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A prefabricated panel and its fixed installation structure

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ABSTRACT

This invention discloses a prefabricated panel and its fixed installation structure. The former includes the light steel frame as well as front and rear plates, the light steel frame includes the left and right side frames as well as upper and lower side frames which enclose to form a square frame. The U-shaped notches of the left and right side frames are set towards left and right respectively, which enables the prefabricated panel to insert with structural members via the U-shaped notches. The front and rear connecting arms of the left and right side frames are provided with mounting holes for screw penetration to fix the prefabricated panel onto the structural members. The front and rear plates are laid on the light steel frame as the front and rear panels of the light steel frame respectively, the top and bottom surfaces of the upper and lower side frames are exposed. The in-built light steel frame in the prefabricated panel of this invention, which takes advantage of the "skin effect" technical principles to lay the light panels outside, has played a stronger performance than a single material. The light steel frame set in the prefabricate panel are exposed around the prefabricated panel, which enables the prefabricated panels to adopt the current connection technology of steel structure to have easy and effective connection with the steel structure.

(FIG 6)

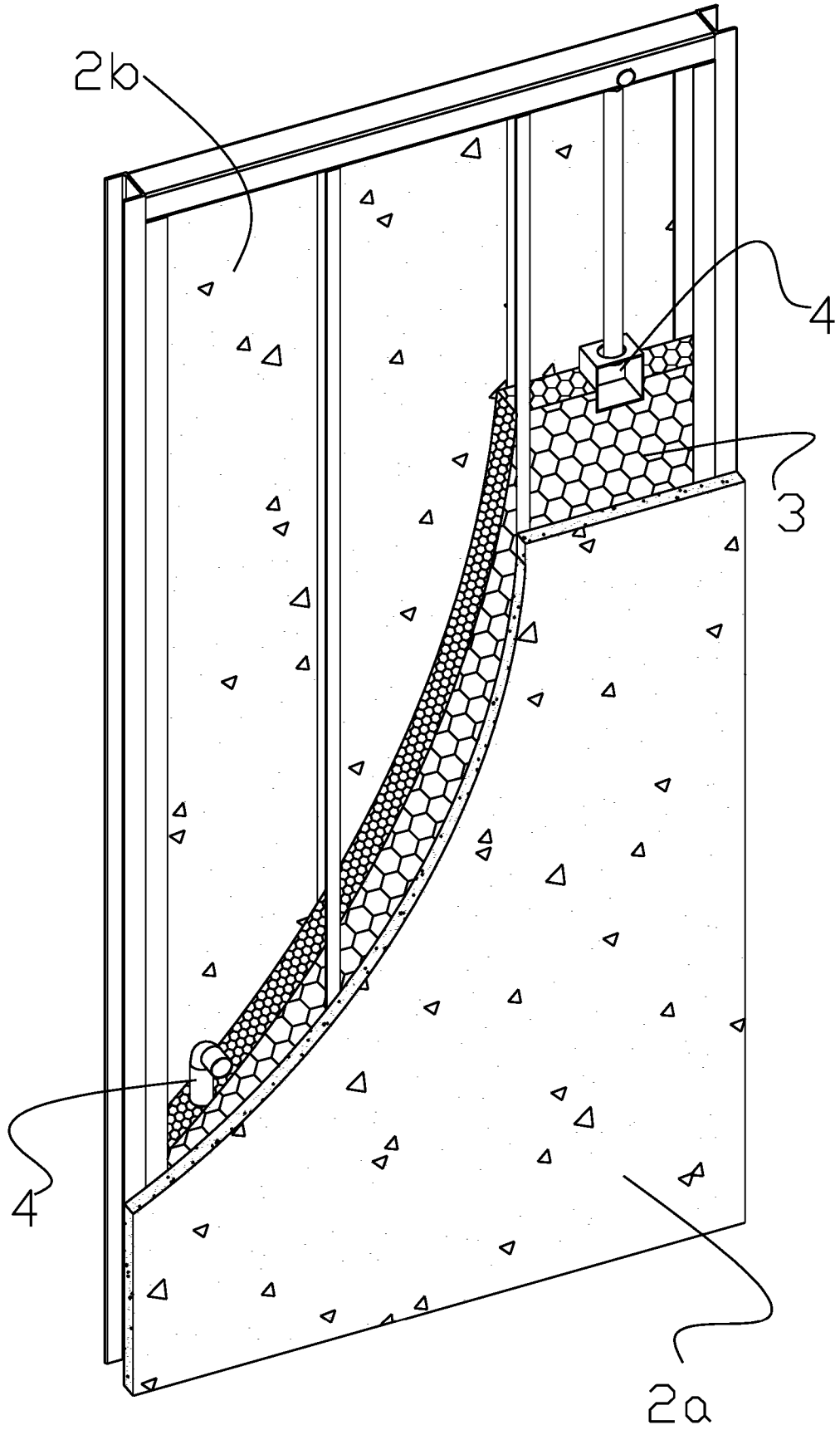


FIG 6

A PREFABRICATED PANEL AND ITS FIXED INSTALLATION STRUCTURE

TECHNICAL FIELD

[0001] This invention relates to a building material, specifically relates to a building prefabricated panel and its fixed installation structure.

BACKGROUND ARTS

[0002] The so-called structure refers to a plane or space system that is able to withstand the impact (load) connected by several members (the units composed of the structure, such as the beam, slab and pillar etc). Due to different building materials, the building structure can be divided into concrete structure, masonry structure, steel structure, light steel structure, timber structure and composite structure. However, depending only on the structure can not meet the basic requirements of the building such as wind and rain prevention, additional enclosing measures (such as wall and roof) are also needed on the basis of the structure.

[0003] Steel structure building refers to the residential building that uses steel as load-bearing beam and pillar, which owns below advantages: 1. Light weight and strong strength. 2. Safe and reliable with good seismic and wind resistant performance. 3. The steel structure members are manufactured in the factory, which means to reduce the on-site workload and shorten the construction period for meeting the requirements of industrialization. 4. The steel structure members are manufactured in the factory, which owns the advantages of reliable quality, accurate dimension, easy installation and easy matching up with relevant components. 5. Steel can be recycled, which means less environmental pollution for structure construction or dismantlement.

[0004] Among the above advantages, "The steel structure members are manufactured in the factory, which means to reduce the on-site workload and shorten the construction period

for meeting the requirements of industrialization” is the current most advanced concept globally, which is the building product’s industrialized production pursued globally.

[0005] In order to respond positively to the requirement of building industrialization, the enclosure part, as an important part of steel structural house, is required to be compatible with the development of steel structural members, which can be manufactured in the factory and assembled on site with the ready-constructed steel structural members.

SUMMARY OF INVENTION

[0006] One purpose of this invention is to provide a prefabricated panel conveniently and rapidly applied to the wall, roof as well as floor for responding positively to the requirement of building industrialization and specifically aiming at the structural characteristics of steel structural members. This prefabricated panel is manufactured in the factory, it is only needed to assemble with the ready-constructed structural members (such as steel structure) to form an enclosing part on site.

[0007] The technical solution for this invention employs is: a prefabricated panel comprises the light steel frame as well as front and rear plates, the recited light steel frame includes the left and right side frames as well as upper and lower side frames, which enclose to form a square frame. The U-shaped notches of the left and right side frames are set towards left and right respectively, which enables the prefabricated panel to insert with structural members that used to fix the prefabricated panel via the left and right U-shaped notches. The recited front and rear connecting arms of the left and right side frames are provided with mounting holes for screw penetration to fix the prefabricated panel onto the structural members. The recited front and rear plates are laid on the light steel frame as the front and rear panels of the light steel frame respectively, the top and bottom surfaces of the recited upper and lower side frames are exposed. The front and rear plates are the lightweight plates such as magnesium board, fiber cement board, OSB board and gypsum board.

[0008] Wherein the left and right edges of the recited front plate align with the vertical edges of the front connecting arms in the left and right side frames respectively. The left and right edges of the rear plate align with the vertical edges of the rear connecting arms in the left and right side frames respectively.

[0009] Wherein the light steel frame also includes the reinforcing rib of the light steel material connecting within a square frame, the front and rear plates are fixed onto the reinforcing ribs. By installing the reinforcing rib, on the one hand, it enables the structure of the light steel frame to be more stable, on the other hand, it also enables the exposed square frame to leave sufficient aperture for connection with structural members.

[0010] Wherein the reinforcing rib comprises the front and rear connecting arms for fixing front and rear plates respectively. The front and rear connecting arms of the reinforcing rib are provided with the front and rear arm threaded holes. The front plate is correspondingly fixed onto the light steel frame with the front arm threaded hole via the screw. The rear plate is correspondingly fixed onto the light steel frame with the rear arm threaded hole via the screw.

