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(54) **PREFABRICATED LIGHT STEEL CONCRETE PLATE COLUMN STRUCTURE AND
CONSTRUCTION METHOD THEREFOR**

(57) A prefabricated lightweight steel reinforced concrete slab-column assembly which is a monolayer or multilayer structure comprises a plurality of vertical prefabricated lightweight steel-reinforced concrete columns (1).

The monolayer or each layer of layer structure comprises a prefabricated lightweight steel-reinforced concrete floor (2) and prefabricated lightweight steel-reinforced

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concrete wall-like supports (3). The prefabricated lightweight steel-reinforced concrete floor (2) is demarcated into a plurality of floor slabs (21) by means of the columns and assembled therewith into the floor. The prefabricated lightweight steel-reinforced concrete wall-like supports (3) are disposed on the prefabricated lightweight steel-reinforced concrete floor (2) and separated apart by the columns so that each of them is sandwiched between two adjacent vertical prefabricated lightweight steel-reinforced (

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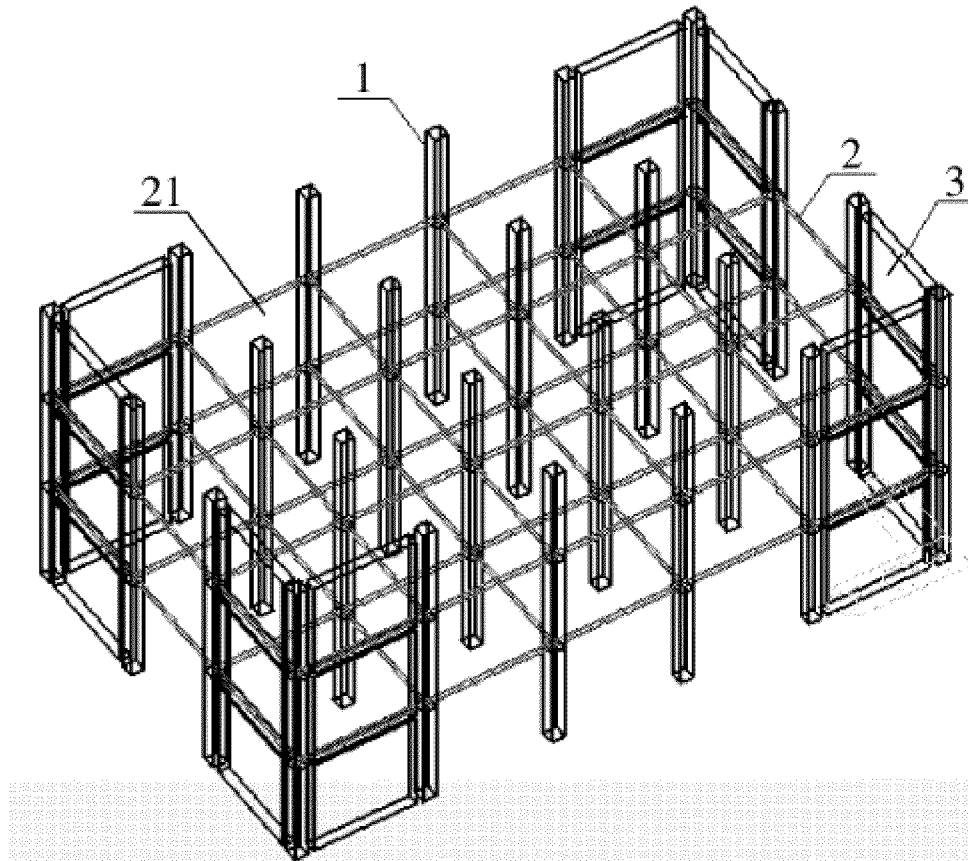


Fig. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of architectural design and, more particularly, to a prefabricated lightweight steel reinforced concrete slab-column assembly and a method for construction thereof.

BACKGROUND

[0002] Prefabricated lightweight steel-reinforced concrete structures are of a type suitable for industrialized construction because of their outstanding advantages such as standardized design, prefabricated production and assembled construction.

[0003] Commonly-used existing assembled monolithic concrete frame, concrete frame-shear wall, complete concrete shear wall and other structures are associated with the following issues or problems:

- 1) the corresponding construction processes involves many field concrete wetting operations which make the processes complicated and inefficient;
- 2) their component prefabrication rates are low (15%-40%) and less possible to be increased; and
- 3) their prefabricated components are of too many types and specifications, which leads to high prefabrication costs in factories and high construction costs and thus inhibits their popularity.

[0004] While existing assembled concrete slab-column structures have eased these issues to a certain extent, they are not resistant enough to lateral loads due to limited stiffness of joints between their prefabricated slabs and columns. Such joints are often subject to complex load conditions and thus impose a great challenge on the assembled design and construction for ensuring sufficient stiffness. Therefore, the existing slab-column structures are not suited to use in the construction of high-rise buildings and their generalization and application suffers from significant limitations.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a prefabricated lightweight steel reinforced concrete slab-column assembly and a method for constructing such an assembly so as to achieve a high component prefabrication and preassembly rate, low construction costs, fewer field wetting operations and high adaptability to various buildings.

