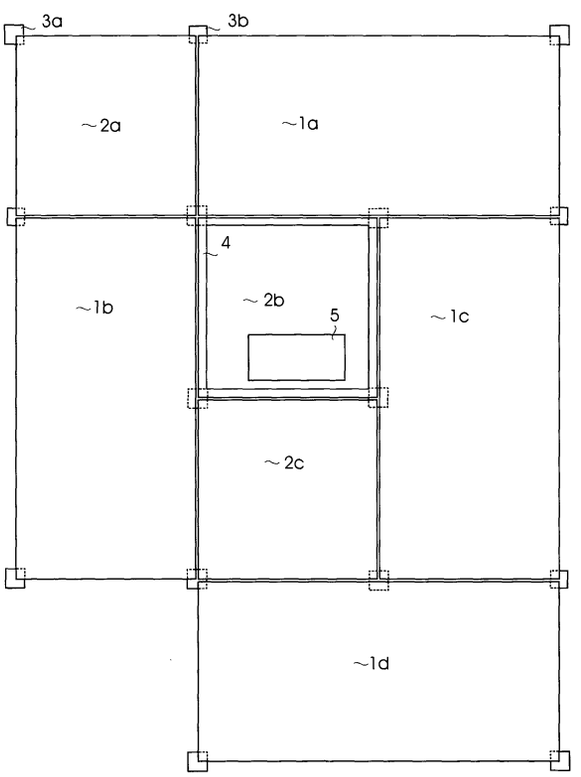

Fig. 1

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Description

[0001] The invention relates to a prefabricated building, comprising a system of floors and columns, to which wall elements and roof elements are connected. Prefabricated buildings of this type are known. Usually, a prefabricated building is erecteded, after which a substantial amount of work still must be done for installing a heating system, a ventilation system and for installing an electricity supply and the like. The prefabricated building according to the invention substantially obviates this disadvantage and is according to an aspect of the invention characterised in that the floors are made up of floor elements of which at least one side is provided with coupling devices and of which corners rest on columns and that the building is provided with a central provision, from where heat, ventilation air, electricity and the like is distributed via at least part of the floor elements.

[0002] A favourable embodiment is characterised in that the central provision is housed inside an at least substantially U-shaped or tubularly shaped building element. In this U-shaped or tubularly shaped building element for example a staircase to a first floor may be accommodated. It is also possible to combine for example a toilet group or a bathroom group with the U-shaped or tubularly shaped building element, which results in a substantial reduction of the number of pipes that must be fitted into the prefabricated building.

[0003] A favourable embodiment is according to a further aspect of the invention characterised in that floor elements each are built up like a sandwich, with a first layer comprising the reinforcement, a second layer, and a third layer which comprises tiles, mounted detachably or removably to the second layer in such a manner that between the second layer and the third layer air and wiring/piping, coming from the central provision can be distributed. Thanks to the tiles, the space between the second layer and the third layer remains accessible. Preferably, the first layer is fabricated in such a way that there is no need to put on a finishing coat afterwards.

[0004] In a favourable embodiment, the floor elements are characterised in that the second layer comprises a system of ribs, extending in a longitudinal and transverse direction, between which a system of recesses exists, while the intersections of ribs form points of support for the third layer. In this way, a strong floor with a relatively low own weight is realised.

[0005] A further favourable embodiment is characterised in that at the intersections, the bottom side of the third layer and the bottom side of tiles are provided with notches, as a result of which the third layer will be positioned just above the ribs. In this way it is prevented that the third layer mutually disconnects the recesses, so that air and wiring/piping coming from the central provision may pass underneath the tiles.

[0006] A further favourable embodiment is characterised in that the notches are made of a resilient material or that they are provided with a foot part made of a resilient material, as a result of which in fact a sprung floor is realised which will hardly conduct contact noise, produced for example when walking the third layer and the tiles, to the building as such. This again has as a result that the thickness of the first and/or the second layer can be chosen smaller, thanks to which significant cost savings can be obtained.

[0007] A further favourable embodiment is characterised in that the building is provided with skirting-constructions, provided with sealable openings, for letting pass air and/or wiring/piping conducted via the floor elements and/or the tiles if desired. Preferably, the skirting-constructions consist of profiles, made of metal or plastic, which can be accommodated inside a recess in an inner wall.

[0008] A favourable alternative embodiment is characterised in that the skirting-constructions consists of brackets and profiles, where the profiles are mounted detachably to the brackets and may be provided with skirting, sealable ventilation grilles and wall outlets.

[0009] A further favourable embodiment is characterised in that a coupling device comprises at least two wired ends, installed on a side of a floor element and connected to a reinforcement of this floor element. A coupling between a floor element and another floor element can be realised then by coupling the threaded ends.

[0010] The invention also relates to a floor element, to be used in a prefabricated building as described in the previous paragraphs.

[0011] The invention also relates to a method for manufacturing a floor element. The inventive method according to which a floor element can be manufactured and in which provisions for heating, ventilation and the distribution of for example cables and coupling devices are present is characterised in that a first layer is cast into which a reinforcement is fit, onto which subsequently a second layer is cast in which a system of ribs extending in a longitudinal and a transverse direction and a system of recesses is made, as well as a system of coupling devices, after which a third layer is installed consisting of tiles, mounted detachably onto the second layer or consisting of a floor with cut-aways into which tiles can be mounted detachably.

[0012] The invention will now be further explained with a reference to the following figures, in which:

Fig. 1 schematically shows a part of a possible embodiment of a prefabricated building according to the invention in top view;

Fig. 2A schematically shows a possible embodiment of a square floor element in top view;

Fig. 2B schematically shows an alternative embodiment of a square floor element in top view;

Fig. 3A schematically shows a floor element in side view;

Fig. 3B schematically shows an alternative floor ele-

ment in side view;

Fig. 4 schematically shows a floor element and a wall element fitted to it in side view;

Fig. 5A shows more in detail a number of tiles in top view;

Fig. 5B shows these tiles in side view;

Fig. 6A schematically shows a number of coupling devices with threaded ends in top view;

Fig. 6B shows more in detail a coupling with threaded ends in side view;

Fig. 7 shows more in detail a possible embodiment of a skirting-construction.