[0011] Wherein the reinforcing rib is parallel to the left and right side frames. The reinforcing rib comprises Z-shaped reinforcing rib that includes front and rear connecting arms, as well as two U-shaped reinforcing ribs. These two U-shaped reinforcing ribs are set back-to-back and fixed with left and right side frames. The Z-shaped reinforcing rib is put between two U-shaped reinforcing ribs and fixedly connected with upper and lower side frames at its both ends.

[0012] Wherein the light steel frame contains the passage for installation of water and electrical pipelines, the inlet and outlet of the passage are exposed.

[0013] Wherein the passage comprises connecting wings, the passage is correspondingly connected to the fixed thread on the inner surface that fixed to rear plate through the connecting wings via the screw.

[0014] Wherein the hollow portion between the light steel frame and front and rear plates is filled with insulation material. The insulation material includes EPS, rock wool, glass wool and polyurethane foam etc.

[0015] Another purpose of this invention is to provide a fixed installation structure of above prefabricated panel.

[0016] The technical solution for this invention employs is: The fixed installation structure of a prefabricated panel, wherein the two prefabricated panels are inserted with the square tube on the left and right sides of the tube respectively, which the square tube is taken as the structural members. The left prefabricated panel located on the left of the square tube, matches up with the corresponding threaded holes on the square tube successively through its front panel as well as the mounting hole of the front connecting arm on the right side frame via the screw. and correspondingly fixed to the square tube with the corresponding threaded holes on the square tube successively through its rear panel as well as the mounting hole of the rear connecting arm on the right side frame via the screw. The right prefabricated panel located on the right of the square tube, matches up with the corresponding threaded holes on the square tube successively through its front panel as well as the mounting hole of the front connecting arm on the left side frame via the screw, and correspondingly fixed to the square tube with the corresponding threaded holes on the square tube successively through its rear panel as well as the mounting hole of the rear connecting arm on the left side frame via the screw.

[0017] The third purpose of this invention is to provide a fixed installation structure of another prefabricated panel.

[0018] The technical solution for this invention employs is: the two prefabricated panels are inserted with the square tube on the left and right sides of the tube respectively, which the square tube is taken as the structural members. The left prefabricated panel located on the left of the square tube, matches up with the corresponding threaded holes on the square tube successively through the front panel on the left prefabricated panel as well as the mounting hole of the front connecting arm on the right side frame of the left prefabricated panel via the screw. The right prefabricated panel located on the right of the square tube, matches up with the corresponding threaded holes on the square tube successively through the front panel on the right prefabricated panel as well as the mounting hole of the front connecting arm on the left side frame of the right prefabricated panel via the screw.

[0019] Outer side of the rear panel on the left and right prefabricated panels is provided with fireproof decorative panel. The fixed installation structure of the fireproof decorative panel on the square tube is as below: the fireproof decorative panel matches up with the corresponding threaded holes on the square tube successively through the decorative panel itself and the rear panel of left prefabricated plate as well as the mounting hole of the rear connecting arm on the right side frame of the left prefabricated panel via the screw, and fixed to the square tube with the left prefabricated plate together. The fireproof decorative panel matches up with the corresponding threaded holes on the square tube successively through the decorative panel itself and the rear panel of the right prefabricated plate as well as the mounting hole of the rear connecting arm on the left side frame of the right prefabricated panel via the screw, and fixed to the square tube with the right prefabricated plate together.

[0020] The fixed installation structure of the fireproof decorative panel on other positions is as follows: the fireproof decorative panel is fixed to the rear plate of the left and right prefabricated panels by the effect between the screw and the rear plate of the left and right prefabricated plates.

[0021] The beneficial effects of this invention is: In order to keep in line with the materials of the steel structure, the in-built light steel frame in the prefabricated panel of this invention, which takes advantage of the "skin effect" technical principles to lay the light panels (such as magnesium board, fiber cement board, OSB board etc) in outer side, has played a stronger performance than a single material and got the achievement of "1 plus 1 is more than 2". The light steel frame set in the prefabricated panel are exposed around the prefabricated panel, therefore, the prefabricated panel of the invention takes advantage of the current steel structure connecting technology (such as bolt connection, welding and anchorage etc) for effective and easy connection with the steel structure. Meanwhile, due to the use of light steel frame, the prefabricated panel of this invention is easy and rapid to connect with the steel structure, the plate bears the load with the structure by its own mechanical property, which can effectively replace the auxiliary members (such as diagonal bracing and tie rod etc) in the steel structure by reasonable setting. The prefabricated panel of this invention can be insulated from heat and sound by filling with insulation materials.

[0022] In addition, the modular dimension of this prefabricated panel can be based on the usual width of ordinary panel in the market, which can reduce the cutting and waste of the panel. Production line can be achieved for the panel manufacturing and robotic welding can be used for the welding of light steel frame, which enables the product to reach good quality and have clear load bearing. All the fixing of lightweight panels is by screws and it facilitates the factory production.

[0023] If the plate itself of the prefabricated panel which laid outside is water resistant and also includes the structural measures such as waterproof membrane, then the waterproof and moisture-proof performances can be achieved. Therefore, front and rear plates as well as fireproof decorative panel lay in the surface of the prefabricated panel enclose the light steel panel to reach the airtight performance such as fire and water resistance.

DESCRIPTION OF DRAWINGS

[0024] Figure 1 illustrates a structure of the prefabricated panel's light steel frame stated in this invention.

[0025] Figure 2 is an exploded view of the light steel frame in Figure 1

[0026] Figure 3 is a structural view of the passage for installation of water and electrical pipelines and the insulation materials in the light steel frame in Figure 1.

[0027] Figure 4 illustrates a structure of the prefabricated panel in this invention

[0028] Figure 5 is the cross sectional view of the prefabricated panel in Figure 4

[0029] Figure 6 is the partial section view of the prefabricated panel in Figure 4

[0030] Figure 7 illustrates the mounting structure of the passage for water and electrical pipelines.

[0031] Figure 8 illustrates the fixed installation manner of the prefabricated panel in Figure 4.

[0032] Figure 9 illustrates the cross sectional view of the first composite unit assembled by the fixed installation manner in Figure 7

[0033] Figure 10 illustrates the fixed installation manner of the first composite unit and fireproof decorative panel in Figure 9.

[0034] Figure 11 illustrates the cross sectional view of the second composite unit assembled by the fixed installation manner in Figure 10

[0035] Figure 12 illustrates the design sketch which several prefabricated panels fixedly installed with fireproof decorative panels.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0036] As shown in Figure 1 to Figure 7, the prefabricated panel of this invention includes light steel frame 1 (or light duty steel frame) and front and rear plates (2a, 2b), this light steel frame 1 includes the left and right side frames (11a, 11b) as well as upper and lower side frames (13a, 13b) which enclose (can be enclosed by welding) to form a square frame. The cross section of the left and right side frames (11a, 11b) are in U shape, which means the left and right side frames (11a, 11b) are U-shaped profile. The U-shaped notches of the left and right side frames (11a, 11b) are set towards left and right respectively, which enables the prefabricated panel to insert with structural members (specifically steel structural members) used to fix the prefabricated panel via the left and right U-shaped notches. The front and rear connecting arms of the left and right side frames (11a,11b) are provided with mounting holes for screw penetration to fix the prefabricated panel A onto the structural members. The front and rear plates (2a, 2b) are laid on the light steel frame 1 as the front and rear panels of the light steel frame 1 respectively, the top and bottom surfaces of the upper and lower side frames (13a, 13b) are exposed. In addition, since the U-shaped notches of the left and right side frames (11a,11b) are also exposed, which enables the whole light steel frame to effectively connect to the structural members via welding, riveting as well as bolt connection etc. With the use of light steel frame 1, the front and rear plates (2a, 2b) are lightweight plates such as magnesium board, fiber cement board, OSB board and gypsum board.

[0037] The above light steel frame and lightweight panel adopts the definition of "Technical regulation of light steel structural housing", which the light steel frame refers to the pure frame or frame supporting structural system composed by small cross-section hot-rolled H profile, high-frequency welding H profile, the ordinary welding H or profiled cross-section profile, cold-rolled or hot-rolled square (rectangular, round) steel tube. Lightweight

plate refers to the material which the dry density is less than the traditional building materials' (such as reinforced concrete) by more than 50% (including 50%)

[0038] The left and right edges of the front plate (2a) can align with the vertical edges of the front connecting arms in the left and right side frames (11a, 11b) respectively. The left and right edges of the rear plate (2b) can align with the vertical edges of the rear connecting arms in the left and right side frames respectively. Wherein the front and rear plates (2a, 2b) are able to extend or retract with respect to the left and right side frames (11a, 11b).