[0006] This object is attained by prefabricated lightweight steel reinforced concrete slab-column assembly according to the present invention, which is a monolayer or multilayer structure comprising a plurality of prefabricated lightweight steel-reinforced concrete columns vertically arranged therein. The monolayer or each layer of

the multilayer structure comprises a prefabricated lightweight steel-reinforced concrete floor and prefabricated lightweight steel-reinforced concrete wall-like supports. The prefabricated lightweight steel-reinforced concrete floor of each layer is demarcated into a plurality of floor slabs by means of the plurality of prefabricated lightweight steel-reinforced concrete columns and assembled therewith into the prefabricated lightweight steel-reinforced concrete floor. The prefabricated lightweight steel-reinforced concrete wall-like supports are disposed on the prefabricated lightweight steel-reinforced concrete floor and separated apart by the plurality of prefabricated lightweight steel-reinforced concrete columns so that each of the separated prefabricated lightweight steel-reinforced concrete wall-like support is sandwiched between two adjacent prefabricated lightweight steel-reinforced concrete columns.

[0007] Further, each of the prefabricated lightweight steel-reinforced concrete column, the prefabricated lightweight steel-reinforced concrete floor and/or prefabricated lightweight steel-reinforced concrete wall-like support may comprise a lightweight steel frame comprised of shear-resistant steel parts and cast concrete encasing the frame.

[0008] Further, each of the shear-resistant steel parts may comprise a lightweight steel sheet and shear-resistant structures, wherein the shear-resistant structures are formed by punching holes in the lightweight steel sheet.

[0009] Further, the frame of each prefabricated lightweight steel-reinforced concrete column may be comprised of four vertically arranged shear-resistant steel parts serving as vertical side panels and horizontally arranged shear-resistant steel parts serving as tie panels connecting the vertically arranged shear-resistant steel parts.

[0010] Further, the frame of each prefabricated lightweight steel-reinforced concrete wall-like support may be assembled from vertically, horizontally and obliquely arranged shear-resistant steel parts.

[0011] Further, the prefabricated lightweight steel-reinforced concrete wall-like support may be a wall-like support without any opening with its frame being formed of four vertically arranged shear-resistant steel parts serving as vertical side panels, horizontally arranged shear-resistant steel parts serving as tie panels connecting the vertically arranged shear-resistant steel parts and obliquely arranged shear-resistant steel parts diagonally connecting the corners for oblique support.

[0012] Further, the prefabricated lightweight steel-reinforced concrete wall-like support may be a wall-like support defining a window opening and consisting of a plurality of frame sections, and wherein each of the frame sections is formed of four vertically arranged shear-resistant steel parts serving as vertical side panels, horizontally arranged shear-resistant steel parts serving as tie panels connecting the vertically arranged shear-resistant steel parts and obliquely arranged shear-resistant steel parts diagonally connecting the corners for oblique

support.

[0013] Further, the prefabricated lightweight steel-reinforced concrete wall-like support may be a wall-like support defining a door opening and consisting of a plurality of frame sections, and wherein each of the frame sections is formed of four vertically arranged shear-resistant steel parts serving as vertical side panels, horizontally arranged shear-resistant steel parts serving as tie panels connecting the vertically arranged shear-resistant steel parts and obliquely arranged shear-resistant steel parts diagonally connecting the corners for oblique support.

[0014] Further, anti-seismic energy dissipation assemblies may be provided between upper portions of the prefabricated lightweight steel-reinforced concrete wall-like supports and the prefabricated lightweight steel-reinforced concrete columns and/or between portions of two adjacent prefabricated lightweight steel-reinforced concrete columns proximal to an overlying prefabricated lightweight steel-reinforced concrete floor.

[0015] Further, each of the anti-seismic energy dissipation assemblies may comprise a steel shell, a steel shaft, a steel ring, preload nuts and belleville springs, the steel shaft fixed within the steel shell by means of the preload nuts at its both ends so that there is a gap between the steel shaft and an inner surface of the steel shell, the steel ring fixed around the steel shaft, the belleville springs disposed on opposing sides of the steel shaft so that each of them abuts against the steel shaft at one side and against the inner surface of the steel shell at the other side.

[0016] Further, the steel shells of the anti-seismic energy dissipation assemblies disposed between the upper portions of the prefabricated lightweight steel-reinforced concrete wall-like supports and the prefabricated lightweight steel-reinforced concrete columns may be integrally prefabricated with the prefabricated lightweight steel-reinforced concrete wall-like support, with ends of their steel shells proximal to the prefabricated lightweight steel-reinforced concrete columns being rigidly connected or hinged to the prefabricated lightweight steel-reinforced concrete columns by connecting joints.

[0017] Further, the anti-seismic energy dissipation assemblies between portions of two adjacent prefabricated lightweight steel-reinforced concrete columns proximal to an overlying prefabricated lightweight steel-reinforced concrete floor may be obliquely disposed, and wherein ends of their steel shells proximal to the prefabricated lightweight steel-reinforced concrete columns are rigidly connected or hinged to the prefabricated lightweight steel-reinforced concrete columns by connecting joints or rigid supports, and wherein ends of the steel shafts proximal to the overlying prefabricated lightweight steel-reinforced concrete floor are rigidly connected or hinged to the prefabricated lightweight steel-reinforced concrete floor by connecting joints.

[0018] Further, two of the anti-seismic energy dissipation assemblies may be disposed in symmetry with each

other between every two of the prefabricated lightweight steel-reinforced concrete columns.

[0019] Further, each of the prefabricated lightweight steel-reinforced concrete columns may consist of prefabricated lightweight steel-reinforced concrete column sections that are vertically assembled together and are each as high as one or two layers.

