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(54) **A METHOD FOR SAFEGUARDING A SPACE AGAINST AN EXPLOSION**

(57) A method for safeguarding a space (190) of a building against an explosion, for instance a space containing an ATM (192) that delivers money via the façade of the building. In order to protect the space, in the space a frame (210) is provided that is anchored to the building, comprising beams (230) and at least three uprights (220),

wherein two uprights and two beams connecting said two uprights form a framework comprising four framework sections, and at least one layer of ballistic cloth (301) is clamped against the framework sections of a pair of two opposite framework sections for forming a divider wall (101).

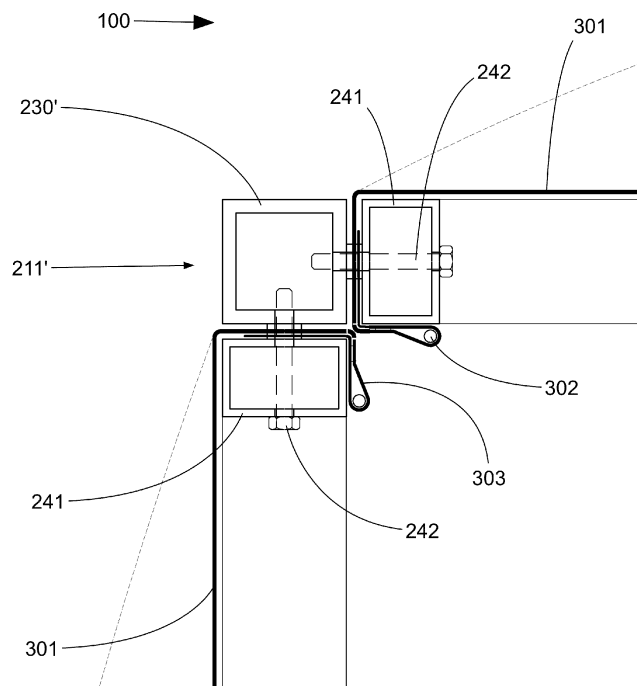


Fig. 3

## Description

**[0001]** The present invention relates to a method for safeguarding a space of a building against an explosion.

**[0002]** Various criminal or terroristic activities cause damage to buildings. For instance, with a ram raid or explosive gas raid criminals intend to access a space containing a vault or ATM via the façade of a building. This method of operation may not only lead to extensive damage to the space directly behind the façade, but also to other parts of the building such as an apartment above the space. The stronger the force of the explosions, the bigger the risk of damage to properties and people. The building may be damaged beyond repair.

**[0003]** The present invention aims to provide a method that reduces the likelihood of damage and/or the amount of damage.

**[0004]** To this end, a method according to the preamble is characterized in that in the space a frame is provided that is anchored to the building, said frame comprising at least three uprights with upper ends and lower ends, which three uprights are not on a single line, wherein each upright is connected with at least two other uprights of the frame by means of at least two beams, two uprights and two beams connecting said two uprights constitute a framework comprising four framework sections, and

at least one layer of ballistic cloth is clamped against the framework sections of a pair of two opposite framework sections in order to form a divider wall.

**[0005]** The divider wall protects the part of the space behind the divider wall against at least part of the effects of an explosion. The ballistic cloth is generally a cloth made of super fibres, such as of carbon fibre, aramid fibre (eg. Kevlar™) or nylon super fibre (eg. Dyneema™). Advantageously the frame comprises profiles, preferably hollow profiles (understood to also include U-profiles, but preferably profiles having a polygonal cross section such as a rectangular cross section), in order to withstand the bending moments that occur during an explosion. The frame is for instance constructed of steel hollow profiles that are welded together or are connected using bolts. This will generally be done at the site of the building.

**[0006]** According to a favourable embodiment, the at least one layer of ballistic cloth is clamped against a second pair of two opposite framework sections for forming said divider wall.

**[0007]** By clamping the at least one layer of ballistic cloth over the entire circumference or over substantially the entire circumference, the ability of the divider wall to withstand an explosion is improved. The second pair of framework sections extends transversely to the previously mentioned pair.

**[0008]** According to a favourable embodiment, clamping the at least one layer of ballistic cloth against a framework section is done by using at least one elongated element that is attached in parallel with the framework section to said framework section by means of at least one

bolted joint per elongated element.

**[0009]** Thus, clamping can be done over a large distance, forces occurring during an explosion are evenly distributed over the ballistic cloth in a simple manner and will be transferred to the framework sections. The elongated element may advantageously have a curvature, wherein in a position where the curved elongated element is held against the framework section, the distance to the framework section at the location of the bolted joint to be formed is larger than at a distance from that bolted joint to be formed (i.e. before tightening the bolt or nut). Thus, for clamping a curved elongated element having more than 1 bolted joint, the convex side will be facing the framework section. If there is only one bolted joint, this will be in the centre and the elongated element will then be fixed with the concave side facing the framework section. After tightening the bolt(s), the elongated element (e.g. a metal strip) will be straight.

**[0010]** According to a favourable embodiment, the at least one layer of ballistic cloth is provided at a circumferential edge with a string extending parallel to the framework section.

**[0011]** In case of an explosion, the ballistic cloth will billow and be pulled out from between the framework section and the elongated element (or any other organ used for clamping, such as an annular-shaped element). Because of this, energy of the explosion will be absorbed. The string provides so much thickness that this process of pulling out will be stopped, thus maintaining the division provided by the at least one layer of ballistic cloth.

