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(54) PREFABRICATED CAST-IN-PLACE CAVITY WALL AND CONSTRUCTION METHOD

(57) The present application relates to the technical field of building construction, and specifically relates to a prefabricated cavity cast-in-place wall and a construction method thereof. The prefabricated cavity cast-in-place wall comprises: a wall body; a plurality of plate connection structures, arranged at least at corners of the wall body, each of the plate connection structures having an accommodating space configured for a corner of a functional plate to be inserted into; and the functional plate, whose corners are inserted into the accommodating spaces of the plate connection structures for fixation. The present application provides a prefabricated cavity cast-in-place wall and a construction method thereof that facilitate the installation of functional plates, have high construction efficiency, and reduce potential water leakage hazards.

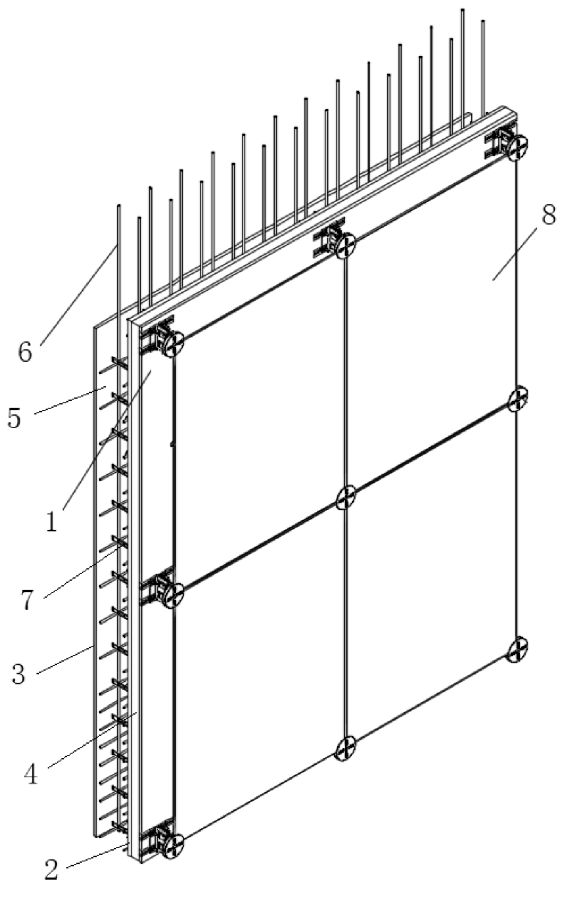


FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to the Chinese patent application filed with the China National Intellectual Property Administration on January 08, 2024, with the application number 202410026940.1 and the invention title "PREFABRICATED CAVITY CAST-IN-PLACE WALL AND CONSTRUCTION METHOD THEREOF", the entire content of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present application relates to the technical field of building construction, and specifically relates to a prefabricated cavity cast-in-place wall and a construction method thereof.

BACKGROUND

[0003] At present, cast-in-place technology is generally used in building construction in China, which requires manual formwork erection and removal operations. After the main body of the building structure is cast and formed, manual plastering and other operations are also needed, resulting in high production costs. For this reason, prefabricated buildings have emerged, which feature fast construction speed, low noise, and little environmental pollution. In order to meet further demand, it is necessary to add some functional plates to the outer surface of prefabricated walls, such as photovoltaic panels, stone plates, or glass curtain walls. Currently, in China's construction industry, photovoltaic panels are generally installed on building walls or roofs by using the BAPV (Building Attached Photovoltaic) method. That is, the photovoltaic system is directly covered on the building surface, and the photovoltaic system does not conflict with the building functions, nor does it damage or weaken the original functions of the building. It is also called an "installation-type" solar photovoltaic building. BAPV has some shortcomings in aspects such as the architectural appearance of the photovoltaic system, design life, roof stress, waterproof reliability, construction difficulty and speed, and roof operation and maintenance.

[0004] Building Appearance: In traditional post-installed photovoltaic power generation projects, supports and photovoltaic cell panels are installed later on colored profiled metal sheets, making the roof messy and poor in integrity.

[0005] Design Life: BAPV photovoltaic modules are completely exposed in an open-air environment and will be eroded by wind and rain all year round, with a service life of generally 20 years.

[0006] Roof Stress: The profiled metal sheets and post-installed photovoltaic cell panels in the BAPV system are subject to complex stress, with both positive and negative wind loads acting between them. Long-term action will produce fatigue effects, affecting structural safety.

[0007] Waterproof Reliability: BAPV requires the installation of profiled metal sheets on the roof first, and then secondary manual installation of photovoltaic modules and other equipment later. The high load during construction will cause deformation of the metal sheets, producing potential water leakage hazards.

[0008] Construction Difficulty and Speed: The BAPV system requires two-phase construction, resulting in a long period. At the same time, the construction of upstandingseam aluminum-magnesium-manganese roof panels is difficult.

[0009] Roof Operation and Maintenance: The secondary construction of the BAPV system causes roof deformation, leading to potential water leakage hazards and high maintenance difficulty.

SUMMARY OF THE INVENTION

[0010] Therefore, the technical problem to be solved by the present application is to overcome the defects in the prior art that prefabricated walls are inconvenient for installing functional plates, have low construction efficiency, and have potential water leakage hazards. Thus, a prefabricated cavity cast-in-place wall and a construction method thereof that facilitate the installation of functional plates, have high construction efficiency, and reduce potential water leakage hazards are provided.

[0011] To solve the above technical problem, the present application provides a prefabricated cavity cast-in-place wall that comprises:

a wall body;
a plurality of plate connection structures, arranged at least at corners of the wall body, each of the plate connection structures having an accommodating space configured for a corner of a functional plate to be inserted into;
the functional plate, whose corners are respectively inserted into the accommodating spaces of the plate connection structures for fixation.

[0012] Optionally, at least three of the plate connection structures are arranged to be spaced apart on each side edge of the wall body, at least four functional plates are provided, and the mutually adjacent corners of the at least four functional plates are inserted into four parts of the accommodating space of a same plate connection structure.

[0013] Optionally, the functional plate is a photovoltaic panel, a stone plate, a metal plate or a glass curtain wall.

[0014] Optionally, the wall body comprises:

a first wall panel, a second wall panel and a third wall panel arranged in parallel and spaced apart in sequence; a first cavity is formed between the first wall panel and the second wall panel, and a thermal insulation board is arranged in the first cavity; a second cavity is formed between the second wall panel and the third wall panel, a steel bar assembly and a first tension assembly are arranged in the second cavity, and the second cavity is configured for concrete casting; the first tension assembly is configured to interconnect the second wall panel and the third wall panel;

the wall body further comprises a second tension assembly, one end of the second tension assembly is fixed to the first wall panel, and the other end of the second tension assembly passes through the thermal insulation board and the second wall panel in sequence and then extends into the second cavity.

[0015] Optionally, each of the plate connection structures comprises:

a first connection assembly, configured to be fixedly connected to the first wall panel;

an adjustment assembly, comprising a first adjustment part configured to be connected to the first connection assembly and a second adjustment part connected to the first adjustment part; the first adjustment part and the second adjustment part are configured to move in different directions relative to the first connection assembly before being fixed;

a second connection assembly, configured to be connected to the second adjustment part and form the accommodating space for accommodating and fixing the functional plate by plug-in fit with the second adjustment part.

[0016] Optionally, the first connection assembly comprises at least one mounting plate with a groove and at least two first fasteners arranged in the groove; the mounting plate is embedded in the first wall panel for fixation, and the groove extends along a first direction; the first adjustment part is provided with a first through hole allowing the first fastener to pass through; the first fastener is configured to move along the first direction under external force and be tightened after reaching a predetermined position.

[0017] Optionally, the first adjustment part comprises a pair of L-shaped folded plates that are oppositely arranged; each L-shaped folded plate comprises a horizontal plate arranged parallel to the mounting plate and a vertical plate arranged perpendicular to the mounting plate; the first through hole is arranged in the horizontal plate; the vertical plate is provided with a second through hole, and the second through hole has an adjustment margin along a second direction; a space allowing the second adjustment part to be inserted into is arranged between the two vertical plates; the second adjustment part is provided with a third through hole, and the third through hole has an adjustment margin along a third direction; a second fastener is configured to pass through the second through hole and the third through hole, move along the second direction and the third direction under external force, and be tightened after reaching a predetermined position; wherein any two of the first direction, the second direction and the third direction are perpendicular to each other.

[0018] Optionally, an extending end of the second adjustment part away from the first connection assembly extends out of the space to be connected to the second connection assembly; the second connection assembly comprises a first connection plate, a second connection plate arranged to be spaced apart, and a strip block arranged between the first connection plate and the second connection plate; the first connection plate is provided with a first penetration slot allowing the extending end of the second adjustment part to pass through and a second penetration slot allowing part of the strip block to be inserted into; the first penetration slot and the second penetration slot are arranged perpendicular to each other; a third fastener passes through a fourth through hole in the second connection plate and is fastened to the strip block; a fourth fastener passes through a fifth through hole in the second connection plate and the first penetration slot and then is fastened to the second adjustment part.