[0039] The light steel frame 1 also includes the reinforcing rib 14 of the light steel material connecting within a square frame, enabling the front and rear plates (2a, 2b) to fix onto the reinforcing ribs. The reinforcing rib 14 comprises the front and rear connecting arms for fixing front and rear plates respectively. The front and rear connecting arms of the reinforcing rib 14 are provided with the front and rear arm threaded holes, enabling the front plate 2a to correspondingly fix onto the light steel frame 1 with the front arm threaded hole via the screw, and the rear plate 2b to correspondingly fix onto the light steel frame 1 with the rear arm threaded hole via the screw.

[0040] In order to facilitate the fixing of the reinforcing rib and make the prefabricated panel into a simpler structure, the reinforcing rib 14 can be set to be parallel to the left and right side frames (11a, 11b), the reinforcing rib 14 comprises Z-shaped reinforcing rib that includes front and rear connecting arms, as well as two U-shaped reinforcing ribs. These two U-shaped reinforcing ribs are set back-to back and fixed with left and right side frames 11a, 11b (such as fixed to the left and right side frames 11a, 11b by welding). The Z-shaped reinforcing rib is evenly set between two U-shaped reinforcing ribs and fixedly connected (e.g by welding) with upper and lower side frames (13a, 13b) at its both ends.

[0041] As shown in Figure 3, Figure 6 and Figure 7, wherein the light steel frame 1 contains the passage for installation of water and electrical pipelines, the inlet and outlet of the passage 4 are exposed, which means the water and electrical pipelines can be installed

on site without damaging the wall. The mounting structure of passage 4 can be: Passage 4 comprises connecting wings 42, the passage 4 is correspondingly connected to the fixed bracket's 41 thread on the inner surface that fixed to rear plate 2b through the holes on the connecting wings 42 via the screw.

[0042] In order to insulate the prefabricated panel of this invention from heat and sound, the hollow portion between the light steel frame 1 and front and rear plates (2a, 2b) is filled with insulation material 3. Wherein the insulation material 3 includes such as EPS, rock wool, glass wool and polyurethane foam etc. Regarding the embodiment provided by the reinforcing rib, the hollow portion is the space partitioned by reinforcing rib.

[0043] The above upper and lower side frames (13a, 13b) can be hollow square steel, i.e. the lightweight steel with square cross section.

[0044] As shown in Figure 8 and Figure 9, the fixing installation structure of above prefabricated panel is: The two prefabricated panels A are inserted with the square tube B on the left and right sides of the tube B respectively, which the square tube B is taken as the structural members. The left prefabricated panel located on the left of the square tube B, matches up with the corresponding threaded holes on the square tube B successively through the front panel 2a on the left prefabricated panel as well as the mounting hole of the front connecting arm on the right side frame 11b of the left prefabricated panel via the screw, and correspondingly fixed to the square tube B with the corresponding threaded holes on the square tube B successively through the rear panel 2b of the left prefabricated panel as well as the mounting hole of the rear connecting arm on the right side frame 11b of the left prefabricated panel via the screw. The right prefabricated panel located on the right of the square tube B, matches up with the corresponding threaded holes on the square tube B successively through the front panel 2a on the right prefabricated panel as well as the mounting hole of the front connecting arm on the left side frame 11a of the right prefabricated panel via the screw, and correspondingly fixed to the square tube with the corresponding threaded holes on the square tube B successively through the rear panel 2b

of the right prefabricated panel as well as the mounting hole of the rear connecting arm on the left side frame 11a of the right prefabricated panel via the screw.

[0045] In order to reduce the workload of interior and exterior wall decorative work, fireproof decorative panel 5 can be laid out for prefabricated panel A, as shown in Figure 10 and Figure 11. Outer side of the rear panel 2b on the left and right prefabricated panels is provided with fireproof decorative panel 5. The fixed installation structure of the fireproof decorative panel 5 on the square tube B can be: The fireproof decorative panel 5 matches up with the corresponding threaded holes on the square tube B successively through the decorative panel itself and the rear panel 2b of left prefabricated plate A as well as the mounting hole of the rear connecting arm on the right side frame 11b of the left prefabricated panel via the screw on the left, and fixed to the square tube B with the left prefabricated plate A together. The fireproof decorative panel 5 matches up with the corresponding threaded holes on the square tube B successively through the decorative panel itself and the rear panel of the right prefabricated plate A as well as the mounting hole of the rear connecting arm on the left side frame 11a of the right prefabricated panel via the screw on the right, and fixed to the square tube B with the right prefabricated plate A together. The fixed installation structures of the fireproof decorative panel 5 on other positions are: the fireproof decorative panel 5 is fixed to the rear plate 2b of the left and right prefabricated panels by the effect between the screw and the rear plate 2b of the left and right prefabricated plates. For laying the fixed installation structure with fireproof decorative panel 5, the fixed installation structure of the left and right prefabricated panel A with the square tube B at the front is the same as the above-described manner.

[0046] The above fireproof decorative panel 5 can be selected into incombustible materials, such as ALC and fiber cement board etc, which is able to improve the fireproof capacity.

[0047] As shown in Figure 12, it is the structure and appearance of several prefabricated panels A and fireproof decorative panels 5 assembled with the square steel B in above-described manner.

[0048] As shown in Figure 1, the summarized above is only a better embodiment for this invention, which is not intended to limit the embodiment range. However, where the equivalent changes and modifications are made within the protection range of this invention, they should belong to the protection category of this invention.

CLAIMS

1. A prefabricated panel, comprising: a light steel frame, a front plate and a rear plate, the light steel frame comprises a left side frame, a right side frame an upper frame and a lower frame enclosed to form a square frame; the cross sections of the left side frame and the right side frame are in U shape; U-shaped notches of the left side frame are disposed leftward facing and U-shaped notches of the right side frame are disposed rightward facing, which are used for insert connecting the prefabricated panel to structural members; a front connecting arm and a rear connecting arm of the respective left side frame and the right side frame are provided with mounting holes for screws to penetrate therethrough so as to fixedly connecting the prefabricated panel onto the structural members; the front plate and the rear plate are laid on the light steel frame as a front panel and a rear panel of the light steel frame respectively, a top surface and a bottom surface of the upper frame and a top surface and a bottom surface of the lower frame are exposed.
2. The prefabricated panel as recited in Claim 1, wherein a left edge and a right edge of the front plate align with a vertical edge of the front connecting arm in the left side frame and a vertical edge of the front connecting arm in the right side frame respectively; a left edge and a right edge of the rear plate align with a vertical edge of the rear connecting arm in the left side frame and a vertical edge of the rear connecting arm in the right side frame respectively.
3. The prefabricated panel as recited in Claim 1, wherein the light steel frame further comprises at least one reinforcing rib of light steel material connecting within the square frame, the front plate and the rear plate are fixed onto the at least one reinforcing rib.
4. The prefabricated panel as recited in Claim 3, wherein each of the recited reinforcing ribs comprises a front connecting arm and a rear connecting arm for fixing the front plate and the rear plate respectively; the front connecting arm and the rear connecting arm of the reinforcing rib are provided with respective front arm threaded hole and rear arm threaded hole; the front plate is fixed onto the light steel frame with the front arm threaded

hole via screw; the rear plate is fixed onto the light steel frame with the rear arm threaded hole via screw.

5. The prefabricated panel as recited in Claim 4, wherein the reinforcing rib is arranged in parallel to the left side frame and the right side frame; of the reinforcing ribs having a Z-shaped reinforcing rib that includes front and rear connecting arms, as well as two U-shaped reinforcing ribs; these two U-shaped reinforcing ribs are back-to back fixed with the left side frame and the right side frame respectively; the Z-shaped reinforcing rib is disposed between two U-shaped reinforcing ribs and is fixedly connected with the upper frame and the lower frames at its respectively ends.

6. The prefabricated panel as recited in Claim 1, wherein the light steel frame comprises passages for the installation of water and electrical pipelines, inlets and outlets of each of the passages are in communication with the ambient.

7. The prefabricated panel as recited in Claim 6, wherein the passage comprises connecting wings, through which respective screws passes and engages thread of a block that is fixed on an inner surface of the rear plate.

8. The prefabricated panel as recited in any of Claims 1 to 7, wherein the hollow portion enclosed by the light steel frame, the front plate and the rear plate is filled with insulation material.