[0020] Further, each of the prefabricated lightweight steel-reinforced concrete column sections may comprise an upper connecting structure and a lower connecting structure, wherein every two of the prefabricated lightweight steel-reinforced concrete column sections are assembled together through fitting and welding the upper connecting structure of one prefabricated lightweight steel-reinforced concrete column section into the lower connecting structure of the other prefabricated lightweight steel-reinforced concrete column section.

[0021] Further, the upper connecting structure may comprise a connecting section, a guide tongue, a buried sheet and an anchoring section, wherein the buried sheet is connected to the anchoring section and buried together with the anchoring section in top of the prefabricated lightweight steel-reinforced concrete column section, and wherein the connecting section is disposed on top of the prefabricated lightweight steel-reinforced concrete column section, the guide tongue is arranged laterally to the connecting section, and the connecting section and the guide tongue are both fixed to the buried sheet.

[0022] Further, the lower connecting structure may comprise an anchoring section, a buried sheet and a connecting section, wherein the buried sheet is connected to the anchoring section and buried together with the anchoring section in the bottom of the prefabricated lightweight steel-reinforced concrete column section, wherein the connecting section is disposed on bottom of the prefabricated lightweight steel-reinforced concrete column section and fixed to the buried sheet, and wherein the connecting section is in positional correspondence, and complementary in shape, to the guide tongue.

[0023] Further, the plurality of prefabricated lightweight steel-reinforced concrete columns may be so arrayed that every four of the prefabricated lightweight steel-reinforced concrete columns delimit a floor slab of the prefabricated lightweight steel-reinforced concrete floor in each layer.

[0024] Further, each of the prefabricated lightweight steel-reinforced concrete columns may be provided therearound with a column joint member, wherein each floor slab of the prefabricated lightweight steel-reinforced concrete floor is provided with a slab joint member at each corner thereof proximal to a corresponding one of the prefabricated lightweight steel-reinforced concrete columns, and wherein joining and welding the column joint members and the slab joint members together results in assembly of the prefabricated lightweight steel-reinforced concrete floor with the prefabricated lightweight steel-reinforced concrete columns.

[0025] Further, the column joint member may comprise

a column upper sheet, a column connecting unit and a column lower sheet, the column connecting unit comprising two column web sheets vertically disposed between the column upper sheet and the column lower sheet as well as two column notches disposed in the lower column sheet, the two column web sheets crossing each other at right angles.

[0026] Further, the slab joint member may comprise a slab upper sheet, a slab connecting unit and a slab lower sheet, the slab connecting unit comprising two slab web sheets vertically disposed between the slab upper sheet and the slab lower sheet as well as two slab notches disposed in the upper sheet, the two slab web sheets arranged perpendicularly to each other, wherein the two column web sheets are in positional correspondence, and complementary in shape, to the respective two slab notches, and wherein two slab web sheets are in positional correspondence, and complementary in shape, to the respective two column notches.

[0027] Further, those prefabricated lightweight steel-reinforced concrete columns assembled with four floor slabs may be central columns, wherein the column joint member of each of the central columns has four column connecting units which are fitted and welded into the respective slab connecting units in the slab joint members for the adjacent four floor slabs so that the prefabricated lightweight steel-reinforced concrete floor is assembled with the central columns.

[0028] Further, those prefabricated lightweight steel-reinforced concrete columns assembled with two floor slabs may be edge columns, and wherein the column joint member of each of the edge columns has two connecting units which are fitted and welded into the respective slab connecting units in the slab joint members for the adjacent two floor slabs so that the prefabricated lightweight steel-reinforced concrete floor is assembled with the edge columns.

[0029] Further, those prefabricated lightweight steel-reinforced concrete columns assembled with one floor slab may be corner columns, and wherein the column joint member of each of the corner columns has one connecting unit which is fitted and welded into slab the connecting unit in the slab joint member for the adjacent one floor slab so that the prefabricated lightweight steel-reinforced concrete floor is assembled with the corner columns.

[0030] Further, the prefabricated lightweight steel-reinforced concrete wall-like supports may be welded or bolted to the prefabricated lightweight steel-reinforced concrete floor by means of steel structures.

[0031] Further, each prefabricated lightweight steel-reinforced concrete floor may be constructed from a lightweight steel skeleton assuming a pattern of intersecting parallel lines and concrete, wherein the prefabricated lightweight steel-reinforced concrete floors are welded together by lightweight steel skeleton(s) into a whole.

[0032] The above object is also attained by a method for constructing the prefabricated lightweight steel rein-

forced concrete slab-column assembly as defined above, comprising the steps of:

- 1) lifting and erecting prefabricated lightweight steel-reinforced concrete column sections of the plurality of vertical prefabricated lightweight steel-reinforced concrete columns on a foundation;
- 2) lifting and erecting prefabricated lightweight steel-reinforced concrete wall-like supports on, and fixing them to, the foundation;
- 3) lifting and laying a prefabricated lightweight steel-reinforced concrete floor on, and connecting it to, the prefabricated lightweight steel-reinforced concrete column sections;
- 4) lifting and disposing prefabricated lightweight steel-reinforced concrete column sections for another layer on, and assembling them with, the respective prefabricated lightweight steel-reinforced concrete column sections for the underlying layer;
- 5) lifting and erecting prefabricated lightweight steel-reinforced concrete wall-like supports for the other layer on, and fixing them to, the prefabricated lightweight steel-reinforced concrete floor of the other layer; and
- 6) repeating steps 3) to 5), until the prefabricated lightweight steel reinforced concrete slab-column assembly is completed.