**[0012]** According to a favourable embodiment, the at least one layer of ballistic cloth is turned back at a circumferential edge and is formed into a hem, and the hem is clamped.

**[0013]** The increased thickness provides a more even distribution of the forces over the ballistic cloth, and transfer to the framework sections. Furthermore, by using a hem, a cavity for the string can be effectively formed, which makes it even more difficult for the ballistic cloth to be pulled out from the framework following an explosion.

**[0014]** According to a favourable embodiment, the frame is provided with at least two further divider walls which each comprise at least one layer of ballistic cloth for forming a tent, which tent at 1 side thereof does not provide a closed divider wall and with that one side is directed toward the façade of the building.

**[0015]** Such a tent is suitable for accommodating, for instance, an ATM. Generally, in order to withstand the forces of an explosion the tent will at least comprise one, preferably at least two and more preferably at least three flexible walls, for instance two sidewalls and the upper side. The low weight of the tent makes it possible to fit it into existing buildings. At the underside thereof the tent will be substantially sealingly positioned against the floor. The tent will also be substantially sealingly positioned against the façade. Thus, in case of an explosion, the force of the explosion and the discharge of released gas-

es will take place via the façade. Because of this, the damage to the space in which the tent is located is limited to a large extent.

**[0016]** According to a favourable embodiment, the clamping is done against the inner circumference of the framework.

**[0017]** Thus, the cloth can be disassembled from the inside in a simple way, keeping constructional buildings and installations accessible for maintenance and inspections.

**[0018]** According to a favourable embodiment, at one side thereof the tent comprises an entrance door.

**[0019]** This side will generally be in the shape of a non-flexible wall. It is for instance a steel wall provided with a steel door.

**[0020]** According to a favourable embodiment, the divider wall is provided with a layer of inorganic material selected from i) fibres, and ii) grains.

**[0021]** Such a layer offers protection against shaped charges. The layer is for instance provided by sand, but preferably by a blanket of glass fibre or rock-wool. The thickness of the layer is generally at least 5 cm, preferably at least 8 cm, such as at least 10 cm.

**[0022]** According to a favourable embodiment, the frame is anchored with the underside thereof.

**[0023]** Thus, no weighted underside, such as a concrete base for the frame, is necessary. The frame is for instance anchored to the floor, to driving piles or the like.

**[0024]** According to a favourable embodiment, the frame is anchored chemically.

**[0025]** Thus, the frame can be anchored in a highly effective way, preferably to the floor.

**[0026]** The present invention will now be illustrated with reference to the drawing where

Fig. 1 shows part of a building having a space provided with a tent for safeguarding the space against an explosion;

Fig. 2a-d show the step-wise construction of a tent for safeguarding a space against an explosion;

Fig. 3 shows in cross section a detail of the upper side of the tent; and

Fig. 4 shows a cross section in top plan view of a detail of an alternative tent.

**[0027]** Fig. 1 shows part of a building 180 comprising a space 190 to be safeguarded against an explosion, adjacent to a façade 191 which gives access from the outside of the building in order to operate the ATM 192. In said space 190 a tent 100 is arranged for protecting the space 190 against an explosion, which tent 100 is anchored to a floor 193 of the space 190. At two sides and at the upper side the tent 100 comprises divider walls 101 which comprise ballistic cloth.

**[0028]** Fig. 2a-d show the construction of the tent 100 for safeguarding the space 190 against an explosion step by step. The tent 100 as visible in Fig. 2d comprises a frame 210 which comprises uprights 220 and beams 230.

These are formed out of steel hollow profiles (80 x 80 mm; wall thickness 10 mm). In the embodiment shown, the frame 210 comprises four uprights 220 which at the upper side are connected by four upper beams 230' and at the underside of the frame 210 by four lower beams 230".

**[0029]** The four upper beams 230' constitute an upper frame section 211' with the upper ends of the uprights 220.

**[0030]** The four lower beams 230" with the lower ends of the uprights 220 constitute a lower frame section 211" with which the frame 210 is anchored to the floor 193.

**[0031]** For constructing the tent 100 in the space 190, holes 294 having a depth of 8 cm are drilled into the floor 193 (side view cross section shown in Fig. 2a). Into the holes 294 a chemical anchoring composition 295 (HIT-HY 200-A + HIT-Z M12; supplier: Hilti The Netherlands B.V., Berkel en Rodenrijs, The Netherlands) is introduced, after which the uprights 220 having a base plate 221 provided with through-holes are anchored to the floor by means of M12 bolts 296 that are inserted through the through-holes into the chemical anchoring composition that subsequently sets. The base plates 221 are welded to the steel uprights 220. Instead of base plates, for instance also one large steel floor plate may be used, whereby the underside of the tent 100 will be connected to the floor 193 over a larger surface and the underlying floor 193 will be loaded more evenly in case of an explosion.

**[0032]** The uprights 220 have lips 222 for attaching beams 230.

**[0033]** Two uprights 220 and two beams 230 together constitute an upright framework 240 (Fig. 2b). With the embodiment described here (having a horizontal rectangular cross section) there are therefore four upright frameworks. The upper side also forms a framework, which is thus a lying framework.