9. The fixed installation structure of the prefabricated panel as recited in any from Claim 1 to Claim 7, wherein two prefabricated panels are insert connected with a square tube, which is the structural members as mentioned, from the left side and the right side of the tube respectively, ;

wherein the left prefabricated panel located on the left of the square tube is fixed to the square tube, by screws that passes successively through mounting holes at the front panel of the left prefabricated panel as well as the mounting holes of the front connecting

arm on the right side frame of the left prefabricated panel and engages with corresponding threaded holes on the square tube , and by screws that passes successively through mounting hole of the rear panel of the left prefabricated panel as well as the mounting holes of the rear connecting arm on the right side frame of the left prefabricated panel To engages with the corresponding threaded holes on the square tube;

wherein the right prefabricated panel located on the right of the square tube is fixed to the square tube by screws that passes successively through mounting holes of the front panel on the right prefabricated panel as well as the mounting holes of the front connecting arm on the left side frame of the right prefabricated panel and engages with corresponding threaded holes on the square tube, and by screws that passes successively through mounting holes of the rear panel of the right prefabricated panel as well as mounting holes of the rear connecting arm on the left side frame of the right prefabricated panel and engages with the corresponding threaded holes on the square tube.

10. The fixed installation structure of the prefabricated panel as recited in any from Claims 1 to 7, wherein two prefabricated panels are insert connected with a square tube, which is the structural members as mentioned, from the left side and the right side of the tube respectively;. wherein the left prefabricated panel located on the left of the square tube is fixed to the square tube, by screws that passes successively through mounting holes at the front panel of the left prefabricated panel as well as the mounting holes of the front connecting arm on the right side frame of the left prefabricated panel and engages with corresponding threaded holes on the square tube; wherein the right prefabricated panel located on the right of the square tube is fixed to the square tube by screws that passes successively through mounting holes of the front panel on the right prefabricated panel as well as the mounting holes of the front connecting arm on the left side frame of the right prefabricated panel and engages with corresponding threaded holes on the square tube,

an outer side of the rear panel on the left and right prefabricated panels is provided with fireproof decorative panel; the fixed installation structure of the fireproof decorative panel on the square tube is that : the fireproof decorative panel is fixed together

with the left prefabricated plate to the by screws that passes successively through mounting holes of the decorative panel itself, mounting holes of the rear panel of left prefabricated plate as well as the mounting hole of the rear connecting arm on the right side frame of the left prefabricated panel and engages with the corresponding threaded holes on the square tube; ;and the recited fireproof decorative panel is fixed together with the right prefabricated plate to the recited square tube by screws that passes successively through mounting holes of the decorative panel itself, mounting holes of the rear panel of the right prefabricated plate as well as mounting holes of the rear connecting arm on the left side frame of the right prefabricated panel and engages with corresponding threaded holes on the square tube;

the fixed installation structures of the recited fireproof decorative panel on other positions is that the fireproof decorative panel is fixed to a rear plate of the left and right prefabricated panels by the effect between the screw and the rear plate of the left and right prefabricated plates.