[0019] Optionally, the middle part of the strip block is further provided with two spaced fastening ends extending towards the first connection assembly; correspondingly, the first penetration slot is provided with an extended groove allowing the two fastening ends to pass through; the extending end of the second adjustment part is provided with an open groove that can be plug-fitted with a part of the strip block between the two fastening ends, so that the extending end of the second adjustment part and the strip block cross each other and form the accommodating space with the first connection plate and the second connection plate; the two fastening ends pass through the extended groove and then are clamped on opposite sides of the second adjustment part, and are fixed thereon by a fifth fastener.

[0020] The present application also provides a construction method for the prefabricated cavity cast-in-place wall as described above, wherein the wall body comprises:

a first wall panel, a second wall panel and a third wall panel arranged in parallel and spaced apart in sequence; a first cavity is formed between the first wall panel and the second wall panel, and a thermal insulation board is arranged in the first cavity; a second cavity is formed between the second wall panel and the third wall panel, a steel bar assembly and a first tension assembly are arranged in the

second cavity, and the second cavity is configured for concrete casting; the first tension assembly is configured to interconnect the second wall panel and the third wall panel;
the method comprises the following steps:

installing and fixing a part of each of the plurality of plate connection structures at corners of an area formed by a mold of the first wall panel respectively, casting concrete for the first wall panel, placing the thermal insulation board onto a surface of the concrete of the first wall panel before the concrete of the first wall panel solidifies, and arranging the part of each of the plate connection structures to pass through the thermal insulation board;
casting concrete for the second wall panel on the thermal insulation board, overlapping and pressing a mold of the third wall panel, the steel bar assembly and the first tension assembly that have been assembled together onto the concrete of the second wall panel before the concrete of the second wall panel solidifies, and inserting the first tension assembly into the concrete of the second wall panel;
casting concrete for the third wall panel, and performing curing operation after forming;
inserting the corners of the functional plate into the accommodating spaces respectively formed by another part of each of the plate connection structures for fixation.

[0021] The technical solution of the present application has the following advantages:

1. In the prefabricated cavity cast-in-place wall provided by the present application, when it is necessary to install the functional plate with the wall, it is only required to insert the corners of the functional plate into the accommodating spaces of the plate connection structures for fixation, and there is no need to additionally arrange profiled metal sheets, so it makes the installation more convenient; there is no need for secondary construction, so it results in high construction efficiency and reduced potential safety hazards and water leakage hazards; and there is no need to risk damaging the wall itself and the functional plate, so it ensures the reliability of the installation.
2. In the prefabricated cavity cast-in-place wall provided by the present application, at least three of the plate connection structures are arranged to be spaced apart on each side edge of the wall body, which facilitates the simultaneous installation and fixation of multiple functional plates, and when one of the functional plates is damaged and needs to be replaced, disassembly and reassembly are more convenient, and the cost is further reduced at the same time.
3. In the prefabricated cavity cast-in-place wall provided by the present application, when it is necessary to connect the functional plate to the first wall panel, it is only required to first adjust the positions of the first adjustment part and the second adjustment part so that the accommodating spaces in the same row or column are aligned, and then insert the corners of the functional plate into the respective accommodating spaces between the second connection assembly and the second adjustment part, which not only avoids damaging the functional plate and the first wall panel, but also ensures the reliability of the connection.
4. In the prefabricated cavity cast-in-place wall provided by the present application, the adjustment of the plate connection structure in the first direction, the second direction, and the third direction is realized by the movement of the first fastener in the first groove, and the movement of the second fastener in the second through hole and the third through hole. The structure is simple and the adjustment is convenient.
5. In the prefabricated cavity cast-in-place wall provided by the present application, the extending end of the second adjustment part extends to a position between the first connection plate and the second connection plate and crosses the strip block to form an accommodating space for the functional plate together with the first connection plate and the second connection plate, which not only avoids damaging the functional plate, but also ensures stable connection due to the squeezing effect of the first connection plate and the second connection plate.
6. In the construction method of the prefabricated cavity cast-in-place wall provided by the present application, the thermal insulation board is integrated into the wall body by factory prefabrication, which effectively improves the thermal insulation performance of the wall body. The prefabricated wall body has a hollow structure, leaving the main structure part to be cast on-site, which can reduce the weight of prefabricated components and is beneficial for hoisting and transportation. The thermal insulation layer is connected to the main structure by the second tension assembly, which can effectively prevent safety accidents such as the peeling of the thermal insulation layer. The thermal insulation board, the plate connection structures, and the prefabricated wall body are integrated in the factory, thereby eliminating a large number of manual operations at the construction site and improving construction efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] To more clearly illustrate the technical solu-

tions in the specific implementations of the present application or in the prior art, the drawings that are needed for describing the specific implementations or the prior art are briefly introduced below. Apparently, the drawings described below only represent some implementations of the present application, and those skilled in the art can obtain other drawings from these drawings without creative efforts.

FIG. 1 is a schematic diagram of the prefabricated cavity cast-in-place wall provided by the present application;

FIG. 2 is a side view of the prefabricated cavity cast-in-place wall provided by the present application;

FIG. 3 is a partial schematic diagram of FIG. 1;

FIG. 4 is a schematic diagram of the plate connection structure;

FIG. 5 is an exploded view of FIG. 4;

FIGS. 6 to 12 are diagrams showing the construction steps of the prefabricated cavity cast-in-place wall.

[0023] Reference numerals:

1, first wall panel; 2, second wall panel; 3, third wall panel; 4, thermal insulation board; 5, second cavity; 6, steel bar assembly; 7, first tension assembly; 8, functional plate; 9, groove; 10, mounting plate; 11, first fastener; 12, second tension assembly; 13, first adjustment part; 14, second adjustment part; 15, l-shaped folded plate; 16, horizontal plate; 17, vertical plate; 18, first through hole; 19, second through hole; 20, second fastener; 21, third through hole; 22, mounting hole; 23, first connection plate; 24, second connection plate; 25, strip block; 26, first penetration slot; 27, second penetration slot; 28, fifth through hole; 29, fourth through hole; 30, fastening end; 31, sixth through hole; 32, extended groove; 33, open groove; 34, opening; 35, fifth fastener; 36, third fastener; 37, fourth fastener; 38, first mold table; 39, second mold table; 40, connector.

DETAILED DESCRIPTION

[0024] The technical solutions of the present application will be clearly and completely described below with reference to the accompanying drawings, and apparently, the described embodiments only represent part of the embodiments of the present application, not all of them. Based on the embodiments described in the present application, all other embodiments obtainable by those skilled in the art without creative work fall within the scope of protection of the present application.

[0025] In addition, the technical features involved in the different embodiments of the present application described below can be combined with each other as long as there is no conflict between them.

[0026] As shown in FIGS. 1 to 3, it is a specific implementation of the prefabricated cavity cast-in-place wall of the present embodiment, comprising a wall body composed of a first wall panel 1, a second wall panel 2 and a third wall panel 3 arranged in parallel and spaced apart in sequence; a first cavity is formed between the first wall panel 1 and the second wall panel 2, and a thermal insulation board 4 is arranged in the first cavity; a second cavity 5 is formed between the second wall panel 2 and the third wall panel 3; a steel bar assembly 6 and a first tension assembly 7 are arranged in the second cavity 5, and the second cavity 5 is configured for concrete casting; the first tension assembly 7 is configured to interconnect the second wall panel 2 and the third wall panel 3. Three of the plate connection structures are arranged to be spaced apart on each side edge of the first wall panel 1, and each of the plate connection structures has an accommodating space configured for a corner of a functional plate 8 to be inserted into. Specifically, one plate connection structure is arranged at each of the four corners of the first wall panel 1, and another plate connection structure is arranged between every two adjacent plate connection structures at the corners; the corners of four functional plates 8 are respectively inserted into the accommodating spaces of the corresponding plate connection structures for fixation, and the mutually adjacent corners of the four functional plates 8 are inserted into four parts of the accommodating space of a same plate connection structure located in the center. The two lower plate connection structures are used to support the weight of the functional plates 8, and the two upper plate connection structures are used to hold the functional plates 8 to prevent them from tipping over. The functional plate 8 is a photovoltaic panel, a stone plate, a metal plate, or a glass curtain wall. In this embodiment, a photovoltaic panel is taken as an example for description, and there is no specific limitation here.

[0027] Specifically, the steel bar assembly 6 comprises horizontal steel bars, vertical steel bars, tie bars, etc.; and the horizontal steel bars, vertical steel bars, and tie bars cross each other to ensure a firm connection. One end of the first tension assembly 7 is anchored in the second wall panel 2, and the other end thereof is anchored in the third wall panel 3.