[0013] Fig. 1 schematically shows a part of a possible embodiment of a prefabricated building according to the invention in top view, consisting of four rectangular floor elements 1a,1b,1c,1d and three square floor elements 2a,2b,2c of which the corner points are supported by columns 3a,3b,.. and which together form a base floor for the prefabricated building. Columns 3a,3b,.. are preferably anchored directly into the ground, but if preferred they may be placed onto a foundation plate or in a foundation tray or onto a prefabricated foundation. A prefabricated building set up in this way may be extended simply by adding columns and additional floor parts. This may be done in the building phase, for example when the prospective occupant desires a more spacious house, with additional space in the form of a balcony, a bay, a lean-to or for example an office space, but it may also take place afterwards. Special is that the prefabricated building can also be extended without adding columns, by coupling additional floor parts to floor elements 1a,1b,1c,1d and/or floor elements 2a,2b,2c.

[0014] Floor element 2b is here provided with a tubularly shaped building element 4, which comprises a central provision 5 consisting of a central heating, a ventilation unit, a mains supply and the like. Floor element 2b forms together with tubularly shaped building element 4 a backbone, from which the prefabricated building takes for an important part its strength. Moreover, all floor elements 1a,1b,1c,1d, 2a,2b are directly or indirectly connected to central provision 5 via ducts, via which heated or if desired cooled air and/or wiring/piping can be passed to the different rooms.

[0015] Fig. 2A schematically shows a possible embodiment of a square floor element 2 in top view. Floor element 2 is made of concrete and consists of a sandwich of three layers. The lowest layer contains a reinforcement, not shown in this figure. The central layer contains a system of ribs 6, extending in a longitudinal and in a transverse direction, between which a system of recesses 7 is positioned. Crossings of ribs 6 form supports for corners of tiles 8, which tiles 8 form the third layer. Only the corners of tiles 8 rest onto the crossings of ribs 6, in such a way that some space is left open between tiles 8 and ribs 6, via which air, conditioned in central provision 5 as well as wiring/piping coming from central provision 5 may pass between tiles 8 and ribs 6. More in general the space between tiles 8 and ribs 6 may also be used for letting pass wiring/piping. On at least one side, floor element 2 is provided with coupling devices 9, with which a floor element may be coupled to another floor element or with which a wall element, not shown here, may be coupled to a floor element. Coupling devices 9 are always placed in a rib, so that they can be coupled more easily to a reinforcement, present in the first layer. Floor element 2 shown here is square, but it may also be rectangular, for example as shown in Fig. 1.

[0016] Fig. 2B schematically shows an alternative embodiment of a square floor element 2 in top view. Floor element 2 is made of concrete and consists of a sandwich of three layers. The lowest layer contains a reinforcement, not shown in this figure. The central layer contains a system of ribs 6, extending in a longitudinal and in a transverse direction, between which a system of recesses 7 is positioned. Crossings of ribs 6 form supports for a continuous third layer 8a, which now covers the entire surface of floor element 2, except for one or more openings into which tiles 8 can be placed. Third layer 8a rest onto the second layer only at the crossings of ribs 6, in such a way that some space is left open between third layer 8a and ribs 6, via which air, conditioned in central provision 5 as well as wiring/piping coming from central provision 5 may pass between third layer 8a with the tiles 8 included in it and ribs 6. More in general the space may also be used for letting pass wiring/piping. On at least one side, floor element 2 is provided with coupling devices 9, with which a floor element may be coupled to another floor element or with which a wall element, not shown here, may be coupled to a floor element. Coupling devices 9 are always placed in a rib, so that they can be coupled more easily to a reinforcement, present in the first layer. Floor element 2 shown here is square, but it may also be rectangular, for example as shown in Fig. 1.

[0017] Fig. 3A schematically shows a floor element 2 in side view, with first layer 10 which comprises reinforcement 11, with ribs 6 and recesses 7 in between which together form the second layer, with coupling devices 9 and with tiles 8 whose corners are provided with notches 12, bonded, pressed or cast to it, which rest on crossings of ribs 6. In first layer 10, junction boxes may be included, to which lamps can be fitted in due course, as well as the necessary wiring/piping. First layer 10 and the second layer consisting of ribs 6 and recesses 7 can be produced in a single production process.

[0018] Fig. 3B schematically shows an alternative floor element 2 in side view, with first layer 10 which contains a reinforcement 11, with ribs 6 and recesses 7 in between which together form the second layer, with coupling devices 9 and with third layer 8a, provided with notches 12, bonded, pressed or cast to it, which rest on crossings of ribs 6. In third layer 8a, tiles 8 can be included, of which the corners rest on crossings of ribs 6 or which rest in a further obvious manner in a frame, fit

in third layer 8a.

[0019] Fig. 4 schematically shows a floor element 2 and a wall element fitted to it in side view. Floor element 2 is provided with ribs 6, with recesses 7 and with coupling devices 9, of which the coupling devices 9 on one side are connected to a projecting anchorplate 13, onto which in this embodiment an insulation layer 14 and an outer wall 15 rests. An inner wall 16 rests directly onto floor element 2 and is provided with small grids 17, in such a way that air, supplied via a space between third layer 8a and floor element 2 will enter room 18 via the grids 17 and in this way will realise a controlled ventilation inside the building, while moreover wiring/piping can be passed in this way. An important additional advantage is that the air prevents a cold spot coming into being near projecting anchorplate 13.