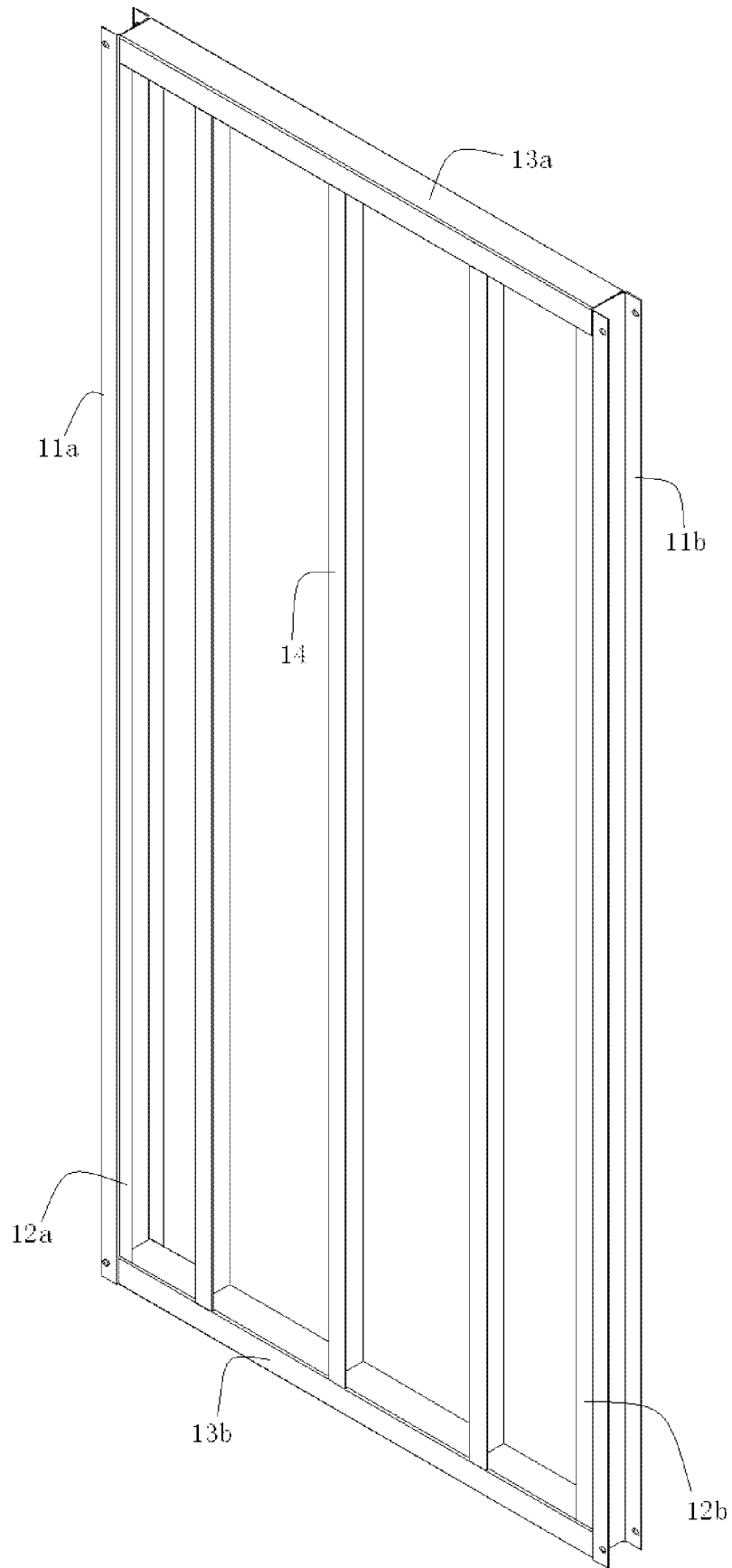


FIG1

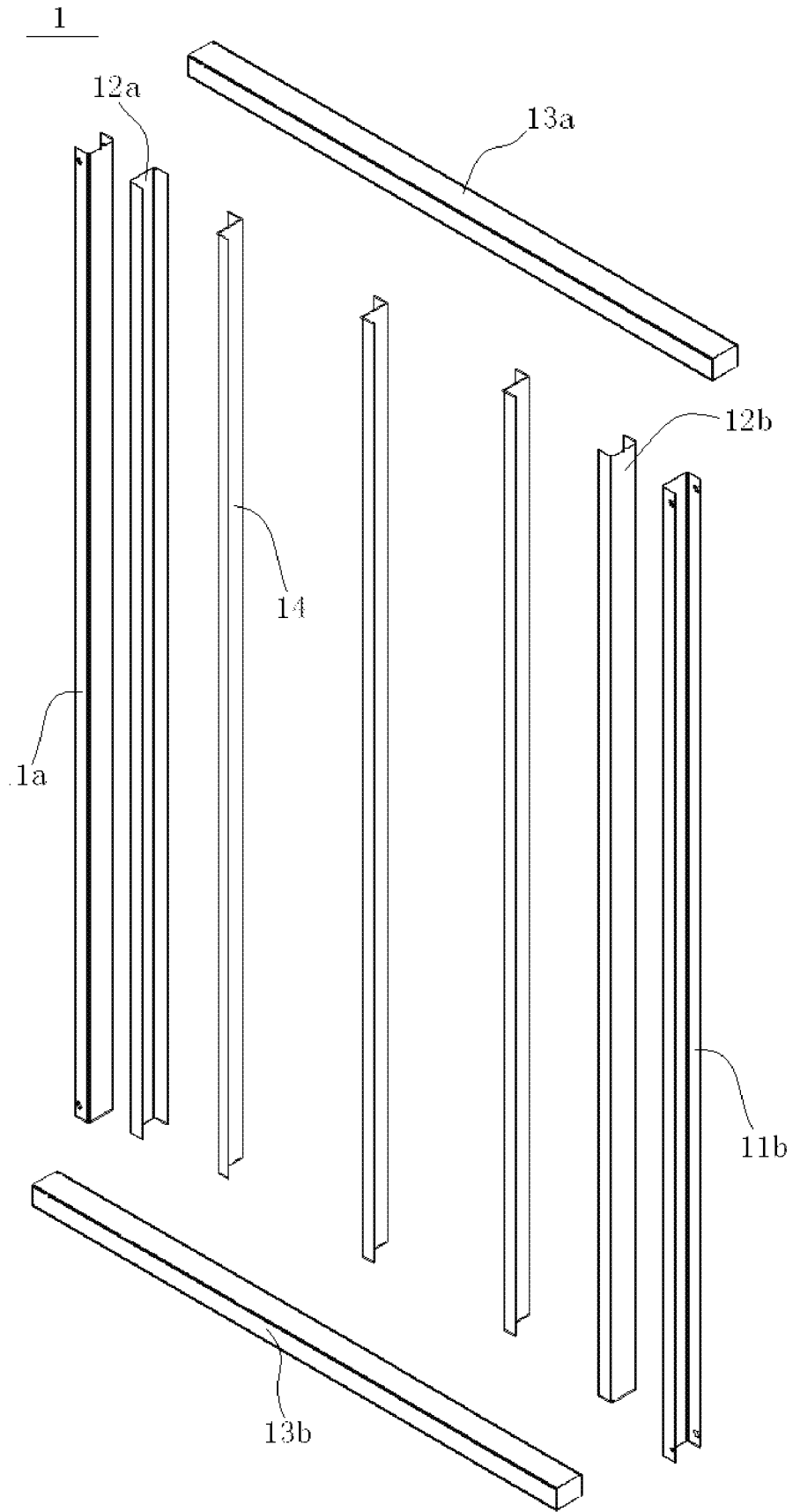


FIG 2

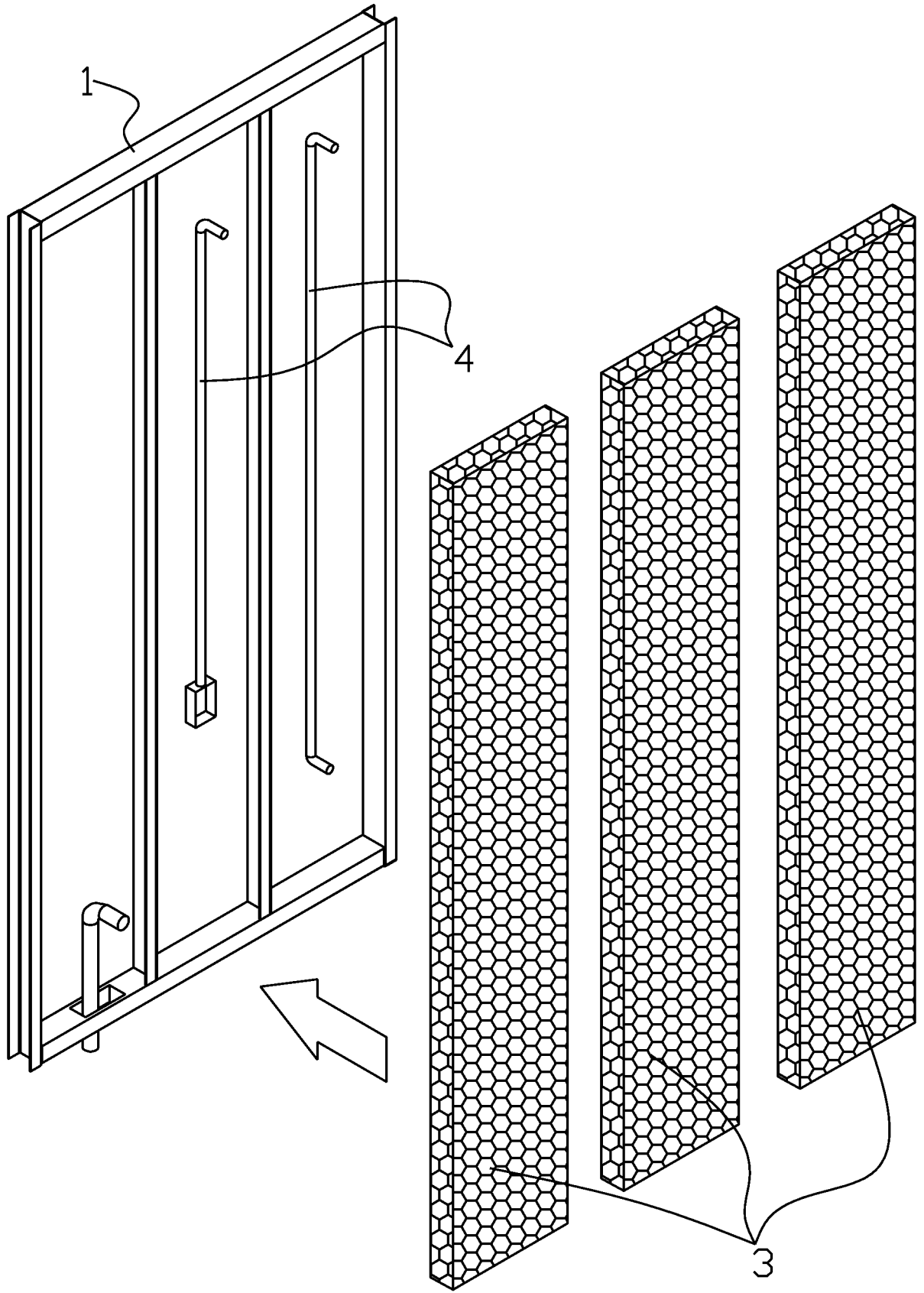


FIG 3