[0033] Further, the prefabricated lightweight steel-reinforced concrete wall-like supports may include interior wall-like supports and exterior wall-like supports, wherein interior wall-like supports for a layer are erected and fixed after the prefabricated lightweight steel-reinforced concrete columns for said layer have been disposed and assembled, and wherein exterior wall-like supports for said layer are erected and fixed together with the disposal and assembly of prefabricated lightweight steel-reinforced concrete columns for an overlying layer.

[0034] Further, in step 3), during the lifting and laying of the prefabricated lightweight steel-reinforced concrete floor, anti-seismic energy dissipation assemblies may be mounted between the prefabricated lightweight steel-reinforced concrete wall-like supports and the prefabricated lightweight steel-reinforced concrete columns or between portions of two adjacent prefabricated lightweight steel-reinforced concrete columns proximal to the prefabricated lightweight steel-reinforced concrete floor.

[0035] Compared with the prior art, the invention offers the advantages as follows:

In the prefabricated lightweight steel reinforced concrete slab-column assembly and its construction method proposed in the present invention, the prefabricated lightweight steel-reinforced concrete floor of each layer is demarcated into a number of floor slabs by the prefabricated lightweight steel-reinforced concrete columns and assembled therewith to form a main body. The prefabricated lightweight

steel-reinforced concrete wall-like supports are disposed between adjacent ones of the prefabricated lightweight steel-reinforced concrete columns. In the assembly, the prefabricated lightweight steel-reinforced concrete floors withstand vertical loads and provide sufficient horizontal stiffness. The prefabricated lightweight steel-reinforced concrete columns withstand the vertical loads transmitted from the prefabricated lightweight steel-reinforced concrete floors, and the prefabricated lightweight steel-reinforced concrete wall-like supports withstand only lateral loads and provide the assembly with lateral stiffness under normal conditions of use and with energy dissipation and shock absorption effects during earthquakes.

[0036] The prefabricated lightweight steel reinforced concrete slab-column assembly and its construction methods have the following advantages:

1. Load conditions of the structure are simple and definite, and the joints therein allow simple load transmission and easy assembly. In this structure, there are two load conditions: the wall-like supports provide the structure with necessary lateral stiffness during normal use and dissipate energy through the anti-seismic energy dissipation assemblies under extreme load conditions (earthquakes, etc.). Therefore, the structure is suitable for multi-story and high-rise buildings.
2. The structure has an increased component prefabrication rate which makes the structure suitable for massive industrial production. The structure can be constructed by a simplified process involving fewer wetting operations in the construction field. This allows a faster construction speed and lower construction costs.
3. The prefabricated components are standardized and modularized in terms of weight and dimensions and are adaptable to various needs. Real standardized design, industrial prefabrication and assembled construction can be achieved through quick selection of suitable prefabricated modular components, specifications and supporting joints for design drawings or standards based on the structure layout, number of layers and load requirements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] The invention will be described in greater detail below with reference to the accompanying drawings, in which:

Fig. 1 is a structural schematic of a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 2 is a structural schematic of a shear-resistant

steel part in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 3 is a structural schematic of another shear-resistant steel part in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 4 is a side view of a prefabricated lightweight steel-reinforced concrete column in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 5 is a top view of a prefabricated lightweight steel-reinforced concrete column in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 6 is a structural schematic of a prefabricated lightweight steel-reinforced concrete wall-like support without any opening in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 7 is a structural schematic of a prefabricated lightweight steel-reinforced concrete wall-like support with a window opening in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 8 is a structural schematic of a prefabricated lightweight steel-reinforced concrete wall-like support with a door opening in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 9 is a structural schematic of an anti-seismic energy dissipation assembly in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 10 is a schematic showing mounted anti-seismic energy dissipation assemblies in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 11 is a schematic showing other mounted anti-seismic energy dissipation assemblies in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 12 is a schematic showing still other mounted anti-seismic energy dissipation assemblies in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 13 is a structural schematic of a prefabricated lightweight steel-reinforced concrete column section in a prefabricated lightweight steel reinforced con-

crete slab-column assembly according to one embodiment of the present invention;

Fig. 14 is a schematic illustrating assembled prefabricated lightweight steel-reinforced concrete column sections in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 15 is a structural schematic of a column joint member in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 16 is a structural schematic of a slab joint member in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 17 is a schematic illustrating a column joint member assembled with a slab joint member in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 18 is a schematic showing central, edge and corner columns in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 19 is a schematic showing a wall-like support without any opening assembled with a prefabricated lightweight steel-reinforced concrete floor in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 20 is a schematic showing a wall-like support with a window opening assembled with a prefabricated lightweight steel-reinforced concrete floor in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 21 is a schematic showing a wall-like support with a door opening assembled with a prefabricated lightweight steel-reinforced concrete floor in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 22 is a schematic diagram showing a first step of a method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention;

Fig. 23 is a schematic diagram showing a second step of the method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to the embodiment of the present invention;

Fig. 24 is a schematic diagram showing a third step of the method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to the embodiment of the present invention;

Fig. 25 is a schematic diagram showing a fourth step

of the method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to the embodiment of the present invention; and

Fig. 26 is a schematic diagram showing a fifth step of the method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to the embodiment of the present invention.