[0028] A specific implementation of the plate connection structure shown in FIGS. 4 and 5 comprises a first connection assembly configured to be fixedly connected to the first wall panel 1, an adjustment assembly, and a second connection assembly configured to be connected to the adjustment assembly.

[0029] The first connection assembly comprises at least one mounting plate 10 with a groove 9 and at least two first fasteners 11 arranged in the groove 9; the mounting plate 10 is embedded in the first wall panel 1 for fixation and is flush with the outer surface of the first wall panel 1; the groove 9 extends along a first direction. Of course, the mounting plate 10 can also be fixed on the outer surface of the first wall panel 1 by bolts, which is not specifically limited here. Option-

ally, this embodiment comprises a pair of mounting plates 10 arranged in parallel and spaced apart, the mounting plate 10 can be formed by integrally bending a steel plate into a C-shape, and the groove 9 is formed between the opening of the C-shape and the side walls thereof, and the first direction is the X-direction shown in FIG. 5. The first fastener 11 comprises a first bolt, a nut sleeved on the first bolt, and a limiting plate. During installation, one end of the first bolt provided with the limiting plate is inserted into the groove 9, and after being adjusted to a suitable position, the nut is tightened. Optionally, the nut is a hexagonal nut, and the limiting plate is a square plate with a side length larger than the width of the notch of the groove, so as to prevent the square plate from slipping out in the direction perpendicular to the first wall panel 1.

[0030] Furthermore, in order to ensure the reliability of the connection between the first wall panel 1, the thermal insulation board 4, and the second wall panel 2, the wall body further comprises a second tension assembly, one end of the second tension assembly 12 is fixed to the first wall panel 1, and the other end of the second tension assembly 12 passes through the thermal insulation board 4 and the second wall panel 2 in sequence and then extends into the second cavity 5. The material of the second tension assembly 12 comprises, but is not limited to, metal or artificially synthesized composite materials.

[0031] The adjustment assembly comprises a first adjustment part 13 configured to be connected to the first connection assembly and a second adjustment part 14 connected to the first adjustment part 13; the first adjustment part 13 and the second adjustment part 14 are configured to move in different directions relative to the first connection assembly before being fixed. Specifically, the first adjustment part 13 comprises a pair of L-shaped folded plates 15 that are oppositely arranged. Each L-shaped folded plate 15 comprises a horizontal plate 16 arranged parallel to the mounting plate 10 and a vertical plate 17 arranged perpendicular to the mounting plate 10, that is, the horizontal plate 16 and the vertical plate 17 are integrally processed and formed to be perpendicular to each other. The horizontal plate 16 is provided with a first through hole 18 that allows the first fastener 11 to pass through, and two first through holes 18 are distributed in the vertical direction to correspond to the grooves 9 on two mounting plates 10 respectively. After the end of the first bolt passes through the first through hole 18, it moves along the first direction under external force and is tightened by a nut after reaching a predetermined position. The vertical plate 17 is provided with two second through holes 19 distributed in the vertical direction, and each of the second through hole 19 has an adjustment margin along a second direction, that is, the second through hole 19 is oblong, and its length is greater than the diameter of the second fastener 20, the second fastener 20 is a second bolt with an anti-falling part, and the anti-falling part is a rectangular parallelepiped with a width greater than the diameter of the main body part of the second bolt. A space allowing the second adjustment part 14 to be inserted into is arranged between the two vertical plates 17; the second adjustment part 14 is a rectangular steel plate and is provided with a third through hole 21, and the third through hole 21 has an adjustment margin along a third direction, that is, the third through hole 21 is oblong, and its length is greater than the diameter of the second fastener 20, and it is arranged to correspond to the second through hole 19; the second fastener 20 is configured to pass through the second through hole 19 and the third through hole 21 in sequence, move along the second direction and the third direction under external force, and be tightened after reaching a predetermined position; wherein any two of the first direction, the second direction and the third direction are perpendicular to each other, the second direction is the Y-direction as shown in FIG. 5, and the third direction is the Z-direction as shown in FIG. 5.

[0032] The surfaces where the vertical plate 17 is in contact with the second adjustment part 14 and the larger end of the second fastener 20, and the surfaces where the horizontal plate 16 is in contact with the larger end of the first fastener 11 are all provided with concave-convex layers. Specifically, the concave-convex layers can be toothed grooves or stripes extending along the Z-direction or X-direction, so as to improve the fastening force of the connection by increasing friction force. At the same time, the end faces of the smaller ends of the first fastener 11 and the second fastener 20 are provided with grooves, which play a role of marking when the first fastener 11 is assembled with the horizontal plate 16 and when the second fastener 20 is assembled with the vertical plate 17, so as to ensure that the concave-convex layers are engaged with each other after the assembling is completed.

[0033] An extending end of the second adjustment part 14 away from the first connection assembly extends out of the space to be connected to the second connection assembly; and a plurality of mounting holes 22 are formed in the end face of the extending end of the second adjustment part 14 facing the second connection assembly.

[0034] The second connection assembly is configured to form the accommodating space for accommodating and fixing the functional plate 8 by plug-in fit with the second adjustment part 14. Specifically, the second connection assembly comprises a first connection plate 23, a second connection plate 24 arranged to be spaced apart, and a strip block 25 arranged between the first connection plate 23 and the second connection plate 24, and both the first connection plate 23 and the second connection plate 24 are circular plates; the first connection plate 23 is provided with a first penetration slot 26 allowing the extending end of the second adjustment part 14 to pass through and a second penetration

slot 27 allowing part of the strip block 25 to be inserted into; the first penetration slot 26 and the second penetration slot 27 are arranged perpendicular to each other, that is, the extending direction of the first penetration slot 26 is the Y-direction, and the extending direction of the second penetration slot 27 is the X-direction. The second connection plate 24 is provided with a plurality of fifth through holes 28 and a plurality of fourth through holes 29 at positions corresponding to the first penetration slot 26 and the second penetration slot 27 respectively. The middle part of the strip block 25 is further provided with two spaced fastening ends 30 extending towards the first connection assembly, specifically, the fastening ends 30 are two protrusion blocks, and a sixth through hole 31 is provided to extend between two sides of each fastening end 30; correspondingly, the first penetration slot 26 is provided with an extended groove 32 allowing the two fastening ends 30 to pass through, that is, the middle part of the first penetration slot 26 extends towards a direction away from the center of the circle to form the extended groove 32; the extending end of the second adjustment part 14 is provided with an open groove 33 that can be plug-fitted with a part of the strip block 25 between the two fastening ends 30, optionally, the extending length of the two protrusion blocks is greater than the depth of the open groove 33, so that the extending end of the second adjustment part 14 can pass through the first penetration slot 26 and then cross the strip block 25 to form an accommodating space with the first connection plate 23 and the second connection plate 24; the two fastening ends 30 pass through the extended groove 32 and then are clamped on opposite sides of the second adjustment part 14; an opening 34 is provided in the second adjustment part 14 at a position corresponding to the two fastening ends 30, and a fifth fastener 35 passes through the sixth through hole 31 and the opening 34 and then fixes the strip block 25 to the second adjustment part 14. The length of the accommodating space along the Z-direction is equal to or slightly smaller than the width of the functional plate 8, so as to apply a certain clamping force to ensure the reliability of installation. A third fastener 36 passes through the fourth through hole 29 in the second connection plate 24 and is fastened in the hole of the strip block 25; a fourth fastener 37 passes through a fifth through hole 28 in the second connection plate 24 and the first penetration slot 26 and then is fastened to the second adjustment part 14 by being inserted into the mounting hole 22 in the corresponding end face of the second adjustment part 14. This way of crossfixing ensures that the functional plate 8 does not rotate after being placed into the accommodating space, thus ensuring the reliability of installation.

[0035] The second connection plate 24 comprises four arc-shaped plates spliced with each other, and the connection between every two adjacent arc-shaped plates is arranged in a stepped and staggered manner. Specifically, two straight sides of one arc-shaped plate are respectively formed with a protrusion, wherein one protrusion is near the center of the circle and the other protrusion is away from the center of the circle, thereby forming a staggered structure, and each protrusion is provided with a fourth through hole 29 or a fifth through hole 28, so that two adjacent fourth through holes 29 or two adjacent fifth through holes 28 are respectively formed on two arc-shaped plates, thereby ensuring the reliability of the second connection plate formed by splicing, and it can prevent the functional plate 8 from inclining outward. The second connection plate 24 is formed by splicing four arc-shaped plates, which is convenient for installation and maintenance, and the connection between every two adjacent arc-shaped plates is arranged in a staggered manner, which facilitates the installation of the third fastener 36 with the strip block 25 and the installation of the fourth fastener 37 with the second adjustment part 14, thereby further ensuring the reliability of the connection.