[0020] Fig. 5A shows more in detail a number of tiles 8 in top view. On each corner a tile is provided with a recess 19, in such a way that between four tiles fit together, a bolt may pass, with which a corner of all four tiles is attached to a floor element, which is for that purpose provided with an embedded screwed sleeve on that place. Preferably, the tiles are moreover provided with a wider recess 20, in such a way that a head of the bolt will fit into the joint recesses of four tiles and a substantially continuous surface is obtained. The tiles may be made of a heat conducting material, which means that the entire floor may be heated or cooled and/or they may be made of an attractive material, which means that an additional floor covering will be superfluous. Moreover the tiles can be removed at any moment, which means that cables and the like can easily be placed in the floor afterwards. A third layer 8a in which individual tiles 8 are embedded, as shown in Fig. 2A, may also be provided with recesses 19,20 in an obvious manner, which means that individual tiles 8 can be fixed in the previously described manner.

[0021] Fig. 5B shows a possible embodiment of these tiles 8 in side view. Visible are the notches 12, bonded, pressed or cast to the corners, of which a bottom side is preferably provided with a resilient layer 21, for example made of rubber, which prevents contact noise from being passed to floor element 2. If moreover the heads of the bolts with which the tiles are attached are provided with a spacer made of a resilient material, then a sprung floor is realised in this manner, for which contact noise is virtually not an object any more. Moreover the opening between floor part 2 and the bottom side of a tile 8 is visible, via which an air current may pass freely and which offers room for cables and wiring/piping, as well as a tile 8 in which by way of illustration a strip 22 is placed between two notches 12, for example made of rubber, with which the air current may be closed off. In this way, a pattern may be fit in, with which the airflow underneath the tiles 8 can be guided in a simple manner.

[0022] Fig. 6A schematically shows a coupling of two floor elements 2a,2b, with coupling devices 9 consisting of threaded ends. Floor element 2a is provided with pairs of threaded ends 23a,23b which can be accessed with the aid of a recess 24 in floor element 2a. Floor element 2b is also provided with pairs of threaded ends 25a,25b which can be accessed with the aid of a recess 26 in floor element 2b. The threaded ends 23a,23b and 25a,25b may be connected to the reinforcements of floor element 2a respectively floor element 2b. In the figure, floor element 2a and floor element 2b are shown somewhat separated for the sake of clarity. When they are moved together, the recesses 24,26 form one single recess in which the ends of the threaded ends 25a,23a, 23b,25b parallel each other. Over these threaded ends for example a comb shaped object made of steel can be placed, after which the threaded ends can be fastened with the aid of nuts. Fig. 6B shows more in detail a coupling in side view, with a comb 27 made of steel and the threaded ends 25a,23a,23b,25b which are fastened with the aid of nuts 28a,28b,28c,28d.

[0023] Fig. 7 shows more in detail a possible embodiment of a skirting-construction, consisting of a system of brackets 29 which are at floor level pushed into a constructional recess in inner wall 16 and which are kept in place with the aid of springs 30, and of profiles 31 which can be slid into brackets 29 after third layer 8a has been put in place, with springs 32 keeping them in place. Profiles 31 may be delivered in standard lengths and may be provided with skirting 33 and grids 17 and/or sockets which have already been wired. Brackets 29 and profiles 31 are preferably made of plastic or metal. Brackets 29 may moreover be used for keeping cables 34 in place, which are laid in the constructional recess.

[0024] After the framework for the prefabricated building is erected the aid of floor elements and columns, wall elements and roof elements may be put in place in a manner well known in the art. Preferably, the wall elements are placed such that they can be bodily removed if desired and reused, for example for an enlargement of another prefabricated building. Thereby the floor elements can be coupled to existing floor elements with the aid of the coupling devices 9, without the need of adding columns or another form of foundation.

Claims

1. Prefabricated building, comprising a system of floors and columns, to which wall elements and roof elements are connected, **characterised in that** the floors are made up of floor elements of which at least one side is provided with coupling devices and of which corners rest on columns and that the building is provided with a central provision, from where heat, ventilation air, electricity and the like is distributed via at least part of the floor elements.

2. Prefabricated building according to claim 1, **characterised in that** the central provision is housed inside an at least substantially U-shaped or tubularly

shaped building element.

3. Prefabricated building according to claim 2, **characterised in that** floor elements each are built up like a sandwich, with a first layer comprising the reinforcement, a second layer, and a third layer which comprises tiles, mounted detachably or removably to the second layer in such a manner that between the second layer and the third layer air and wiring/piping, coming from the central provision can be distributed.

4. Prefabricated building according to claim 3, **characterised in that** the second layer comprises a system of ribs, extending in a longitudinal and transverse direction, between which a system of recesses exists, while the intersections of ribs form points of support for the third layer.

5. Prefabricated building according to claim 3 of 4, **characterised in that** at the intersections, the bottom side of the third layer and the bottom side of tiles are provided with notches.

6. Prefabricated building according to claim 5, **characterised in that** the notches are made of a resilient material or that they are provided with a foot part made of a resilient material.

7. Prefabricated building according to claim 5 of 6, **characterised in that** the building is provided with skirting-constructions, provided with sealable openings, for letting pass air and/or wiring/piping conducted via the floor elements and/or the tiles if desired.

8. Prefabricated building according to claim 7, **characterised in that** the skirting-constructions consist of profiles, made of metal or plastic, which can be accommodated inside a recess in an inner wall.

9. Prefabricated building according to claim 8, **characterised in that** the skirting-constructions consists of brackets and profiles, where the profiles are mounted detachably to the brackets and may be provided with skirting, sealable ventilation grilles and wall outlets.

10. Prefabricated building according to one of the previous claims, **characterised in that** a coupling device comprises at least two wired ends, installed on a side of a floor element and connected to a reinforcement of this floor element.

11. Floor element or skirting-construction, to be used as part of a prefabricated building according to one of the previous claims.

12. Method for manufacturing a floor element, **characterised in that** a first layer is cast into which a reinforcement is fit, onto which subsequently a second layer is cast in which a system of ribs extending in a longitudinal and a transverse direction and a system of recesses is made, as well as a system of coupling devices, after which a third layer is installed consisting of tiles, mounted detachably onto the second layer or consisting of a floor with cutaways into which tiles can be mounted detachably.