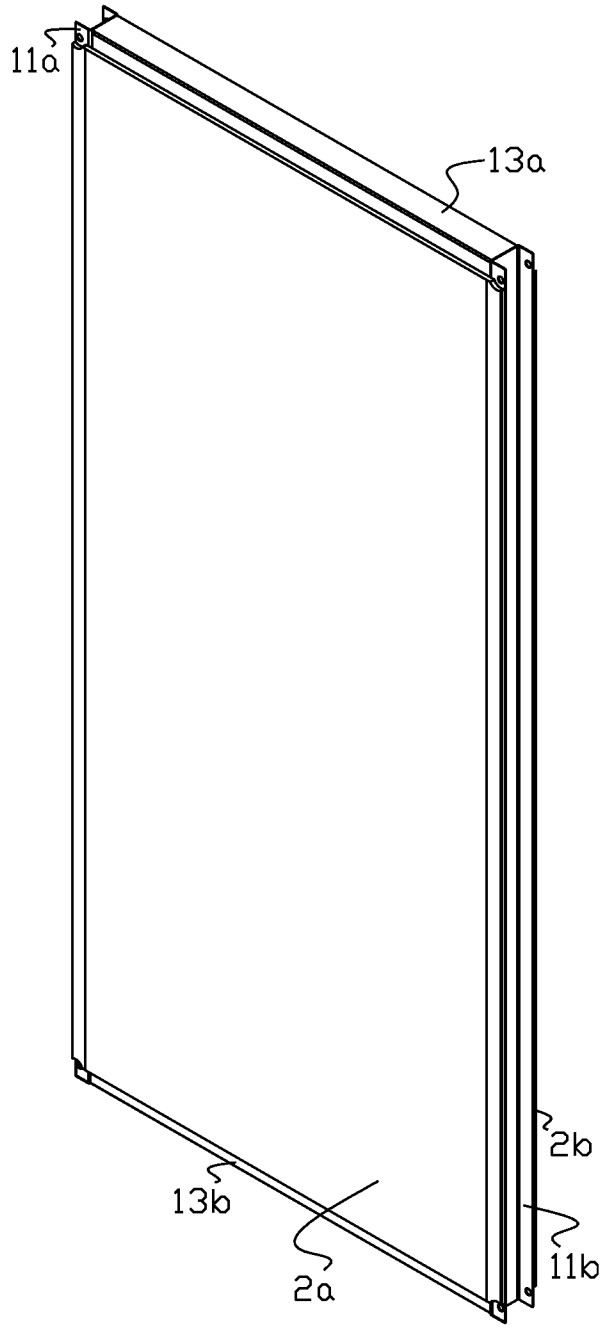


FIG 4

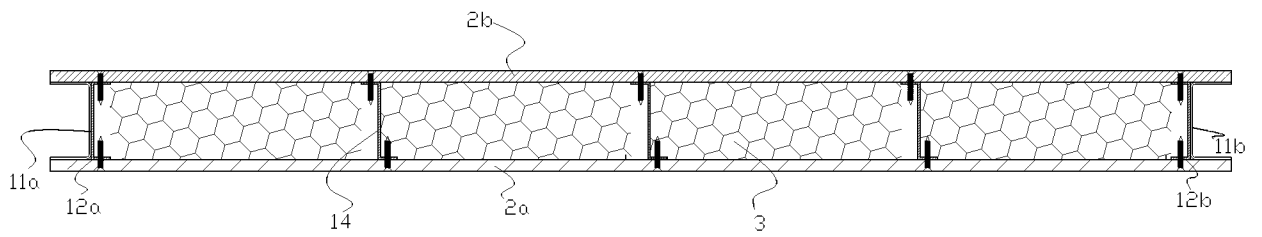


FIG 5

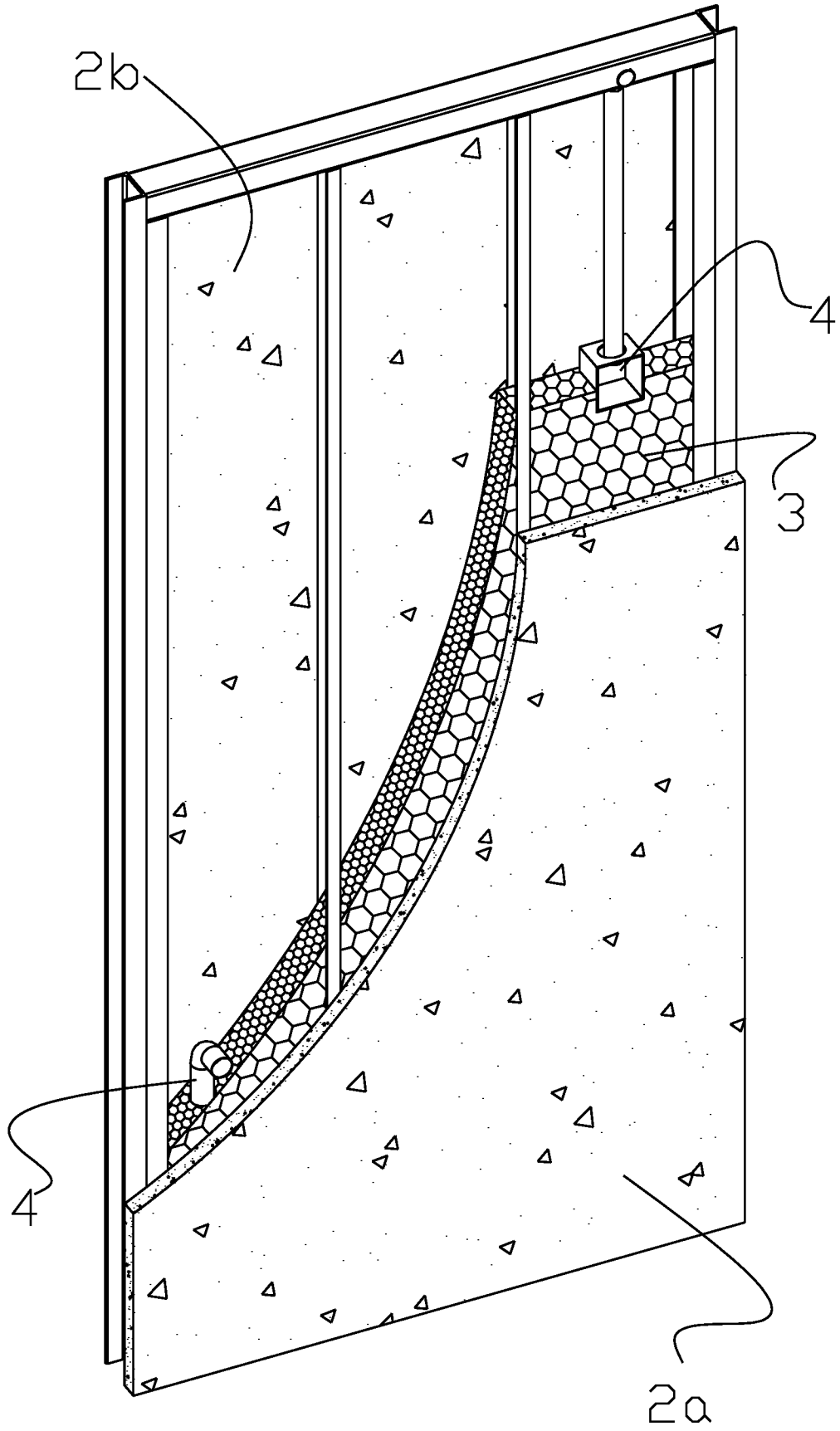


FIG 6