[0036] To further fixedly connect the plate connection structure to the first wall panel 1, the first connection assembly further comprises a connector 40 connected to the mounting plate 10, and the connector 40 extends towards a direction away from the second connection assembly. Specifically, the connector 40 is an anchor bolt, the larger end of the anchor bolt is welded and fixed to the mounting plate 10 or fastened thereto by a nut, and the smaller end thereof passes through the first wall panel 1, the thermal insulation board 4, and the second wall panel 2 in sequence and then extends into the second cavity 5. To further increase the connection strength between the connector 40 and the first wall panel 1, a bolt with anchor ends at both ends can also be selected, and the anchor ends are circular, square, etc., in one aspect, the anchor end at the end away from the mounting plate 10 can prevent the first wall panel 1 from falling off along the axial direction of the bolt, and in another aspect, it can increase the contact area with the concrete in the second cavity 5 on the other side of the first wall panel 1, thereby improving the reliability of the connection.

[0037] The construction method for the prefabricated cavity cast-in-place wall shown in FIGS. 6 to 12 comprises the following steps:

assembling a mold of the first wall panel 1 on a first mold table 38, installing and fixing each of the mounting plates 10 of the plurality of plate connection structures at corners of an area formed by the mold of the first wall panel 1 respectively, casting concrete for the first wall panel 1, installing the connectors 40 on the thermal insulation board 4, placing the thermal insulation board 4 onto a surface of the concrete of the first wall panel 1 before the concrete of the first wall panel 1 solidifies, arranging the connector 40 of each of the plate connection structures to pass through the thermal insulation board 4, and anchoring the connectors 40 through the thermal insulation board 4 into the concrete of the first

wall panel 1.

[0038] Casting concrete for the second wall panel 2 on the thermal insulation board 4, hoisting, overlapping and pressing a mold of the third wall panel 3, the steel bar assembly 6 and the first tension assembly 7 that have been assembled together on a second mold table 39 onto the concrete of the second wall panel 2 before the concrete of the second wall panel 2 solidifies, and inserting the first tension assembly 7 into the concrete of the second wall panel 2.

[0039] Casting concrete for the third wall panel 3, and performing curing operation after forming. When the strength reaches the corresponding requirement, removing the tooling and separating it from the mold table.

[0040] Before installing the functional plate, first inserting one end of the first fastener 11 into the groove 9 of the mounting plate 10, passing the other end through the horizontal plate 16 of the first adjustment part 13, adjusting the position of the first fastener 11 in the groove 9, and tightening the first fastener 11. Then inserting the second adjustment part 14 into the space between the pair of L-shaped folded plates 15, passing the second fastener 20 through the first adjustment part 13 and the second adjustment part 14 in sequence, adjusting the corresponding position by moving the second fastener 20 in the second through hole 19 and the third through hole 21, and then fastening it. This adjustment method does not require installing a leveling keel at the construction site, and the adjustment is convenient. Then plugging the first connection plate 23 with the second adjustment part 14, passing the strip block 25 through the second penetration slot 27 in the first connection plate 23, clamping it on both sides of the second adjustment part 14, and fixing it with the fifth fastener 35. Finally, using the third fasteners 36 and the fourth fasteners 37 to pass through the fourth through holes 29 and the fifth through holes 28 in the second connection plate 24 respectively, and then fixing them with the strip block 25 and the second adjustment part 14 to form four parts of the accommodating space for accommodating and supporting the functional plate 8.

[0041] It should be noted that, in actual use, after transporting the wall in this embodiment to the construction site and hoisting it into place according to the design requirements, casting concrete into the second cavity to form the wall. Before casting concrete, the openings of the second cavity at both ends of the wall should be sealed with templates. After the concrete wall reaches the required strength, the photovoltaic panels can be installed. First, levelling each plate connection structure, then removing the outermost arc-shaped plate, supporting the photovoltaic panel on the strip block, making the photovoltaic panel abut against the first connection plate, and installing the arc-shaped plate to fix it after placing it stably. The arc-shaped plates can be installed in an order from top to bottom and from left to right.

[0042] The second wall panel and the third wall panel on both sides of the concrete are templates during concrete casting, and the cast concrete and the steel bar assembly integrated in the second cavity form a structurally load-bearing wall together. The first wall panel, the second wall panel, and the third wall panel should have a certain flexural strength to resist the lateral pressure generated when concrete is cast into the second cavity. The materials used for these wall panels include, but are not limited to, cement-based composite materials, metals, and artificially synthesized composite materials, and any equivalent implementation or modification that does not depart from the principle of the present application shall be included in the scope of the present application. The function of the first tension assembly is to connect the wall panels on both sides of the structural functional area together and jointly resist the lateral pressure during the concrete casting process, and the processing material used for the first tension assembly should have a certain tensile strength, comprising but not limited to metal or artificially synthesized composite materials. The specific shape in this embodiment is only used to explain the present application and not to limit the present application. The function of the second tension assembly is to connect the wall panels on both sides of the thermal insulation functional area together, so that the wall panels with the function of protecting the thermal insulation layer will not fall off. To ensure the reliable connection between the second tension assembly and the wall structure part, one end of the second tension assembly is exposed in the second cavity, and concrete will be cast into the second cavity. After the concrete hardens, the second tension assembly can be reliably fixed in the wall panel and is not easy to fall off. The photovoltaic panel integrates architecture, technology, and aesthetics. The photovoltaic panel can also be hidden under the components during the design and construction process, which can not only prevent direct sunlight and rain erosion, but also would not affect the appearance of the entire building, so it achieves a neat and unified effect. The specific style in the drawings is only used to explain the present application and not to limit the present application. Any equivalent implementation or modification that does not depart from the principle of this embodiment shall be included in the scope of the present application.

[0043] The present application integrates the building photovoltaic panels and thermal insulation function of the wall into the prefabricated component, so that the performance of the wall panel meets the thermal insulation and energy-saving standards, and there is no need for subsequent manual thermal insulation processing operations on the wall panel. The installation of the photovoltaic panel also does not require installing a keel for leveling, which is convenient and fast, and eliminates the safety hazard caused by the peeling of the external wall insulation layer; the wall adopts a cav-

ity structure, which is lighter in weight than the conventional prefabricated concrete external wall panel, is lower in production cost, is higher in production efficiency, reduces labor cost, and shortens the construction period; and large-scale factory production is realized, which is convenient and fast.

[0044] Apparently, the above embodiments are only examples for clear description, and are not intended to limit the implementation ways. For those of ordinary skill in the art, on the basis of the above description, other different forms of changes or modifications can also be made. It is unnecessary and impossible to exhaustively list all the implementation ways here. Any obvious change or modification derived from this is still within the scope of protection of the present invention.

Claims

1. A prefabricated cavity cast-in-place wall, **characterized by** comprising:

   a wall body;
   a plurality of plate connection structures, arranged at least at corners of the wall body, each of the plate connection structures having an accommodating space configured for a corner of a functional plate (8) to be inserted into;
   the functional plate (8), whose corners are respectively inserted into the accommodating spaces of the plate connection structures for fixation.

2. The prefabricated cavity cast-in-place wall according to claim 1, **characterized in that** at least three of the plate connection structures are arranged to be spaced apart on each side edge of the wall body, at least four functional plates (8) are provided, and the mutually adjacent corners of the at least four functional plates are inserted into four parts of the accommodating space of a same plate connection structure.

3. The prefabricated cavity cast-in-place wall according to claim 1, **characterized in that** the functional plate (8) is a photovoltaic panel, a stone plate, a metal plate or a glass curtain wall.

4. The prefabricated cavity cast-in-place wall according to any one of claims 1-3, **characterized in that** the wall body comprises:

   a first wall panel (1), a second wall panel (2) and a third wall panel (3) arranged in parallel and spaced apart in sequence; a first cavity is formed between the first wall panel (1) and the second wall panel (2), and a thermal insulation board (4) is arranged in the first cavity; a second cavity (5) is formed between the second wall panel (2) and the third wall panel (3), a steel bar assembly (6) and a first tension assembly (7) are arranged in the second cavity (5), and the second cavity (5) is configured for concrete casting; the first tension assembly (7) is configured to interconnect the second wall panel (2) and the third wall panel (3);
   the wall body further comprises a second tension assembly (12), one end of the second tension assembly (12) is fixed to the first wall panel (1), and the other end of the second tension assembly (12) passes through the thermal insulation board (4) and the second wall panel (2) in sequence and then extends into the second cavity (5).

5. The prefabricated cavity cast-in-place wall according to claim 4, **characterized in that** each of the plate connection structures comprises:

   a first connection assembly, configured to be fixedly connected to the first wall panel (1);
   an adjustment assembly, comprising a first adjustment part (13) configured to be connected to the first connection assembly and a second adjustment part (14) connected to the first adjustment part (13); the first adjustment part (13) and the second adjustment part (14) are configured to move in different directions relative to the first connection assembly before being fixed;
   a second connection assembly, configured to be connected to the second adjustment part (14) and form the accommodating space for accommodating and fixing the functional plate (8) by plug-in fit with the second adjustment part (14).