**[0034]** Distributed over the inner circumference thereof, the framework 240 has threaded holes 243.

**[0035]** Two opposite upright frameworks 240 are provided with ballistic cloth (aramid), just like the lying framework (i.e. the upper frame section 211'), which ballistic cloth is secured by elongated elements 241 (such as rectangular profiles or slightly curved metal strips) by means of bolts 242 (Fig. 2c). This will be elucidated further with reference to Fig. 3.

**[0036]** Fig. 2d shows a perspective view in which the floor is not shown. The ballistic cloth at the side and the upper side are not shown either. The upright framework 240 facing away from the façade 191 is provided with a closeable steel door 260. In a closed state this also forms a divider wall 101 of the tent 100.

**[0037]** The upright framework facing the façade 191 is not provided with ballistic cloth. It resides substantially against the façade. In other words, the tent 100 preferably is gap-free against the inside of the façade 191. With the embodiment described here, the upright framework facing the façade is provided with a steel plate 271 having

a thickness of 4 mm, which steel plate has an opening for the ATM 192.

[0038] When criminals attempt to access the ATM 192, for instance by introducing a flammable gas and letting it explode, the tent 100 will absorb the blow and the rest of the space 190 will be largely protected against the effects of the explosion. Gases will escape to the open air via the opening in the steel plate 271 of the framework facing the façade 191.

[0039] In Fig. 2d in the upper part of the divider wall containing the door 260, two optional openings can be seen. One functions as a cable conduit. The other is for ventilation, wherein a tube will be connected to that opening. If these openings are small, the space 190 remains protected sufficiently.

[0040] Fig. 3 shows in cross section schematically part of the upper frame section 211', which comprises an upper beam 230'. Between elongated elements 241 ballistic cloth 301 is clamped, wherein the elongated elements 241 are secured to the upper beam 230' by means of bolts 242. For the attachment of ballistic cloth against the uprights 220, this is done likewise. The four elongated elements 241 are therefore fixed against four framework sections that are a combination of four parts (two pairs of parts) selected from uprights and beams. With the embodiment described here, the elongated elements 241 are hollow profiles as well. These are provided with through-holes, through which the bolts 242 are inserted and screwed into the threaded holes 243 for evenly clamping the ballistic cloth 301.

[0041] At the side edge the ballistic cloth 301 is folded back and secured by stitching, wherein in the hem 303 formed this way a string 302 is introduced. In case of an explosion the ballistic cloth 301 will give way outwardly (indicated with thin lines), and the ballistic cloth will be pulled between an elongated element and an upper beam (or upright). Because of this, explosion energy is absorbed. The string 302, however, provides such a thickness that the ballistic cloth 301 cannot be pulled out of the framework, thus keeping the space 190 protected.

[0042] It is noted that in fact a stack of layers of ballistic cloth will be used, for instance 8 layers with a total thickness of ca 0.5 cm. A layer facing the interior of the space (i.e. facing away from the interior of the tent) is preferably made of carbon fibre, since this is highly fire-resistant, thus delaying and/or avoiding the spreading of fire from the space 190 in the tent 100 to the space 190.

[0043] Fig. 4 shows a cross section in top plan view of a detail of an alternative tent, wherein a divider wall 101 is provided with a blanket 443 of rockwool having a thickness of 10 cm. The blanket 443 is kept in place by means of a steel plate with holes 444 (5 mm thick) of which the side edges 445 are bent and are attached at the uprights 220 and beams 230. Such a feature can provide at least some protection against shaped charges.

[0044] In Fig. 4 the ballistic cloth 301 is indicated using broken lines, shown in a position it has during an explosion.

## Claims

1. A method for safeguarding a space (190) of a building (180) against an explosion, **characterized in that** in the space (190) a frame (210) is provided that is anchored to the building (180), said frame (210) comprising at least three uprights (220) with upper ends and lower ends, which three uprights (220) are not on a single line, wherein each upright is connected with at least two other uprights (220) of the frame (210) by means of at least two beams (230), two uprights (220) and two beams (230) connecting said two uprights (220) constitute a framework (240) comprising four framework sections, and at least one layer of ballistic cloth (301) is clamped against the framework sections of a pair of two opposite framework sections in order to form a divider wall (101).
2. The method according to claim 1, wherein the at least one layer of ballistic cloth (301) is clamped against a second pair of two opposite framework sections for forming said divider wall (101).
3. The method according to claim 1 or 2, wherein clamping the at least one layer of ballistic cloth (301) against a framework section is done by using at least one elongated element (241) that is attached in parallel with the framework section to said framework section by means of at least one bolted joint per elongated element.
4. The method according to any of the preceding claims, wherein the at least one layer of ballistic cloth (301) is provided at a circumferential edge with a string (302) extending parallel to the framework section.
5. The method according to any of the preceding claims, wherein the at least one layer of ballistic cloth (301) is turned back at a circumferential edge and is formed into a hem (303), and the hem (303) is clamped.
6. The method according to any of the preceding claims, wherein the frame (210) is provided with at least two further divider walls (101) which each comprise at least one layer of ballistic cloth (301) for forming a tent (100), which tent (100) at 1 side thereof does not provide a closed divider wall (101) and with that one side is directed toward the façade (191) of the building (180).
7. The method according to any of the preceding claims, wherein the clamping is done against the inner circumference of the framework (240).
8. The method according to any of the preceding

claims, wherein at one side thereof the tent (100) comprises an entrance door (260).