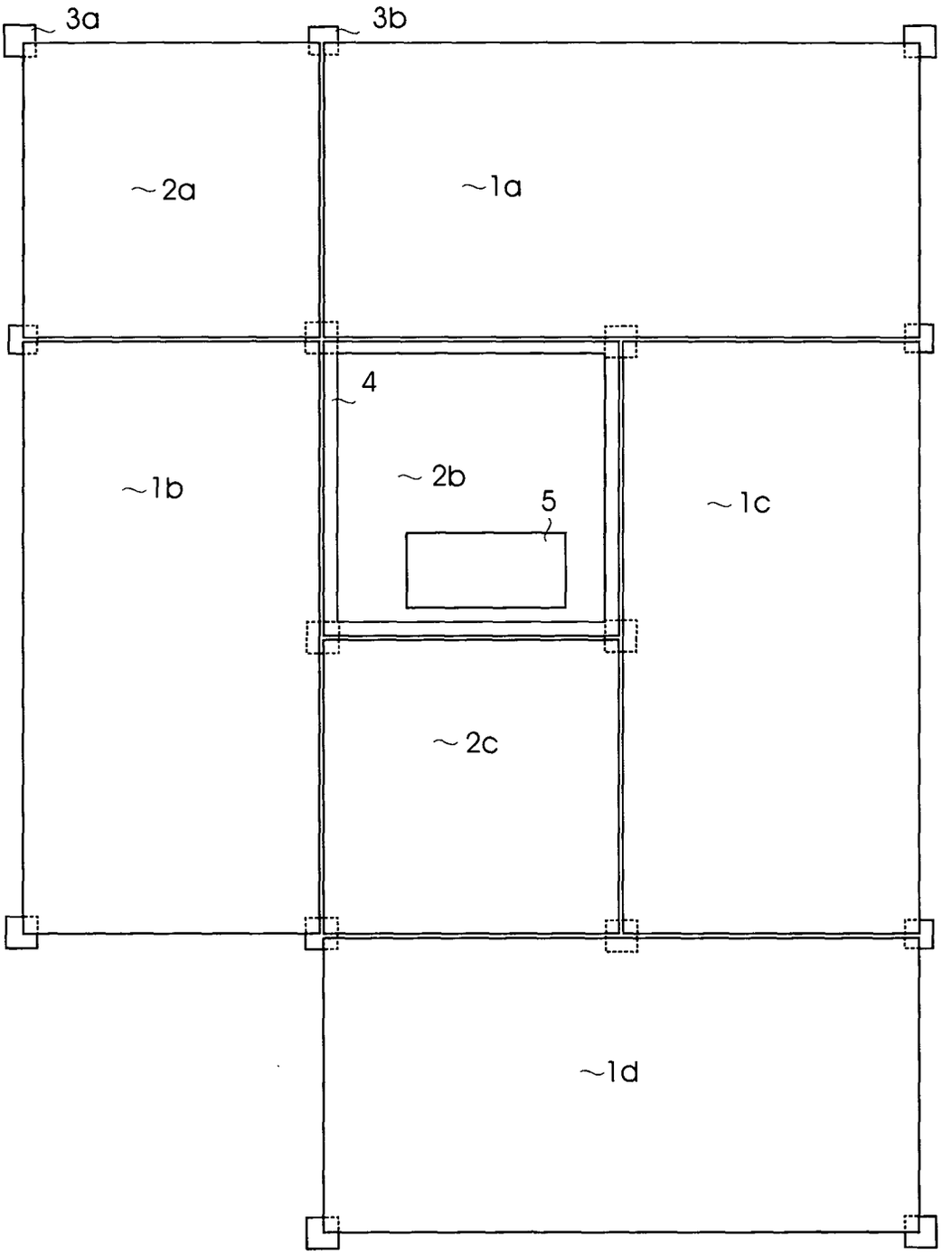

Fig. 1

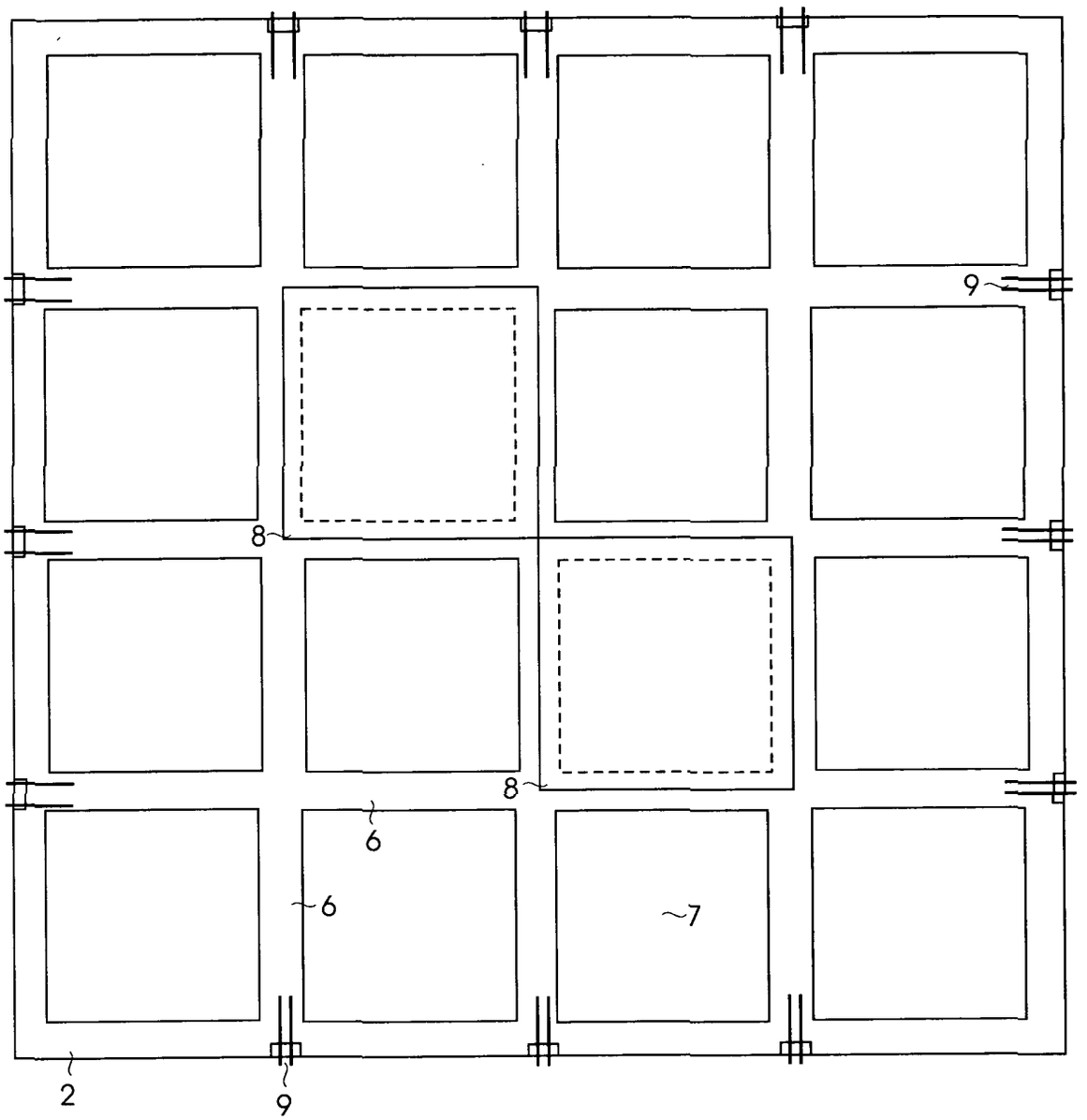

Fig. 2A

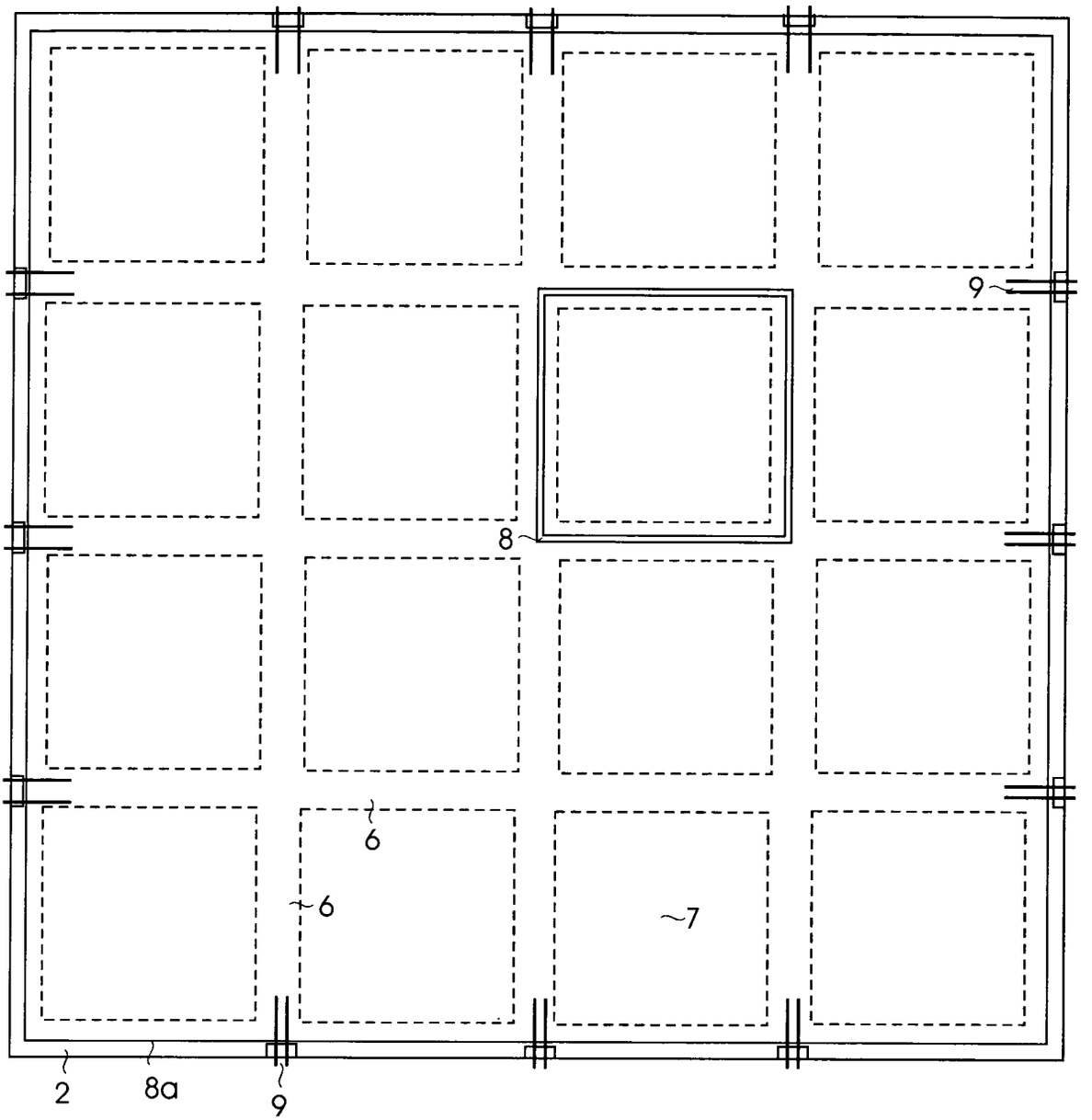

Fig. 2B