[0038] In Figs. 1 to 26, 1 denotes a prefabricated lightweight steel-reinforced concrete column; 11, a prefabricated lightweight steel-reinforced concrete column section; 12, a central column; 13, an edge column; 14, a corner column; 2, a prefabricated lightweight steel-reinforced concrete floor; 21, a floor slab; 3, a prefabricated lightweight steel-reinforced concrete wall-like support; 31, a frame section; 32, connecting device; 33, an interior wall-like support; 34, an exterior wall-like support; 4, a shear-resistant steel part; 41, a lightweight steel sheet; 42, a shear-resistant structure; 5, an anti-seismic energy dissipation assembly; 51, a steel shell; 52, a steel shaft; 53, a steel ring; 54, a preload nut; 55, a belleville spring; 56, a connecting joint; 57, a rigid support; 6, an upper connecting structure; 61, a connecting section; 62, a guide tongue; 63, a buried sheet; 64, an anchoring section; 7, a lower connecting structure; 71, an anchoring section; 72, a buried sheet; 73, a connecting section; 8, a column joint member; 81, a column upper sheet; 82, a column connecting unit; 821, a column web sheet; 822, a column notch; 83, a column lower sheet; 9, a slab joint member; 91, a slab upper sheet; 92, a slab connecting unit; 921, a slab web sheet; 922, a slab notch; 93, a slab lower sheet; and 10, a foundation.

DETAILED DESCRIPTION

[0039] Prefabricated lightweight steel reinforced concrete slab-column assemblies and methods for construction thereof according to specific embodiments of the present invention will be described below with reference to the accompany drawings. Features and advantages of the invention will be more apparent from the following detailed description, and from the appended claims. Note that the figures are provided in a very simplified form not necessarily presented to scale, with the only intention of facilitating convenience and clarity in explaining the embodiments.

[0040] The central concept of the present invention is to provide a prefabricated lightweight steel reinforced concrete slab-column assembly and a method for construction thereof, in which a prefabricated lightweight steel-reinforced concrete floor in each layer of the assembly is demarcated into a number of floor slabs by prefabricated lightweight steel-reinforced concrete columns and assembled therewith to form a main body. A prefabricated lightweight steel-reinforced concrete wall-like support is disposed between every adjacent two of

the prefabricated lightweight steel-reinforced concrete columns. In the assembly, the prefabricated lightweight steel-reinforced concrete floors withstand vertical loads and provide sufficient horizontal stiffness. The prefabricated lightweight steel-reinforced concrete columns withstand the vertical loads transmitted from the prefabricated lightweight steel-reinforced concrete floors, and the prefabricated lightweight steel-reinforced concrete wall-like supports withstand only lateral loads and provide the assembly with lateral stiffness under normal conditions of use and with energy dissipation and shock absorption effects during earthquakes. The prefabricated lightweight steel reinforced concrete slab-column assembly and the method have a high component prefabrication and preassembly rate, allow low construction costs, require fewer field wetting operations and are highly adaptable to various buildings.

[0041] Reference is now made to Figs 1 to 26, in which Fig. 1 is a structural schematic of a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 2 is a structural schematic of a shear-resistant steel part in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 3 is a structural schematic of another shear-resistant steel part in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 4 is a side view of a prefabricated lightweight steel-reinforced concrete column in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 5 is a top view of a prefabricated lightweight steel-reinforced concrete column in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 6 is a structural schematic of a prefabricated lightweight steel-reinforced concrete wall-like support without any opening in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 7 is a structural schematic of a prefabricated lightweight steel-reinforced concrete wall-like support with a window opening in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 8 is a structural schematic of a prefabricated lightweight steel-reinforced concrete wall-like support with a door opening in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 9 is a structural schematic of an anti-seismic energy dissipation assembly in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 10 is a schematic showing mounted anti-seismic energy dissipation assemblies in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 11 is a

schematic showing other mounted anti-seismic energy dissipation assemblies in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 12 is a schematic showing still other mounted anti-seismic energy dissipation assemblies in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 13 is a structural schematic of a prefabricated lightweight steel-reinforced concrete column section in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 14 is a schematic illustrating assembled prefabricated lightweight steel-reinforced concrete column sections in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 15 is a structural schematic of a column joint member in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 16 is a structural schematic of a slab joint member in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 17 is a schematic illustrating a column joint member assembled with a slab joint member in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 18 is a schematic showing positions of central, edge and corner columns in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 19 is a schematic showing a wall-like support without any opening assembled with a prefabricated lightweight steel-reinforced concrete floor in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 20 is a schematic showing a wall-like support with a window opening assembled with a prefabricated lightweight steel-reinforced concrete floor in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 21 is a schematic showing a wall-like support with a door opening assembled with a prefabricated lightweight steel-reinforced concrete floor in a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 22 is a schematic diagram showing a first step of a method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention; Fig. 23 is a schematic diagram showing a second step of the method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to the embodiment of the present invention; Fig. 24 is a schematic diagram showing a third step of the method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to the embod-

iment of the present invention; Fig. 25 is a schematic diagram showing a fourth step of the method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to the embodiment of the present invention; and Fig. 26 is a schematic diagram showing a fifth step of the method for constructing a prefabricated lightweight steel reinforced concrete slab-column assembly according to the embodiment of the present invention.