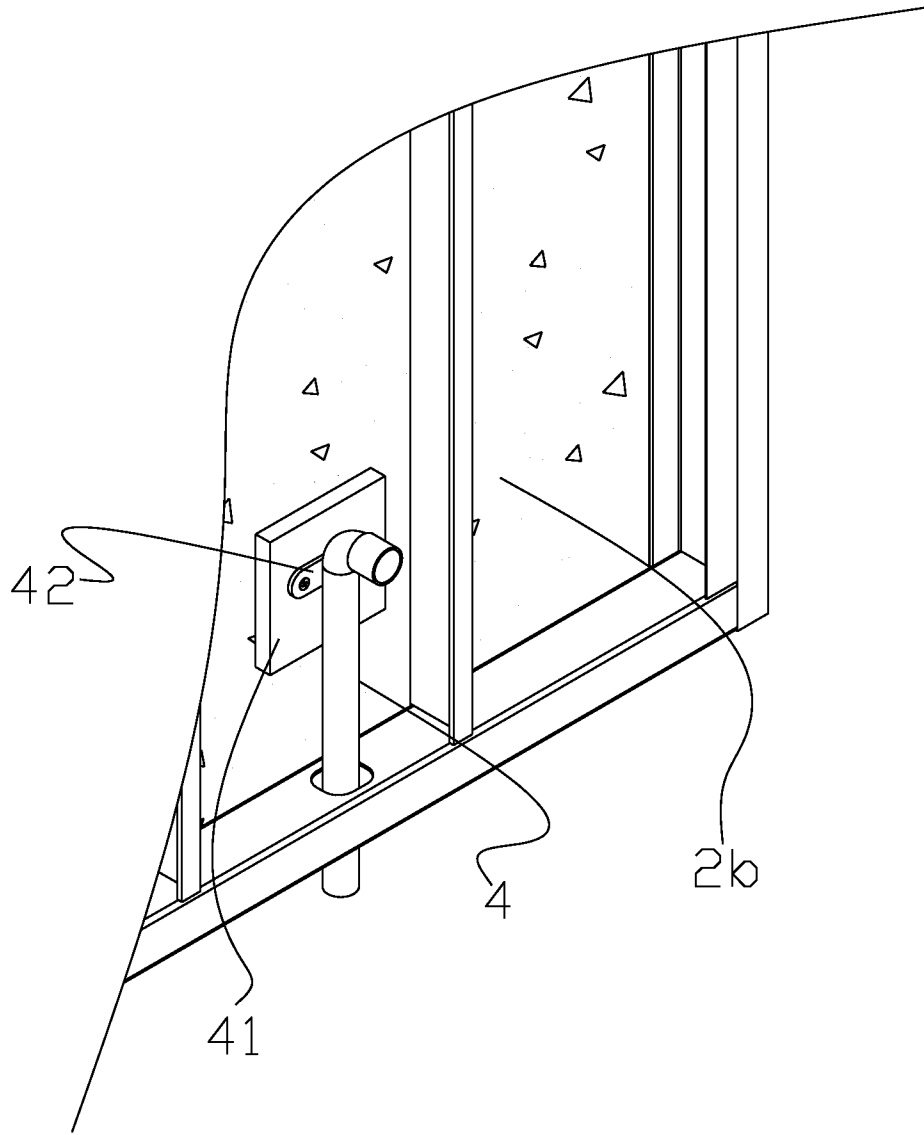


FIG 7

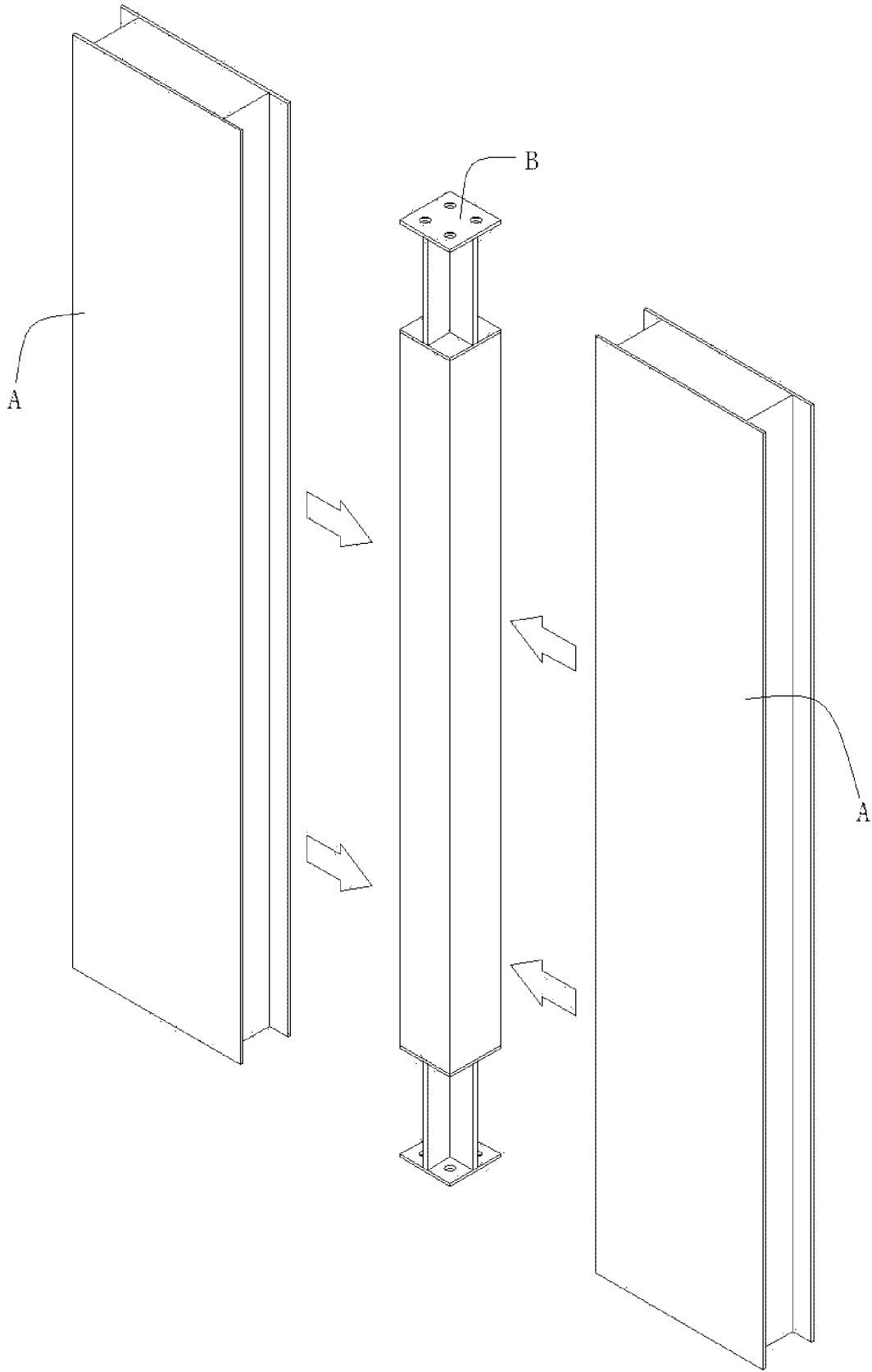


FIG 8

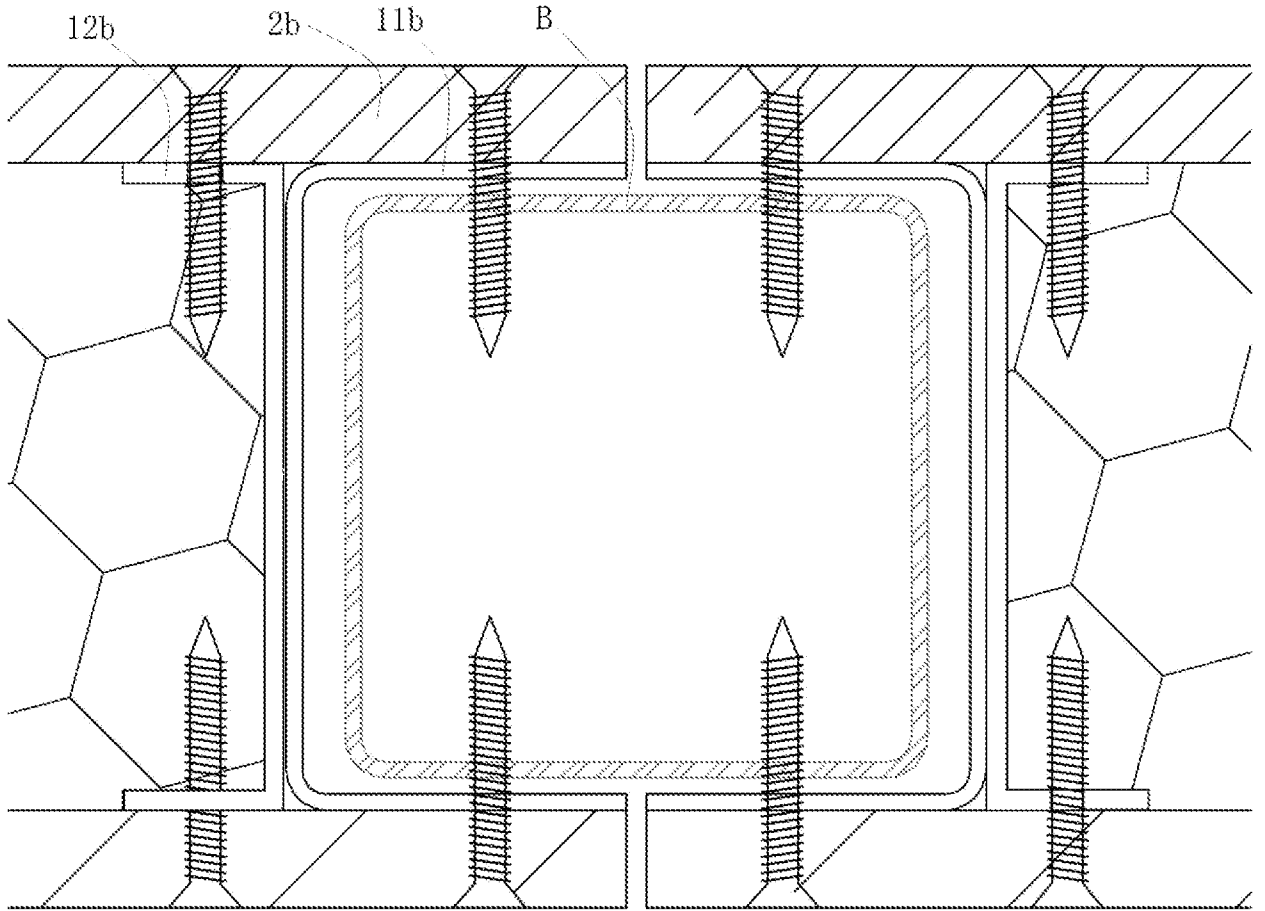


FIG 9