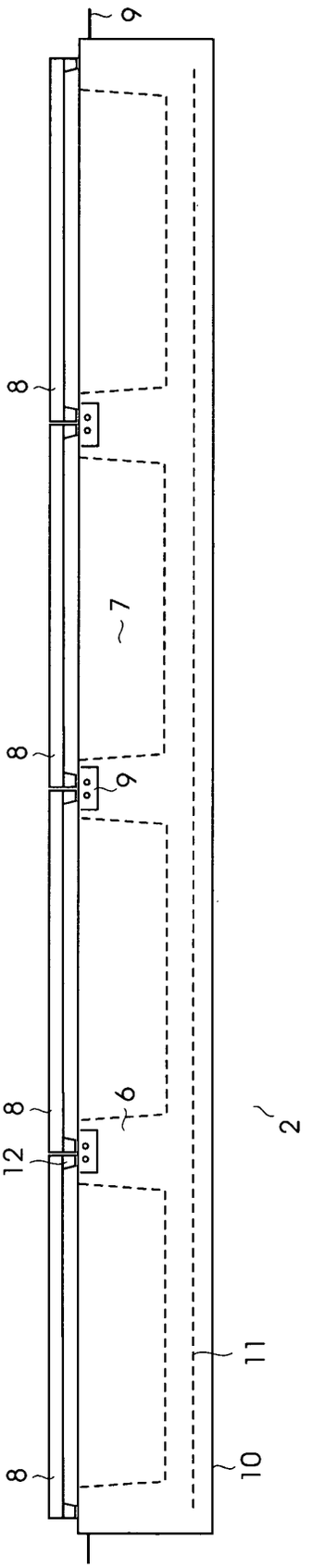

Fig. 3A

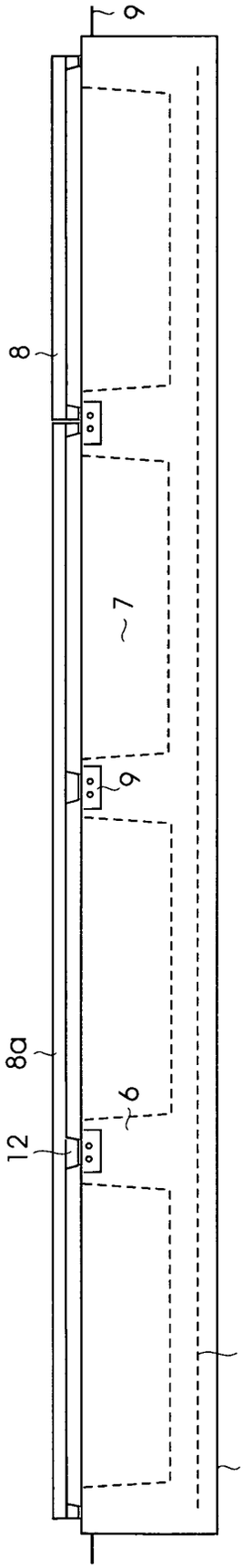

Fig. 3B

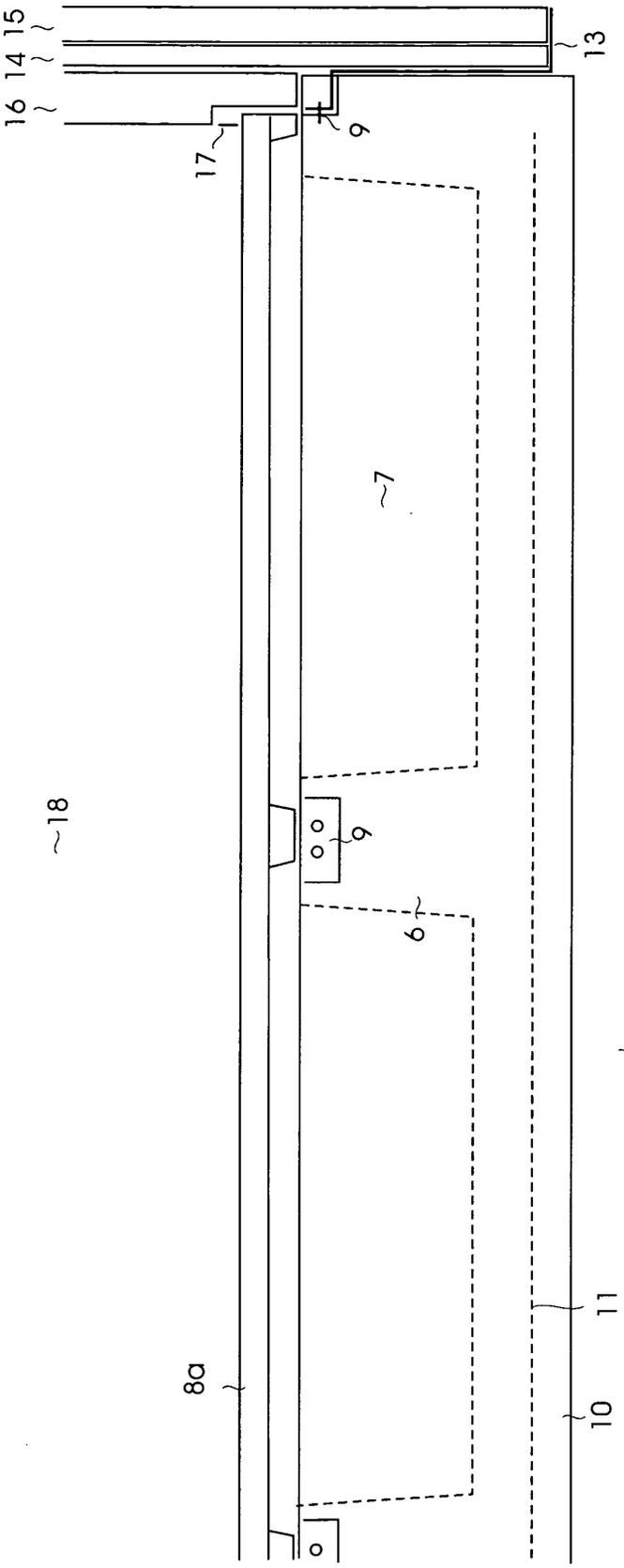

Fig. 4

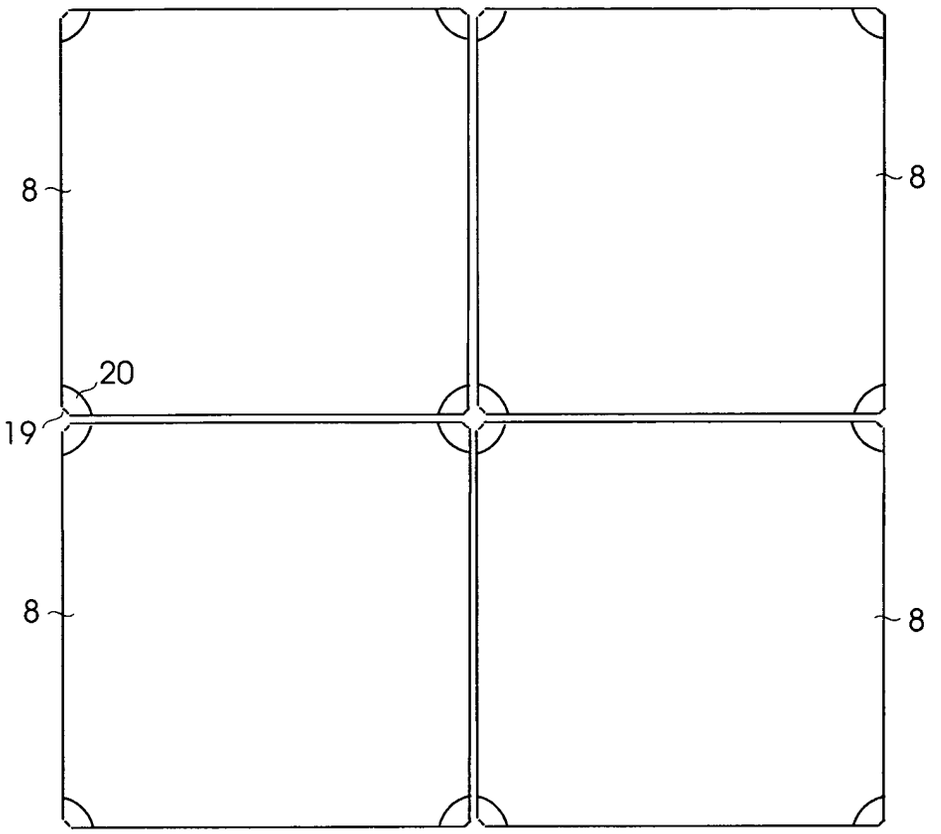