9. The method according to any of the preceding claims, wherein the divider wall (101) is provided with a layer of inorganic material selected from i) fibres, and ii) grains. 5
10. The method according to any of the preceding claims, wherein the frame (210) is anchored with the underside thereof. 10
11. The method according to any of the preceding claims, wherein the frame (210) is anchored chemically. 15

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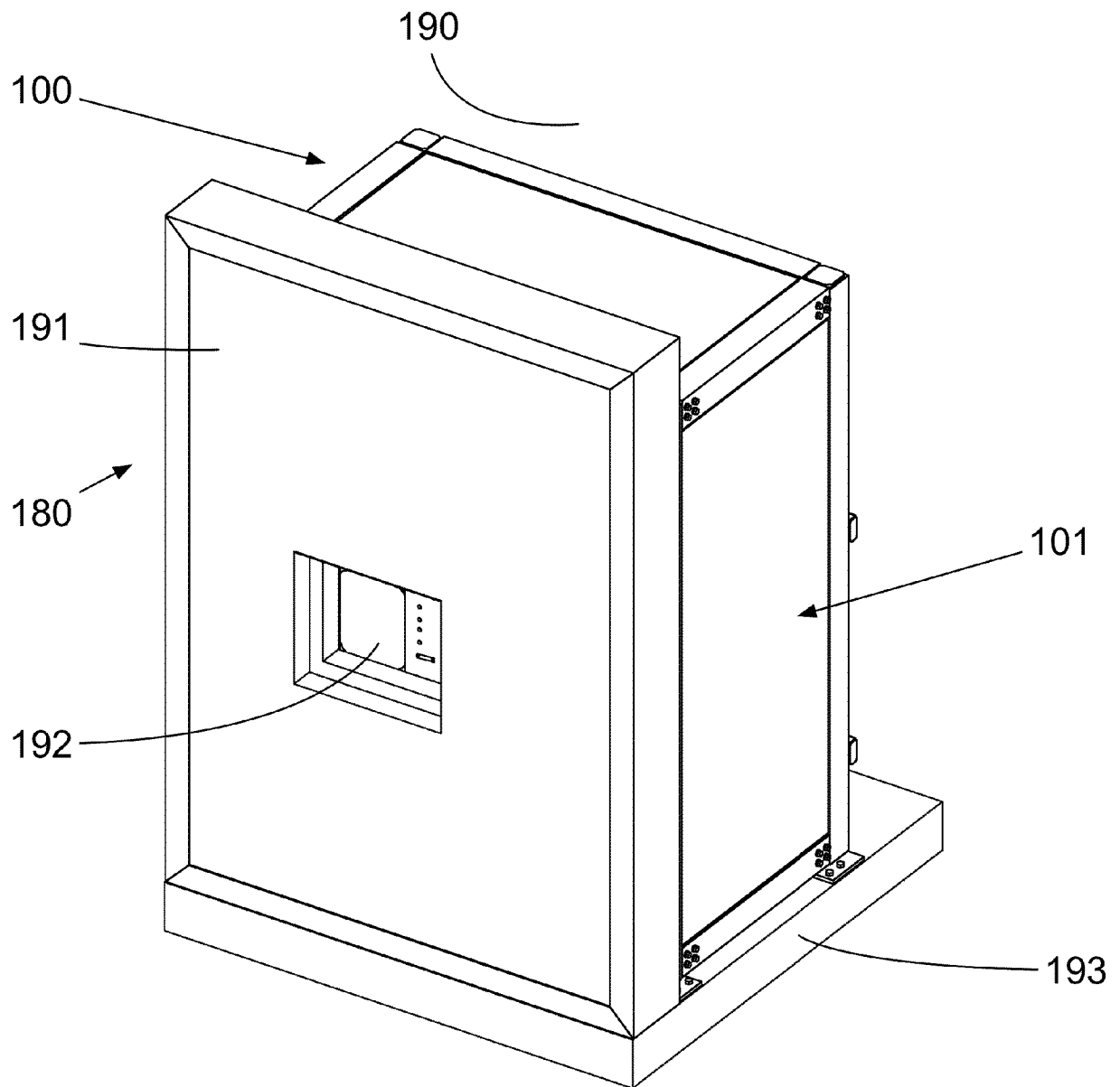