6. The prefabricated cavity cast-in-place wall according to claim 5, **characterized in that** the first connection assembly comprises at least one mounting plate (10) with a groove (9) and at least two first fasteners (11) arranged in the groove (9); the mounting plate (10) is embedded in the first wall panel (1) for fixation, and the groove (9) extends along a first direction; the first adjustment part (13) is provided with a first through hole (18) allowing the first fastener (11) to pass through; the first fastener (11) is configured to move along the first direction under external force and be tightened after reaching a predetermined position.

7. The prefabricated cavity cast-in-place wall according to claim 6, **characterized in that** the first adjustment part (13) comprises a pair of L-shaped folded plates (15) that are oppositely arranged; each L-shaped folded plate (15) comprises a hor-

izontal plate (16) arranged parallel to the mounting plate (10) and a vertical plate (17) arranged perpendicular to the mounting plate (10); the first through hole (18) is arranged in the horizontal plate (16); the vertical plate (17) is provided with a second through hole (19), and the second through hole (19) has an adjustment margin along a second direction; a space allowing the second adjustment part (14) to be inserted into is arranged between the two vertical plates (17); the second adjustment part (14) is provided with a third through hole (21), and the third through hole (21) has an adjustment margin along a third direction; a second fastener (20) is configured to pass through the second through hole (19) and the third through hole (21), move along the second direction and the third direction under external force, and be tightened after reaching a predetermined position; wherein any two of the first direction, the second direction and the third direction are perpendicular to each other.

8. The prefabricated cavity cast-in-place wall according to claim 7, **characterized in that** an extending end of the second adjustment part (14) away from the first connection assembly extends out of the space to be connected to the second connection assembly; the second connection assembly comprises a first connection plate (23), a second connection plate (24) arranged to be spaced apart, and a strip block (25) arranged between the first connection plate (23) and the second connection plate (24); the first connection plate (23) is provided with a first penetration slot (26) allowing the extending end of the second adjustment part (14) to pass through and a second penetration slot (27) allowing part of the strip block (25) to be inserted into; the first penetration slot (26) and the second penetration slot (27) are arranged perpendicular to each other; a third fastener (36) passes through a fourth through hole (29) in the second connection plate (24) and is fastened to the strip block (25); a fourth fastener (37) passes through a fifth through hole (28) in the second connection plate (24) and the first penetration slot (26) and then is fastened to the second adjustment part (14).

9. The prefabricated cavity cast-in-place wall according to claim 8, **characterized in that** the middle part of the strip block (25) is further provided with two spaced fastening ends (30) extending towards the first connection assembly; correspondingly, the first penetration slot (26) is provided with an extended groove (32) allowing the two fastening ends (30) to pass through; the extending end of the second adjustment part (14) is provided with an open groove (33) that can be plug-fitted with a part of the strip block (25) between the two fastening ends (30), so that the extending end of the second adjustment part (14) and the strip block (25) cross each other and form the accommodating space with the first connection plate (23) and the second connection plate (24); the two fastening ends (30) pass through the extended groove (32) and then are clamped on opposite sides of the second adjustment part (14), and are fixed thereon by a fifth fastener (35).

10. A construction method for the prefabricated cavity cast-in-place wall according to any one of claims 1-9, **characterized in that** the wall body comprises:

a first wall panel (1), a second wall panel (2) and a third wall panel (3) arranged in parallel and spaced apart in sequence; a first cavity is formed between the first wall panel (1) and the second wall panel (2), and a thermal insulation board (4) is arranged in the first cavity; a second cavity (5) is formed between the second wall panel (2) and the third wall panel (3), a steel bar assembly (6) and a first tension assembly (7) are arranged in the second cavity (5), and the second cavity (5) is configured for concrete casting; the first tension assembly (7) is configured to interconnect the second wall panel (2) and the third wall panel (3);
the method comprises the following steps:

installing and fixing a part of each of the plurality of plate connection structures at corners of an area formed by a mold of the first wall panel (1) respectively, casting concrete for the first wall panel (1), placing the thermal insulation board (4) onto a surface of the concrete of the first wall panel (1) before the concrete of the first wall panel (1) solidifies, and arranging the part of each of the plate connection structures to pass through the thermal insulation board (4);
casting concrete for the second wall panel (2) on the thermal insulation board (4), overlapping and pressing a mold of the third wall panel (3), the steel bar assembly (6) and the first tension assembly (7) that have been assembled together onto the concrete of the second wall panel (2) before the concrete of the second wall panel (2) solidifies, and inserting the first tension assembly (7) into the concrete of the second wall panel (2);
casting concrete for the third wall panel (3), and performing curing operation after forming;
inserting the corners of the functional plate

(8) into the accommodating spaces respectively formed by another part of each of the plate connection structures for fixation.