Fig. 5A

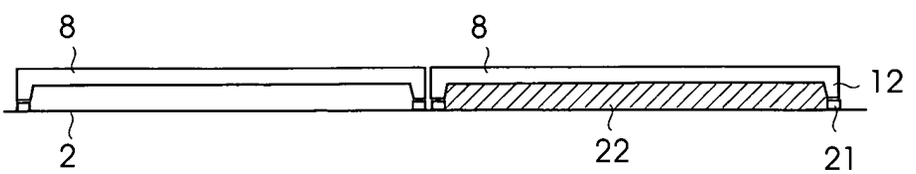

Fig. 5B

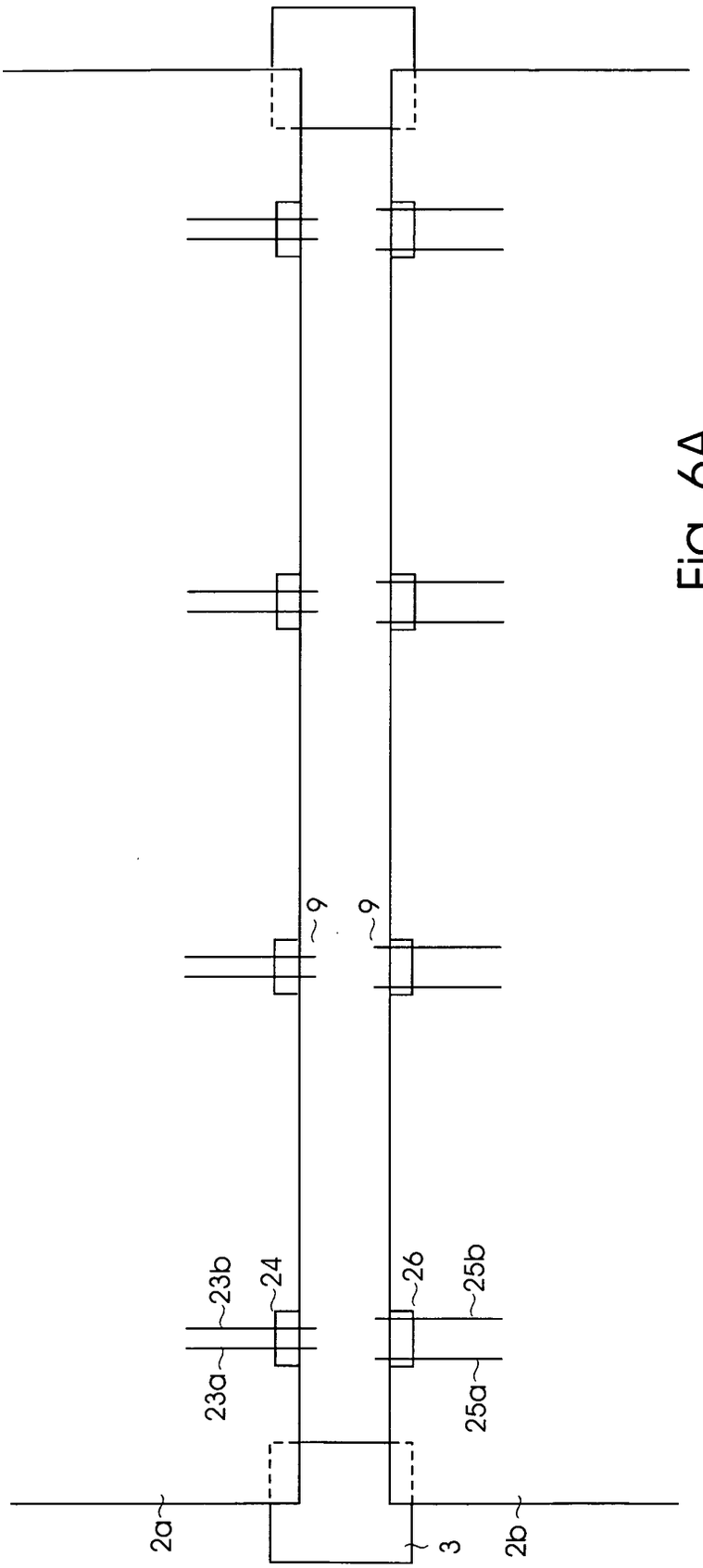

Fig. 6A

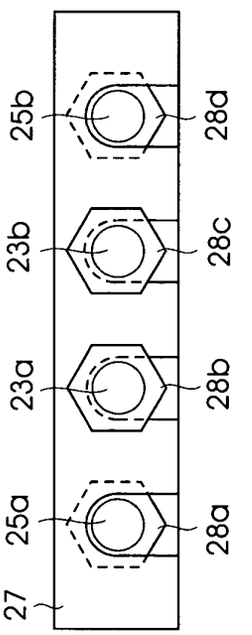