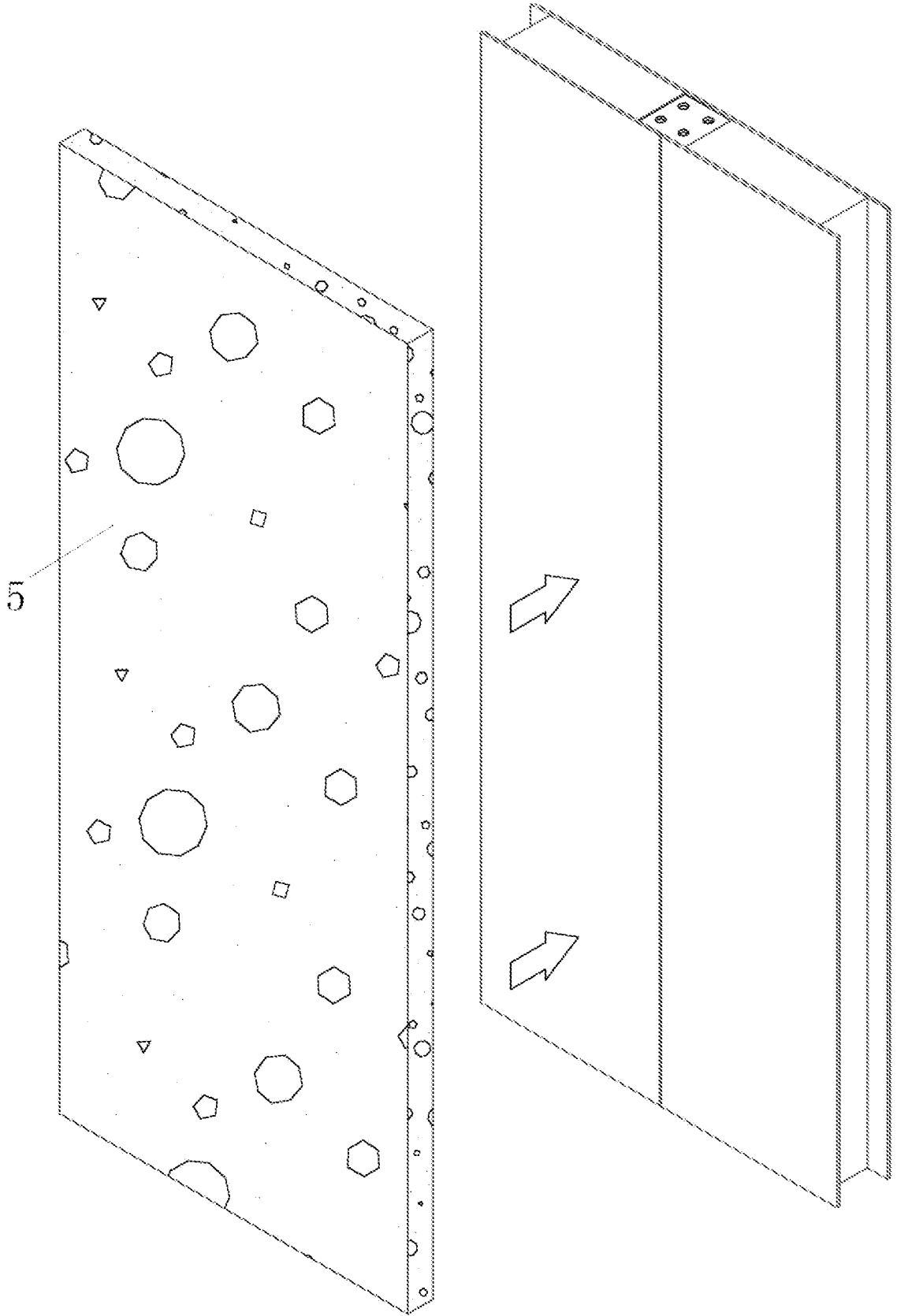


FIG 10

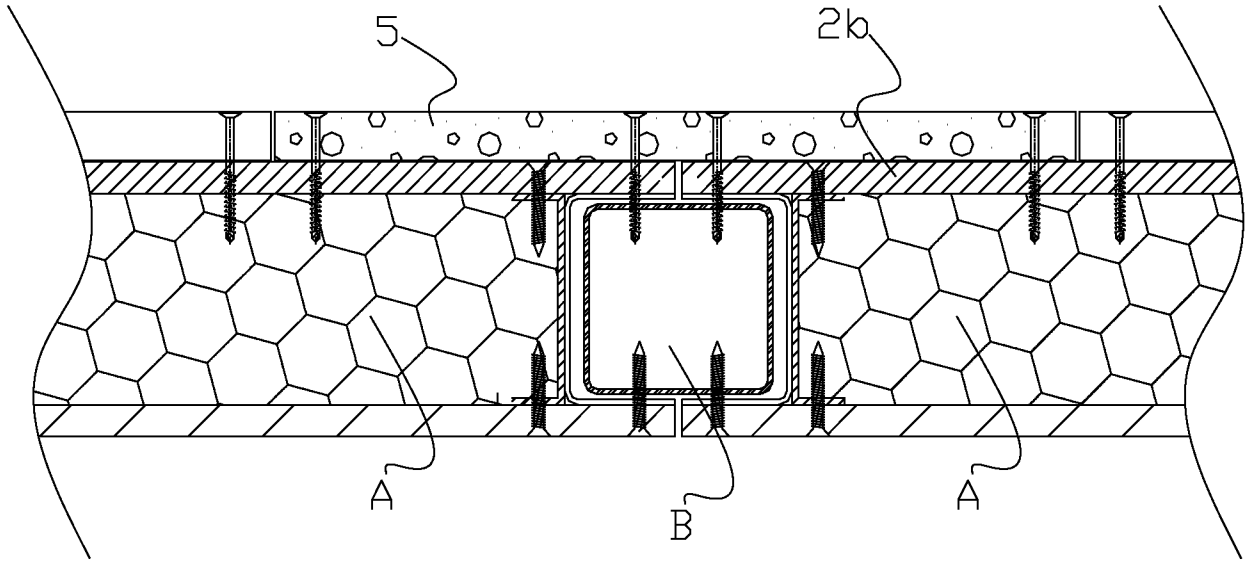


FIG 11

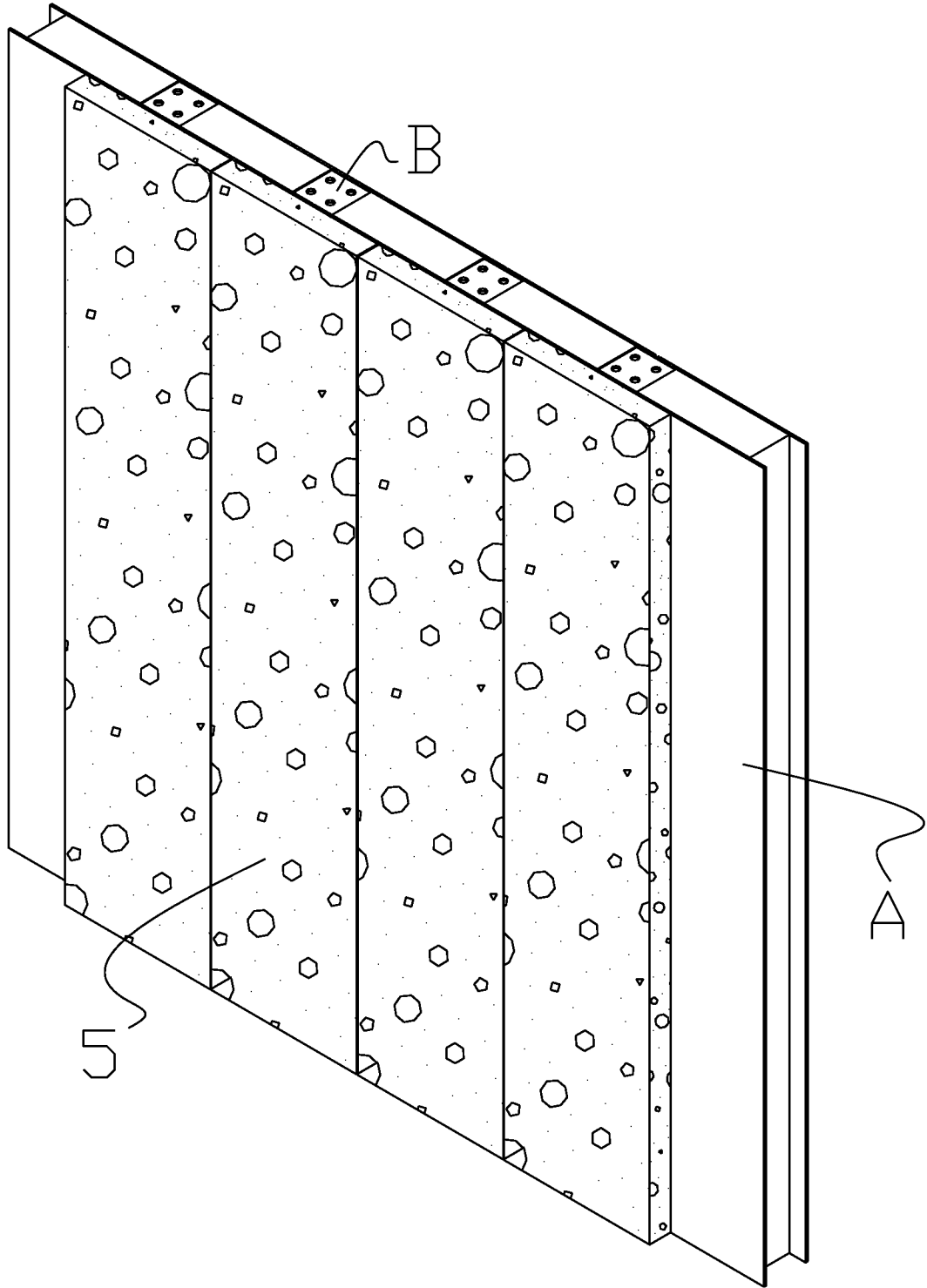


FIG 12