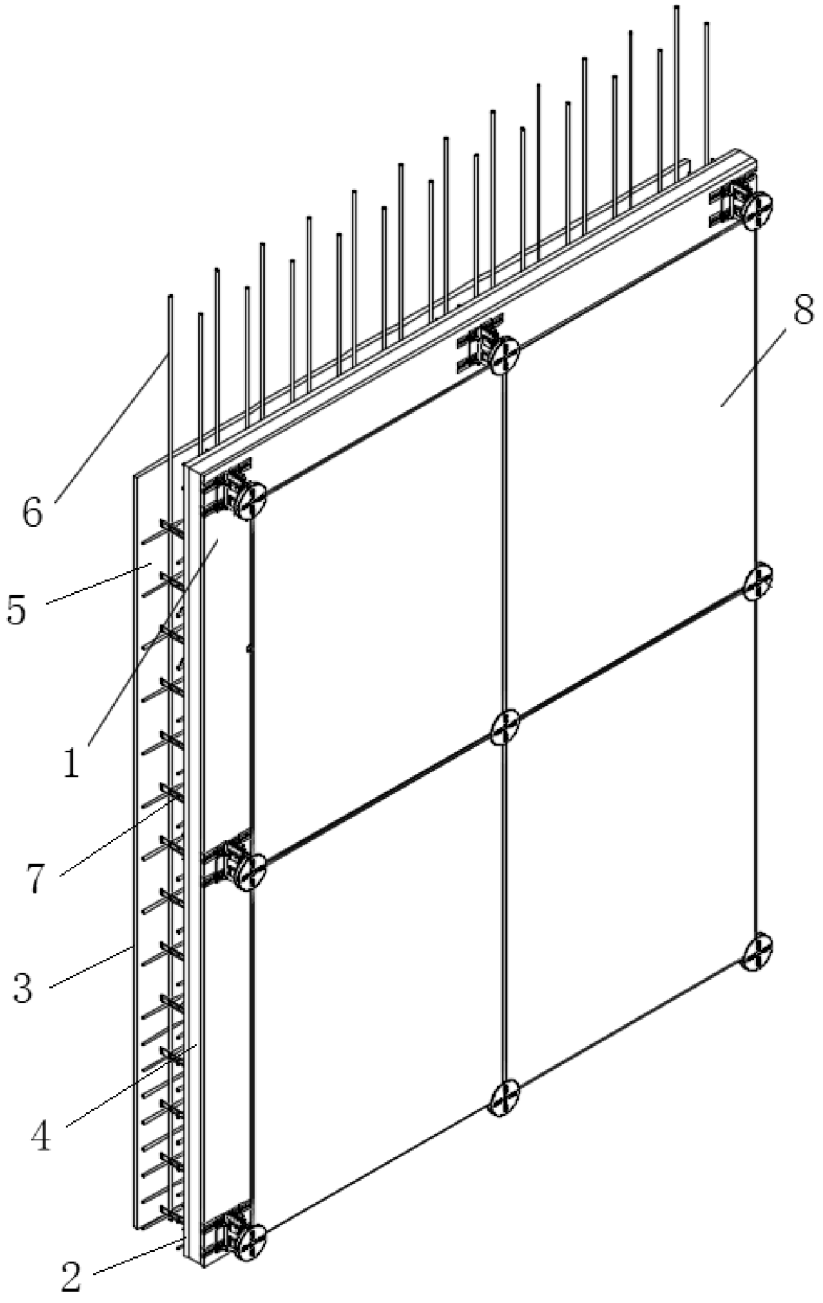


FIG. 1

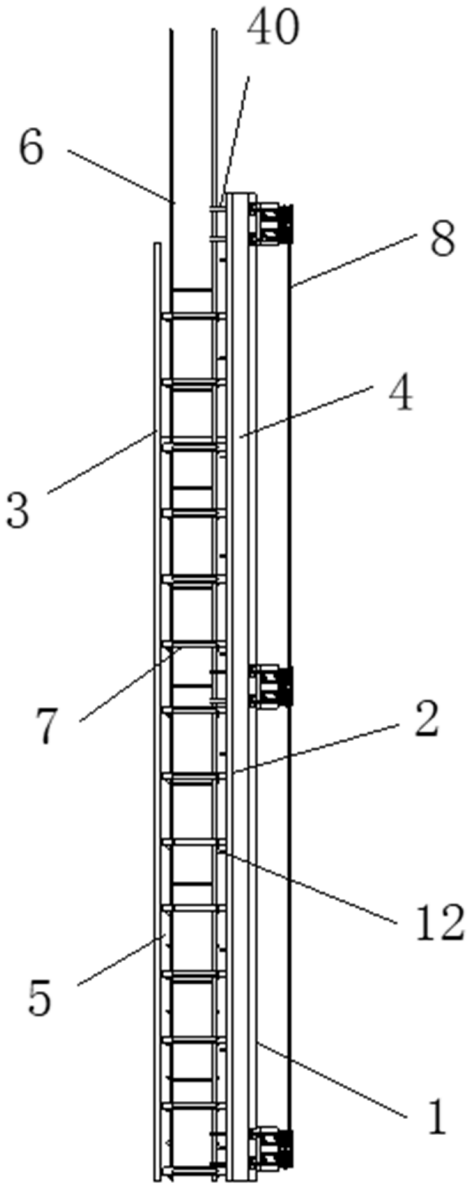


FIG. 2

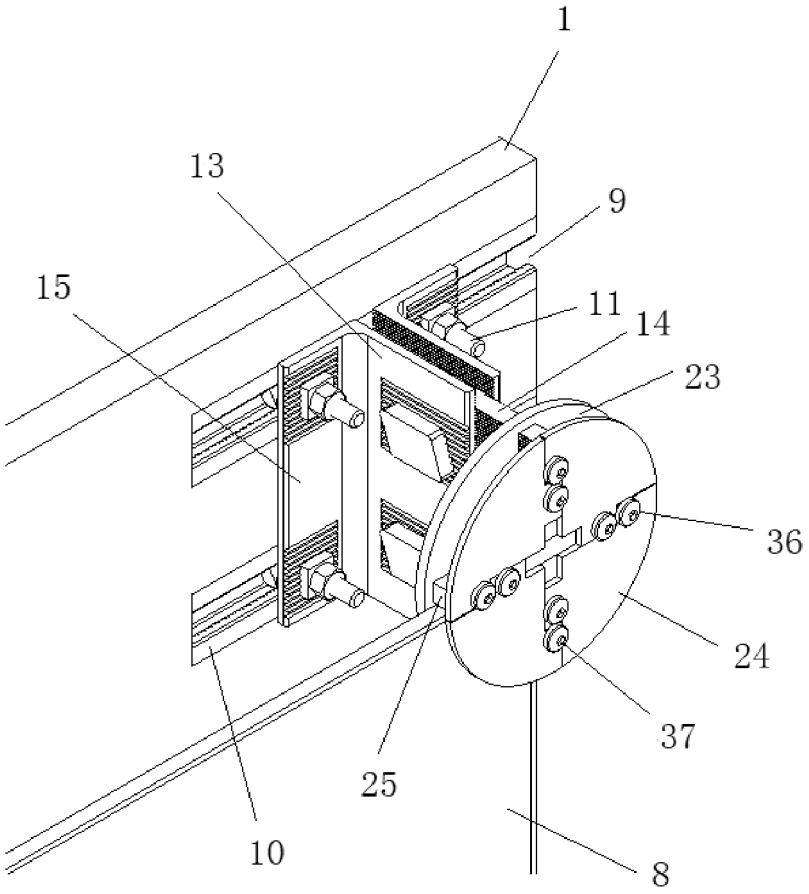


FIG. 3

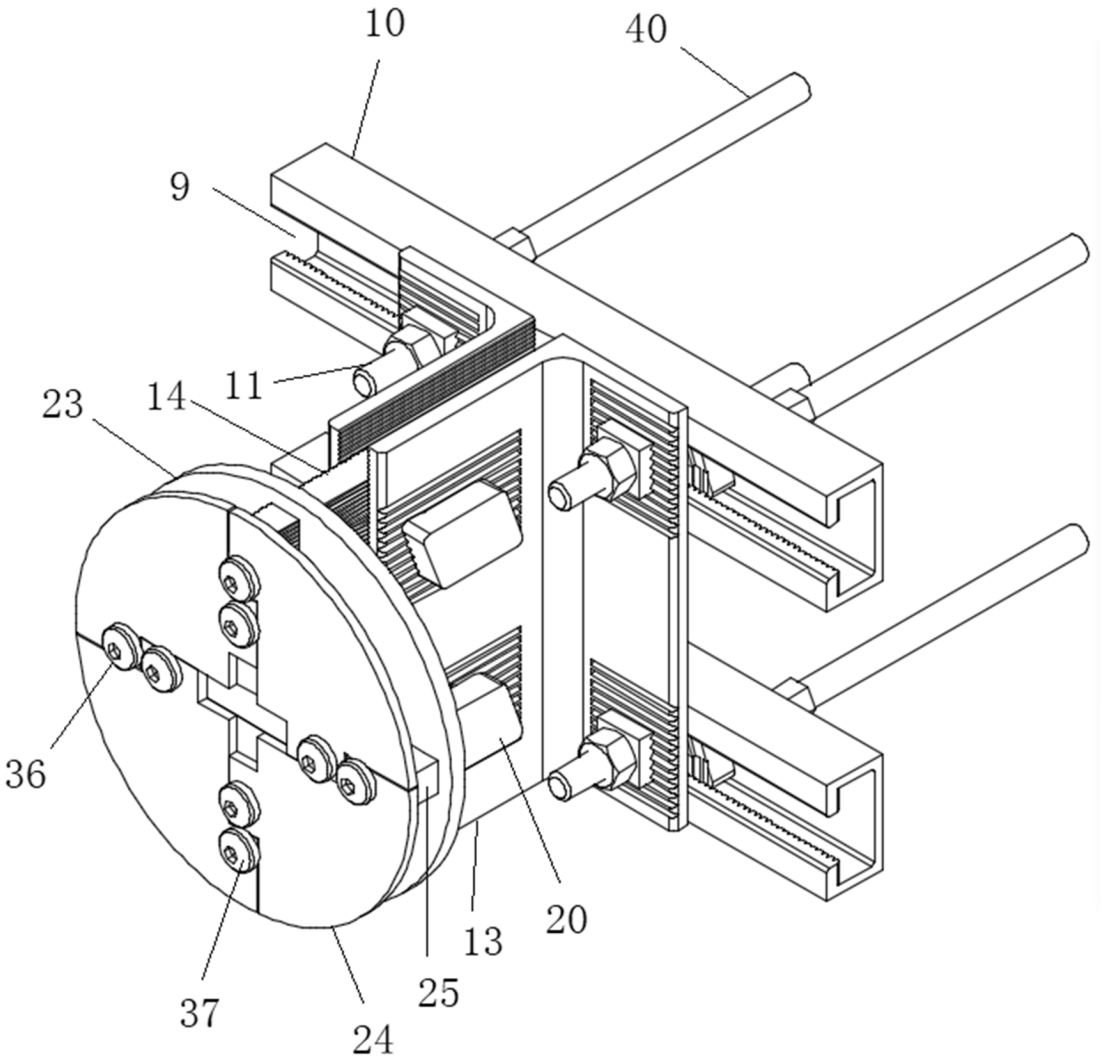


FIG. 4

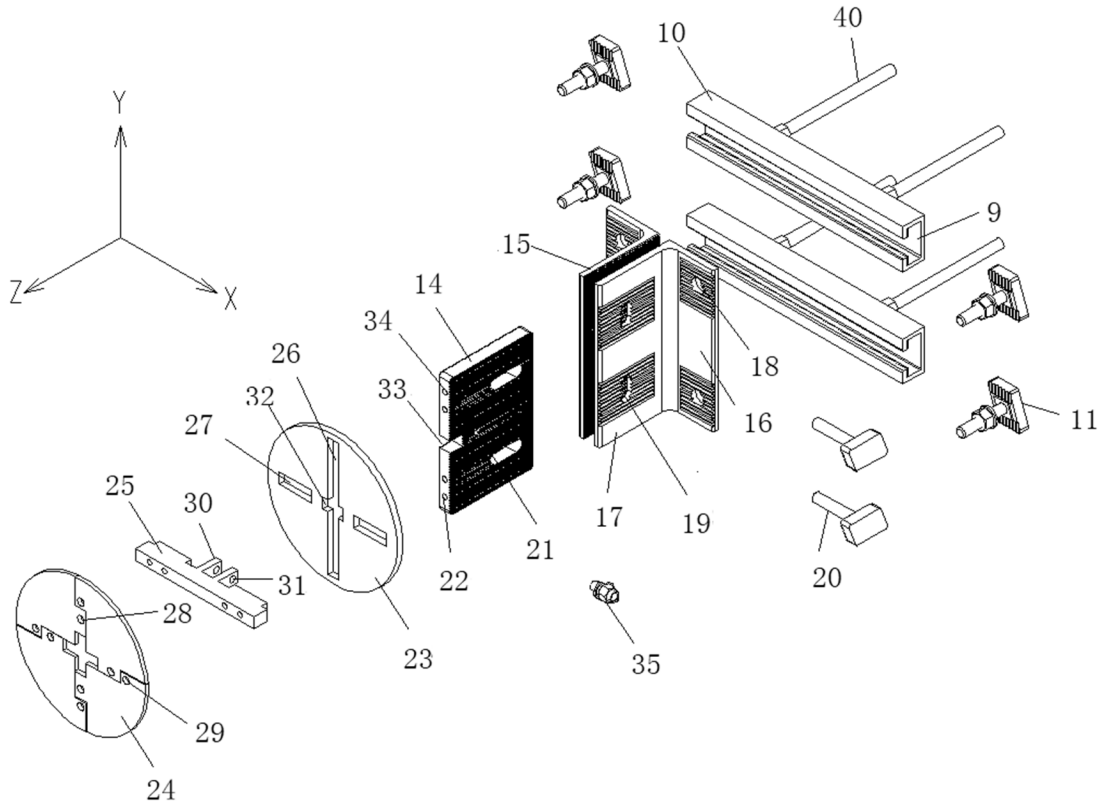


FIG. 5

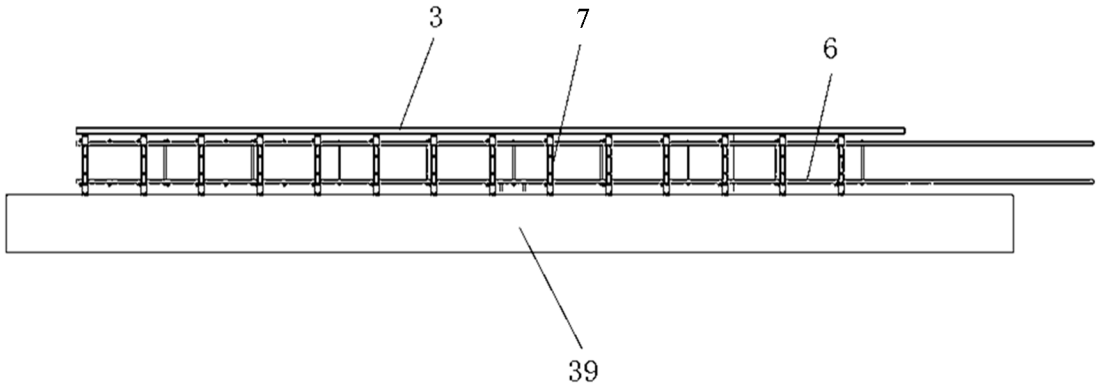


FIG. 6

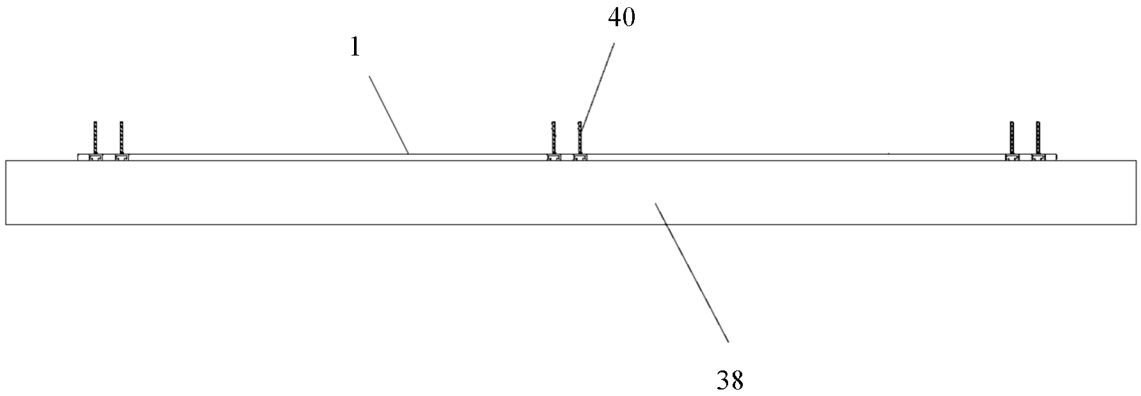


FIG. 7

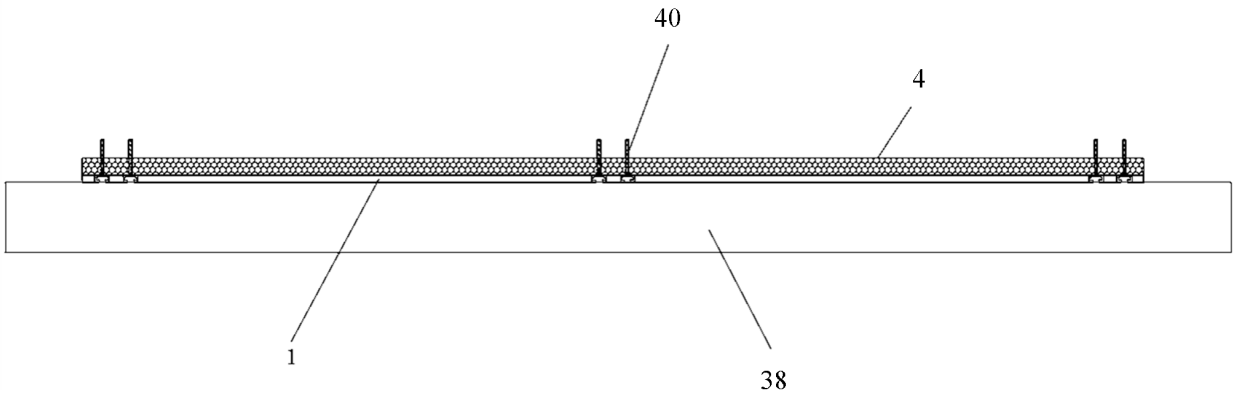


FIG. 8

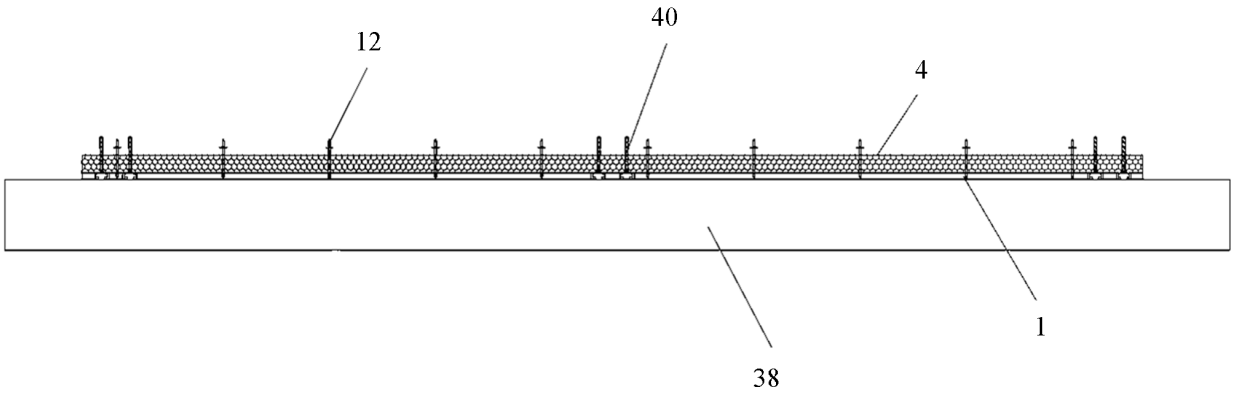


FIG. 9

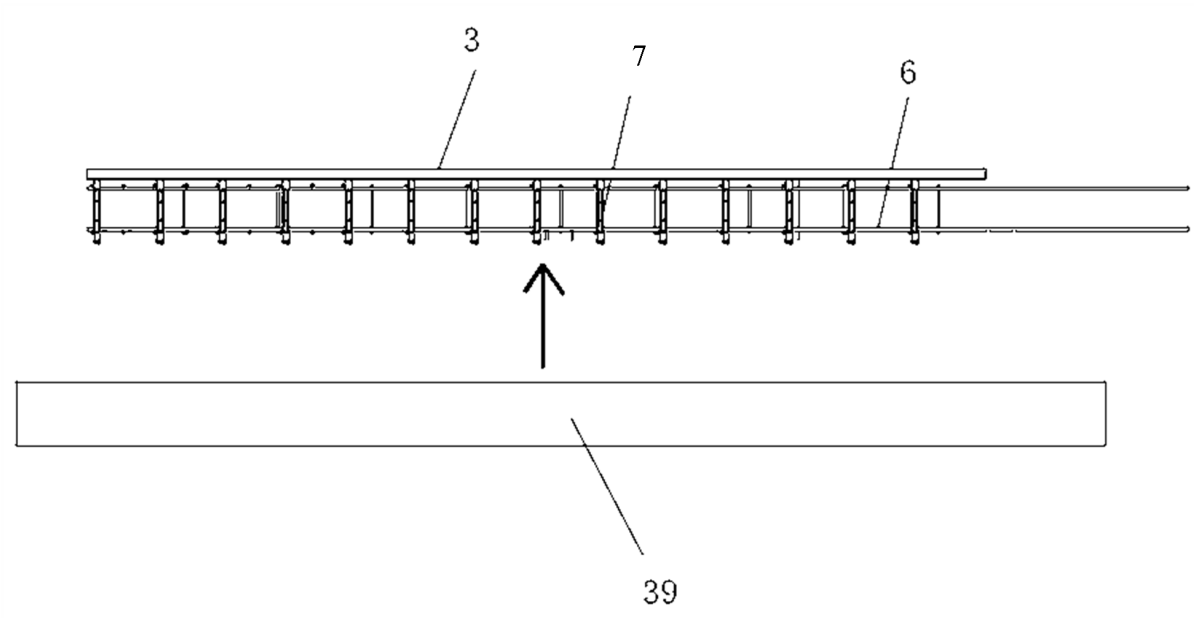


FIG. 10

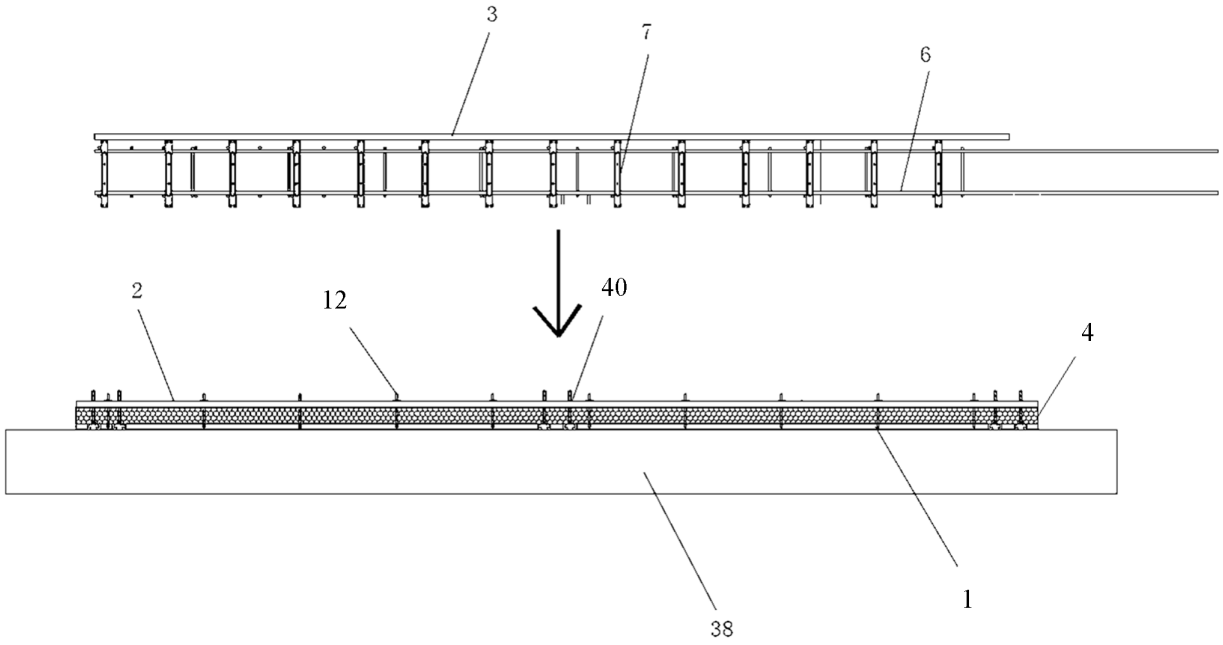


FIG. 11

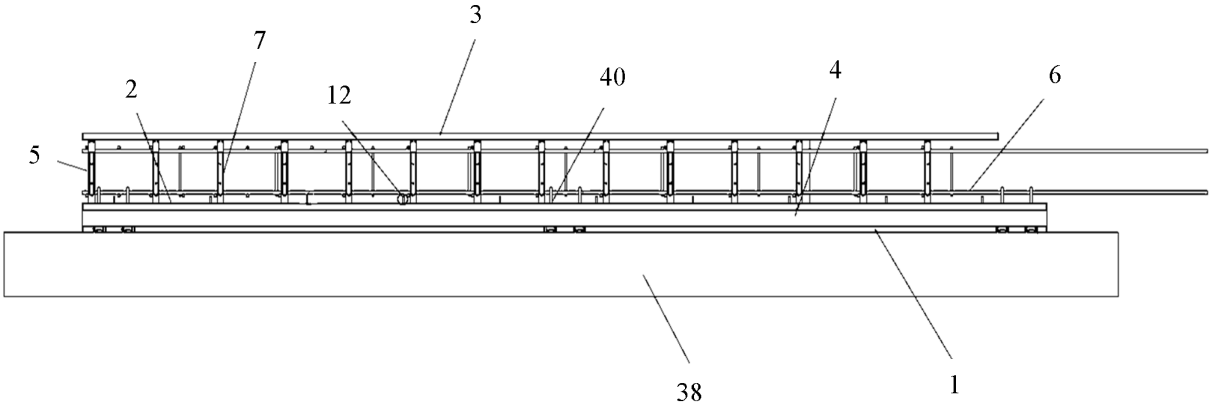


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2025/070980

A. CLASSIFICATION OF SUBJECT MATTER

E04B2/00(2006.01)i; E04B1/76(2006.01)i; B28B7/22(2006.01)i; B28B23/02(2006.01)i; B28B19/00(2006.01)i

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)

IPC:E04B,B28B

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

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