Fig. 6B

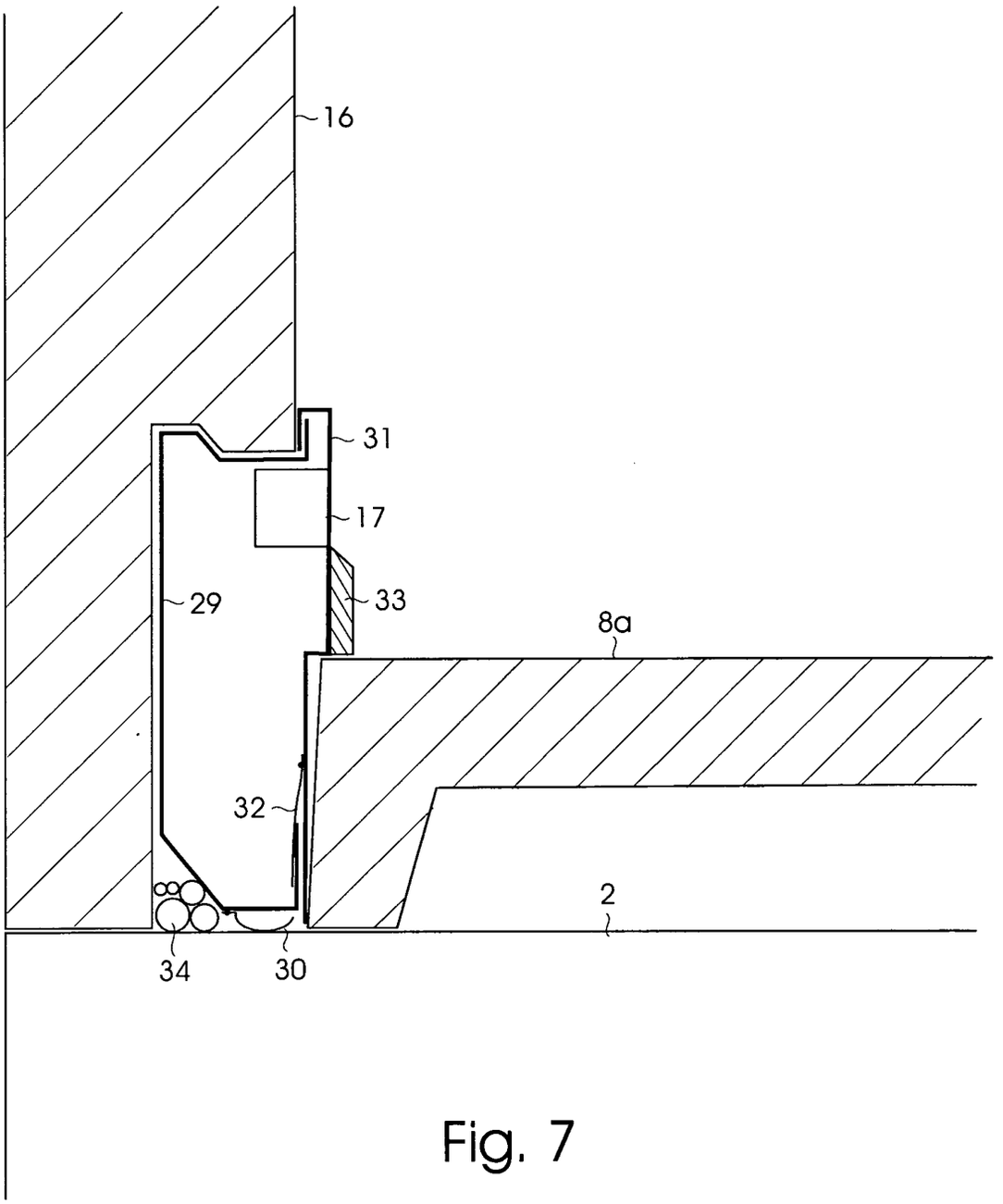

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 05 07 6355

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)
E04B
E04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 October 2005	Khera, D

CATEGORY OF CITED DOCUMENTS

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