[0042] As shown in Fig. 1, a prefabricated lightweight steel reinforced concrete slab-column assembly according to one embodiment of the present invention is a monolayer or multilayer structure comprising a number of vertical prefabricated lightweight steel-reinforced concrete columns 1 vertically arranged therein. Each layer of the monolayer or multilayer structure includes a prefabricated lightweight steel-reinforced concrete floor 2 and prefabricated lightweight steel-reinforced concrete wall-like supports 3. The prefabricated lightweight steel-reinforced concrete floor 2 is demarcated into a number of floor slabs 21 by the prefabricated lightweight steel-reinforced concrete columns 1. The floor slabs 21 are assembled with the prefabricated lightweight steel-reinforced concrete columns 1 to form the prefabricated lightweight steel-reinforced concrete floor 2. The prefabricated lightweight steel-reinforced concrete wall-like supports 3 are separated apart by the prefabricated lightweight steel-reinforced concrete columns 1, and each of them is disposed on the prefabricated lightweight steel-reinforced concrete floor 2 so that it is sandwiched between adjacent two of the prefabricated lightweight steel-reinforced concrete columns 1.

[0043] In this embodiment of the present invention, where in each layer of the prefabricated lightweight steel reinforced concrete slab-column assembly, the prefabricated lightweight steel-reinforced concrete columns 1 demarcate the prefabricated lightweight steel-reinforced concrete floor 2 into the floor slabs 21 and are assembled therewith to form the main body, with the prefabricated lightweight steel-reinforced concrete wall-like supports 3 each being disposed between two adjacent ones of the prefabricated lightweight steel-reinforced concrete columns 1, in the whole structure, the prefabricated lightweight steel-reinforced concrete floor 2 withstands vertical loads while providing sufficient horizontal stiffness, the prefabricated lightweight steel-reinforced concrete columns 1 withstand the vertical loads transmitted from the prefabricated lightweight steel-reinforced concrete floor 2, and the prefabricated lightweight steel-reinforced concrete wall-like supports 3 withstand only lateral loads and provide the assembly with lateral stiffness under normal conditions of use and with energy dissipation and shock absorption effects during earthquakes. This prefabricated lightweight steel reinforced concrete slab-column assembly has a high component prefabrication and preassembly rate, allows low construction costs, requires fewer field wetting operations and is highly adaptable to various buildings.

[0044] Further, each of the prefabricated lightweight steel-reinforced concrete columns 1, the prefabricated lightweight steel-reinforced concrete floor 2 and the prefabricated lightweight steel-reinforced concrete wall-like supports 3 may be comprised of a lightweight steel frame constructed from shear-resistant steel parts 4 and cast concrete encasing the frame.

[0045] In this embodiment, as shown in Fig. 2, each shear-resistant steel part 4 includes a lightweight steel sheet 41 and shear-resistant structures 42 which are protrusions projecting from holes punched in the lightweight steel sheet 41. The shear-resistant features 42 are formed by a hot rolling, hot pressing or cold rolling process and equidistantly distributed along a length of the lightweight steel sheet 41.

[0046] As shown in Fig. 3, it is contemplated that the punched holes and the protrusions (i.e., the shear-resistant structures 42) projecting therefrom may also be distributed otherwise regularly in the lightweight steel sheet 41, while still exhibiting shear resistance. Therefore, present invention is also intended to embrace such alternatives.

[0047] Further, as shown in Figs. 4 and 5, the frame of each prefabricated lightweight steel-reinforced concrete column 1 may be comprised of four vertically arranged shear-resistant steel parts 4 serving as vertical side panels and horizontally arranged shear-resistant steel parts 4 serving as tie panels connecting the vertically arranged shear-resistant steel parts.

[0048] Further, the frame of each prefabricated lightweight steel-reinforced concrete wall-like support 3 may be made up of vertical, horizontal and oblique shear-resistant steel parts 4.

[0049] Specifically, each of the prefabricated lightweight steel-reinforced concrete wall-like supports 3 may be a wall-like support without any opening, a wall-like support with a window opening, or a wall-like support with a door opening.

[0050] As shown in Fig. 6, the frame of the prefabricated lightweight steel-reinforced concrete wall-like support 3 without any opening may be comprised of four vertically arranged shear-resistant steel parts 4 serving as vertical side panels, horizontally arranged shear-resistant steel parts 4 serving as tie panels connecting the vertically arranged shear-resistant steel parts, and obliquely arranged shear-resistant steel parts 4 diagonally connecting the corners for oblique support.

[0051] As shown in Fig. 7, the frame of the prefabricated lightweight steel-reinforced concrete wall-like support 3 with a window opening may consist of a number of frame sections 31 each comprised of four vertically arranged shear-resistant steel parts 4 serving as vertical side panels, horizontally arranged shear-resistant steel parts 4 serving as tie panels connecting the vertically arranged shear-resistant steel parts, and obliquely arranged shear-resistant steel parts 4 diagonally connecting the corners for oblique support.

[0052] As shown in Fig. 8, the frame of the prefabricat-

ed lightweight steel-reinforced concrete wall-like support 3 with a door opening may consist of a number of frame sections 31 each comprised of four vertically arranged shear-resistant steel parts 4 serving as vertical side panels, horizontally arranged shear-resistant steel parts 4 serving as tie panels connecting the vertically arranged shear-resistant steel parts, and obliquely arranged shear-resistant steel parts 4 diagonally connecting the corners for oblique support.