CNTXT; WPABSC; ENTXTC, VEN; USTXT; WOTXT; EPTXT; CNKI: CJFD: 上海衡煦节能环保技术有限公司, 周裕文, 预制, 现浇, 空腔, 墙, 保温, 边角, 功能板, 连接结构, 卡, 夹, 插, wall, cast, prefabricated, panel?, insulation, functional, plate?, board, connect+, insert+, corner?.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 117846172 A (SHANGHAI HENGXU ENERGY SAVING AND ENVIRONMENTAL PROTECTION TECHNOLOGY CO., LTD.) 09 April 2024 (2024-04-09) claims 1-10, description, paragraphs [0003]-[0064], and figures 1-12	1-10
Y	CN 212802100 U (SHANGHAI HENGXU ENERGY SAVING ENVIRONMENTAL PROTECTION TECHNOLOGY CO., LTD.) 26 March 2021 (2021-03-26) description, paragraphs [0005]-[0073], and figures 1-3	1-7, 10
Y	CN 219638292 U (JIANGSU JINGTIAN CONSTRUCTION ENGINEERING CO., LTD.) 05 September 2023 (2023-09-05) description, paragraphs [0034]-[0052], and figures 1-6	1-7, 10
Y	CN 206957001 U (HANGZHOU KUNSHI CONSTRUCTION ENGINEERING CONSULTING CO., LTD.) 02 February 2018 (2018-02-02) description, paragraphs [0013]-[0052], and figures 1-3	5-7
A	CN 209686679 U (KUNSHAN HONGXILAI DECORATION ENGINEERING CO., LTD.) 26 November 2019 (2019-11-26) entire document	1-10

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

* Special categories of cited documents:
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"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 March 2025	**01 April 2025**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088**	Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2025/070980

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2015308098 A1 (AV_NEW S.R.L.) 29 October 2015 (2015-10-29) entire document	1-10
Y	CN 213952623 U (SHANGHAI HENGXU ENERGY SAVING ENVIRONMENTAL PROTECTION TECHNOLOGY CO., LTD.) 13 August 2021 (2021-08-13) description, paragraphs [0004]-[0031], and figures 1-2	1-7, 10

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2025/070980

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 117846172 A	09 April 2024	None	
CN 212802100 U	26 March 2021	None	
CN 219638292 U	05 September 2023	None	
CN 206957001 U	02 February 2018	None	
CN 209686679 U	26 November 2019	None	
US 2015308098 A1	29 October 2015	EP 2915933 A1	09 September 2015
		EP 2915933 A3	23 December 2015
		IT 423553 B	02 August 2016
CN 213952623 U	13 August 2021	None	

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202410026940 **[0001]**