Fig. 1

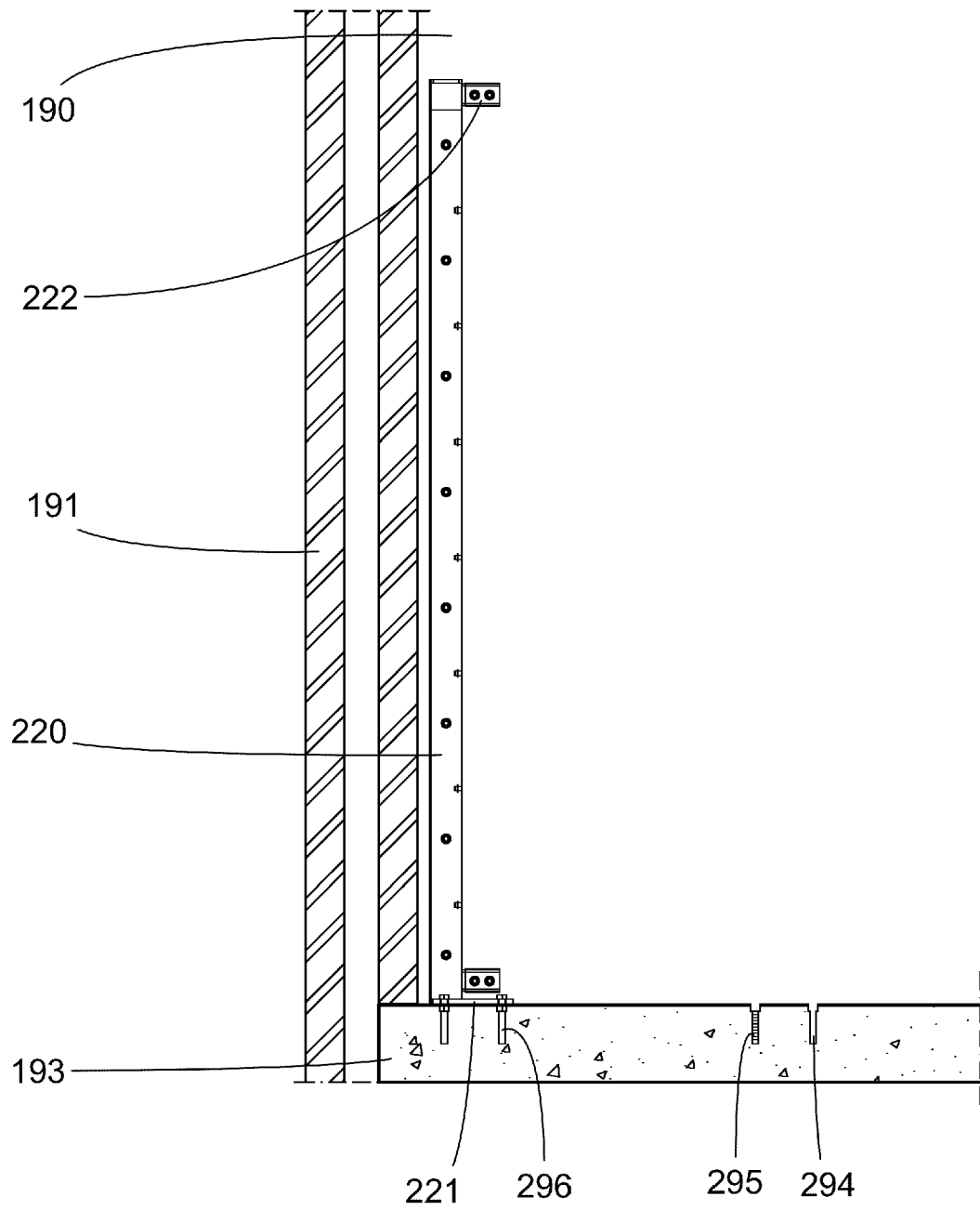


Fig. 2A

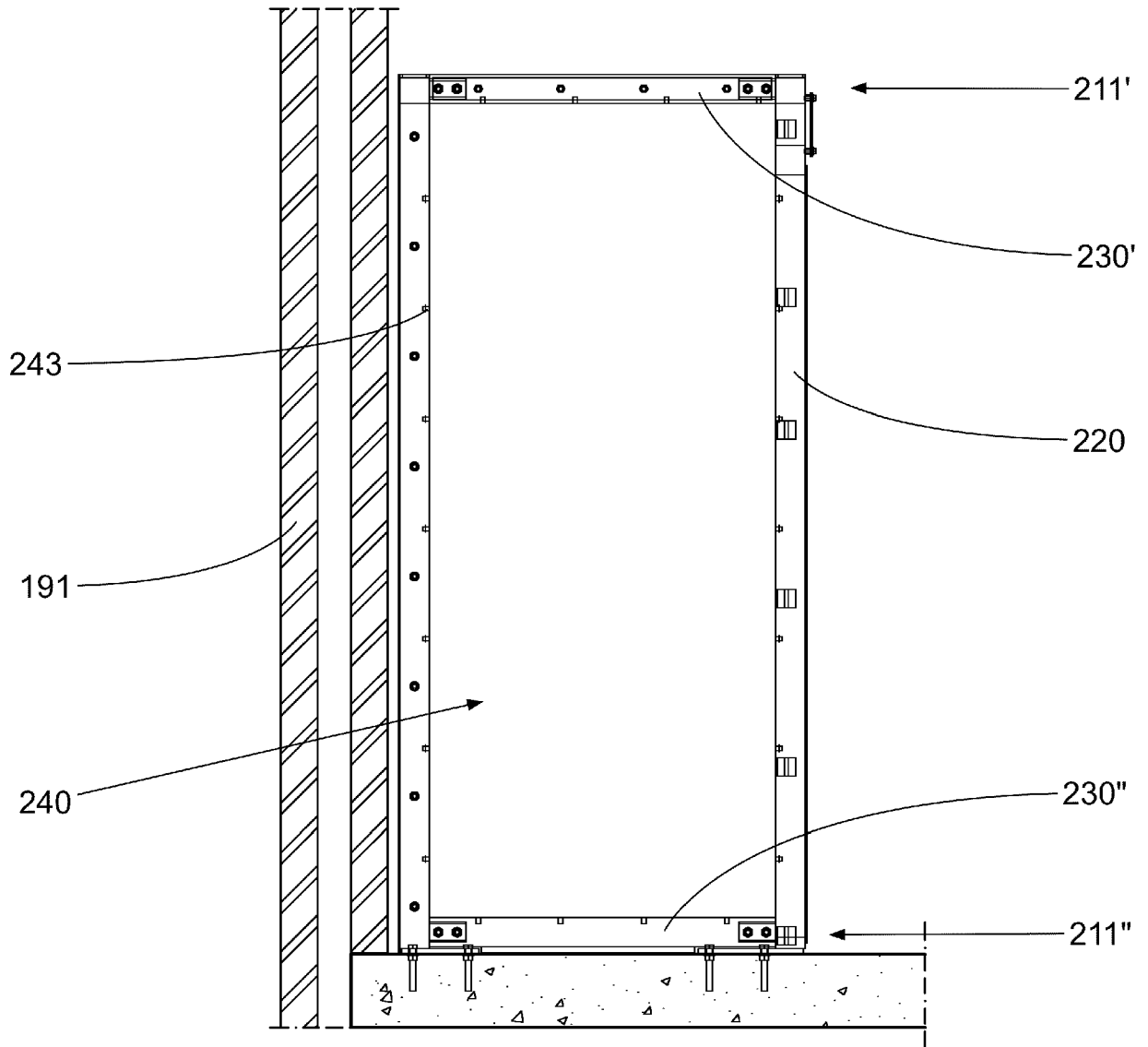


Fig. 2B

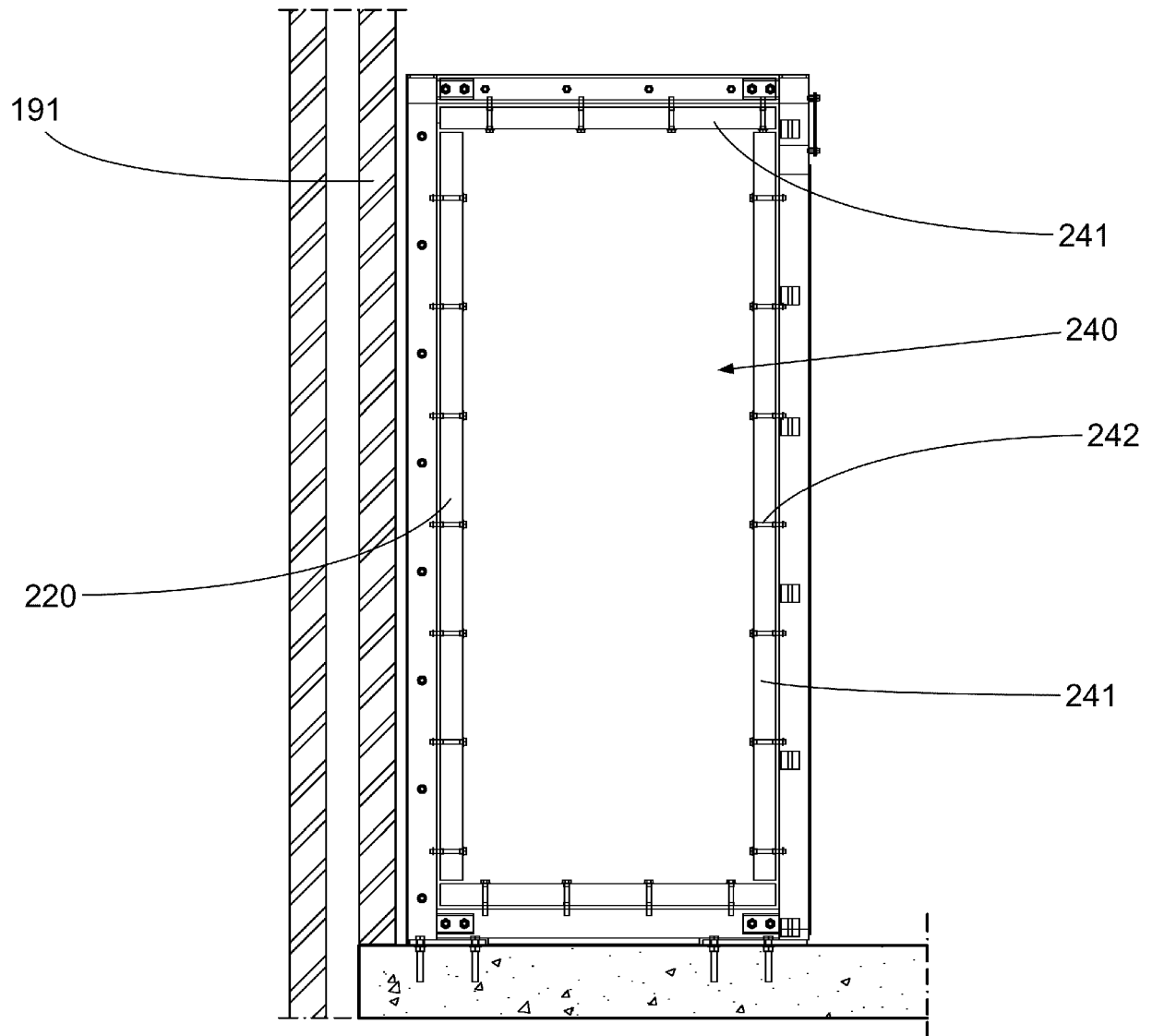


Fig. 2C

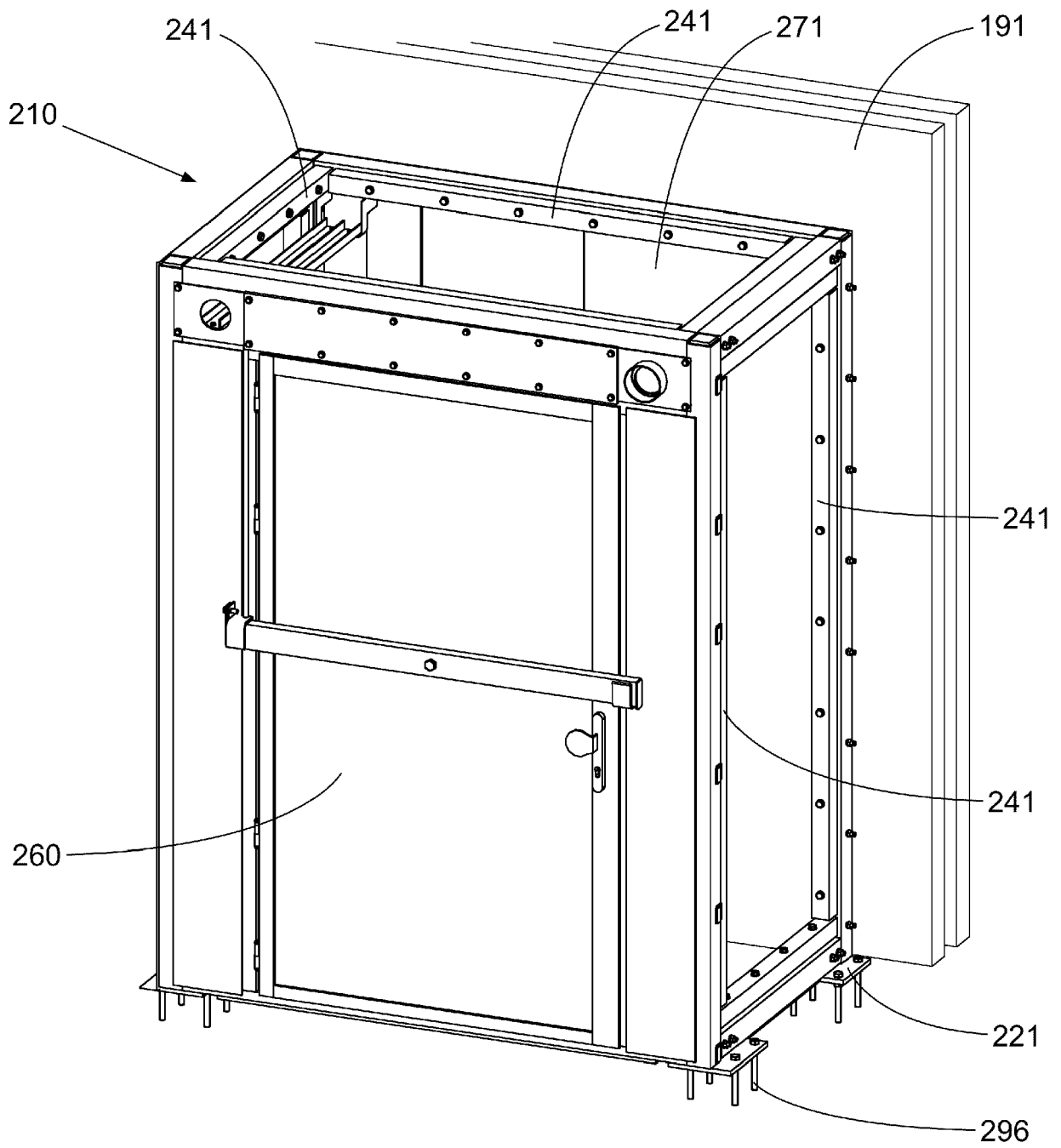


Fig. 2D

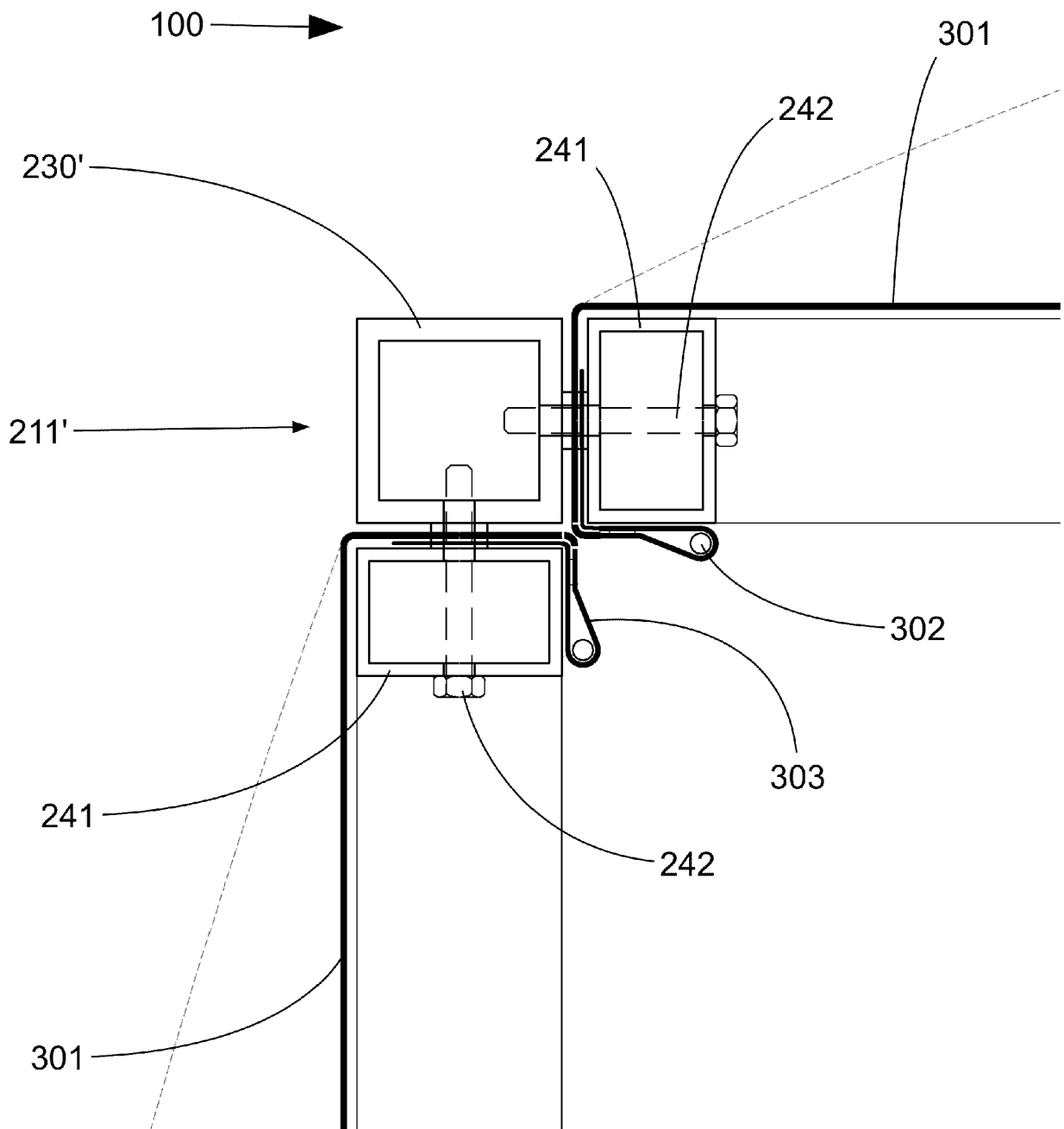


Fig. 3

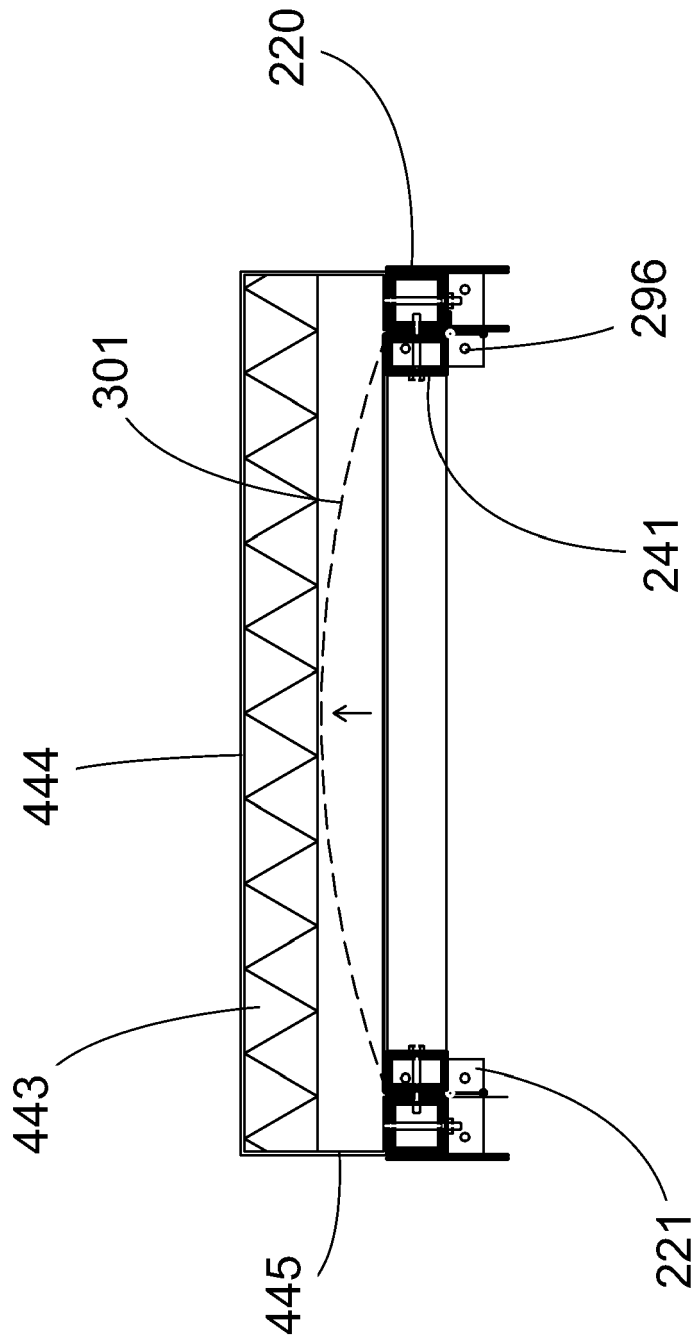


Fig. 4



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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |                                                         |                                                        |
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| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                  | Relevant to claim                                       | CLASSIFICATION OF THE APPLICATION (IPC)                |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                |                                                         |                                                        |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                | Date of completion of the search<br><b>8 March 2016</b> | Examiner<br><b>Decker, Robert</b>                      |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                                |                                                         |                                                        |

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