[0053] Further, as shown in Fig. 19, the prefabricated lightweight steel-reinforced concrete wall-like support 3 without any opening may be welded or bolted to the prefabricated lightweight steel-reinforced concrete floor 2 by means of connecting device 32 provided respectively at its bottom corners.

[0054] As shown in Fig. 20, the prefabricated lightweight steel-reinforced concrete wall-like support 3 with a window opening may be welded or bolted to the prefabricated lightweight steel-reinforced concrete floor 2 by means of connecting device 32 provided respectively at its bottom corners and the bottom corners of the window opening.

[0055] As shown in Fig. 21, the prefabricated lightweight steel-reinforced concrete wall-like support 3 with a door opening may be welded or bolted to the prefabricated lightweight steel-reinforced concrete floor 2 by means of connecting device 32 provided respectively at its bottom corners and the bottom corners of the door opening.

[0056] Further, anti-seismic energy dissipation assemblies 5 may be provided between upper portions of the prefabricated lightweight steel-reinforced concrete wall-like support 3 and the prefabricated lightweight steel-reinforced concrete columns 1 and between portions of adjacent ones of the prefabricated lightweight steel-reinforced concrete columns 1 proximal to the overlying prefabricated lightweight steel-reinforced concrete floor 2.

[0057] In this embodiment, as shown in Fig. 9, each of the anti-seismic energy dissipation assemblies may include a steel shell 51, a steel shaft 52, a steel ring 53, preload nuts 54 and belleville springs 55. The steel shaft 52 is fixed within the steel shell 51 by means of the preload nuts 53 at its both ends such that there is a gap between the steel shaft 52 and an inner surface of the steel shell 51. The steel ring 53 is fixed around the steel shaft 52, and the belleville springs 55 are disposed on opposing sides of the steel shaft 52. Each of the belleville springs 55 abuts against the steel shaft 52 at one side and against the inner surface of the steel shell 51 at the other side. In the event of an earthquake, the steel shaft 52 will be displaced relative to the steel shell 51, causing a small amount of compression of a corresponding one of the Belleville springs 55 which absorbs the shock from the earthquake.

[0058] Specifically, as shown in Fig. 10, the steel shells 51 of the anti-seismic energy dissipation assemblies 5 provided between the upper portions of the prefabricated lightweight steel-reinforced concrete wall-like supports 3

and the prefabricated lightweight steel-reinforced concrete columns 1 may be integrally prefabricated with the prefabricated lightweight steel-reinforced concrete wall-like support 3, and the ends of their steel shaft 52 proximal to the prefabricated lightweight steel-reinforced concrete columns 1 are rigidly connected or hinged thereto by connecting joints 56.

[0059] As shown in Fig. 11, for every two adjacent ones of the prefabricated lightweight steel-reinforced concrete columns 1 which are spaced apart from each other too close to allow the placement of any of the prefabricated lightweight steel-reinforced concrete wall-like supports 3, anti-seismic energy dissipation assemblies 5 may be angularly disposed between portions of the two adjacent prefabricated lightweight steel-reinforced concrete columns 1 proximal to the overlying prefabricated lightweight steel-reinforced concrete floor 2, with the ends of their steel shells 51 proximal to the respective prefabricated lightweight steel-reinforced concrete columns 1 being rigidly connected or hinged thereto by respective connecting joints 56 and with the ends of their steel shafts 52 proximal to the overlying prefabricated lightweight steel-reinforced concrete floor 2 being rigidly connected or hinged thereto by respective connecting joints 56.

[0060] As shown in Fig. 12, in case the gap between the portions of the two adjacent prefabricated lightweight steel-reinforced concrete columns 1 proximal to the overlying prefabricated lightweight steel-reinforced concrete floor 2 in which the anti-seismic energy dissipation assemblies 5 are to be arranged is too large to allow the foregoing configuration, each of the anti-seismic energy dissipation assemblies 5 may be further provided with a rigid support 57 that is connected to the end of its steel shell 51 proximal to a corresponding one of the two prefabricated lightweight steel-reinforced concrete column 1 and is rigidly connected or hinged to the specific prefabricated lightweight steel-reinforced concrete column 1.

[0061] As shown in Figs. 10 to 12, two anti-seismic energy dissipation assemblies may be arranged between every two adjacent ones of the prefabricated lightweight steel-reinforced concrete columns in symmetry with each other so that they can work in a combined way.

[0062] Further, each of the prefabricated lightweight steel-reinforced concrete columns 1 may consist of prefabricated lightweight steel-reinforced concrete column sections 11 that are vertically assembled together and are each as high as one or two layers of the assembly.

[0063] In this embodiment, each of the prefabricated lightweight steel-reinforced concrete column sections 11 includes an upper connecting structure 6 and a lower connecting structure 7. Every two of the prefabricated lightweight steel-reinforced concrete column sections 11 are assembled together through fitting and welding the upper connecting structure 6 of one of them into the lower connecting structure 7 of the other.

[0064] Specifically, as shown in Fig. 13, the upper connecting structure 6 may include a connecting section 61,

a guide tongue 62, a buried sheet 63 and an anchoring section 64. The buried sheet 63 is connected to the anchoring section 64 and is buried together therewith in the top of the prefabricated lightweight steel-reinforced concrete column section 11. The connecting section 61 is disposed on top of the prefabricated lightweight steel-reinforced concrete column section 11, and the guide tongue 62 is arranged laterally to the connecting section 61. The connecting section 61 and the guide tongue 62 are both fixed to the buried sheet 63. The lower connecting structure 7 may include an anchoring section 71, a buried sheet 72 and a connecting section 73. The buried sheet 72 is connected to the anchoring section 71 and buried together therewith in the bottom of the prefabricated lightweight steel-reinforced concrete column section 11. The connecting section 73 is disposed on bottom of the prefabricated lightweight steel-reinforced concrete column section 11 and fixed to the buried sheet 72. The connecting section 73 is in positional correspondence, and complementary in shape, to the guide tongue 62. As shown in Fig. 14, assembly of the two prefabricated lightweight steel-reinforced concrete column sections 11 only involves: moving the connecting section 73 of one of the prefabricated lightweight steel-reinforced concrete column sections 11 downward along the guide tongue 62 of the other prefabricated lightweight steel-reinforced concrete column section 11, so that the connecting section 61 of the unmoved prefabricated lightweight steel-reinforced concrete column section 11 is inserted into the connecting section 73 of the moved prefabricated lightweight steel-reinforced concrete column section 11; and ensuring a firm connection between the two prefabricated lightweight steel-reinforced concrete column sections 11 by strongly welding them together along their contact faces.

[0065] Further, as shown in Fig. 18, the vertically arranged prefabricated lightweight steel-reinforced concrete columns 1 may be so arrayed that every four of them delimit a floor slab 21 of the prefabricated lightweight steel-reinforced concrete floor 2 in each layer.

[0066] In this embodiment, each of the prefabricated lightweight steel-reinforced concrete columns 1 is provided therearound with a column joint member 8, and each floor slab 21 of the prefabricated lightweight steel-reinforced concrete floor 2 is provided with a slab joint member 9 at each of its corners proximal to one of the prefabricated lightweight steel-reinforced concrete columns 1. Joining and welding the column joint members 8 and the slab joint members 9 together results in assembly of the prefabricated lightweight steel-reinforced concrete floor 2 with the prefabricated lightweight steel-reinforced concrete columns 1.

[0067] Specifically, as shown in Fig. 15, the column joint member 8 may include a column upper sheet 81, a column connecting unit 82 and a column lower sheet 83. The column connecting unit 82 includes two column web sheets 821 vertically arranged between the upper sheet 81 and the lower sheet 83 as well as two column notches

822 arranged in the column lower sheet 83. The two column web sheets 821 cross each other at right angles. As shown in Fig. 16, the slab joint member 9 may include a slab upper sheet 91, a slab connecting unit 92 and a slab lower sheet 93. The slab connecting unit 92 includes two slab web sheets 921 vertically arranged between the upper sheet 91 and the lower sheet 93 as well as two slab notches 922 arranged in the slab upper sheet 91. The two slab web sheets 921 are perpendicularly arranged to each other. The two column web sheets 821 are in positional correspondence, and complementary in shape, to the respective two slab notches 922, and the two slab web sheets 921 are in positional correspondence, and complementary in shape, to the respective two column notches 822. As shown in Fig. 17, assembly of a floor slab 21 of the prefabricated lightweight steel-reinforced concrete floor 2 with a prefabricated lightweight steel-reinforced concrete column 1 can be accomplished by only fitting the two column web sheets 821 in the column connecting unit 82 for the prefabricated lightweight steel-reinforced concrete column 1 into the respective slab notches 922 in the slab connecting unit 92 at the corresponding corner of the floor slab 21 and fitting the two slab web sheets 921 in the slab connecting unit 92 into the respective column notches 821 in the column connecting unit 82, then welding them together along their contact faces and welding the column upper sheet 81 and column lower sheet 83 for the prefabricated lightweight steel-reinforced concrete column 1 to the slab upper sheet 91 and the slab lower sheet 93 for the floor slab 21 respectively such that assembly of a corresponding floor slab 21 with a prefabricated lightweight steel-reinforced concrete column 1 can be accomplished.

[0068] In this embodiment, as shown in Fig. 18, the prefabricated lightweight steel-reinforced concrete columns 1 may include central columns 12, edge columns 13 and corner columns 14.

[0069] Specifically, each central column 12 is a prefabricated lightweight steel-reinforced concrete column 1 assembled with four floor slabs 21, and its column joint member 8 has four column connecting units 82 which are fitted and welded into the respective slab connecting units 92 in the slab joint members 9 for the adjacent four floor slabs 21 so that the prefabricated lightweight steel-reinforced concrete floor 2 is assembled with the central columns 12.

[0070] Each edge column 13 is a prefabricated lightweight steel-reinforced concrete column 1 assembled with two floor slabs 21, and its column joint member 8 has two column connecting units 82 which are fitted and welded into the respective slab connecting units 92 in the slab joint members 9 for the adjacent two floor slabs 21 so that the prefabricated lightweight steel-reinforced concrete floor 2 is assembled with the edge columns 13.

[0071] Each corner column 14 is a prefabricated lightweight steel-reinforced concrete column 1 assembled with one floor slab 21, and its column joint member 8 has one column connecting unit 82 which is fitted and welded

into the slab connecting unit 92 in the slab joint member 9 for the adjacent one floor slab 21 so that the prefabricated lightweight steel-reinforced concrete floor 2 is assembled with the corner column 14.

[0072] Further, each prefabricated lightweight steel-reinforced concrete floor 2 may be constructed from a lightweight steel skeleton assuming a pattern of intersecting parallel lines and concrete, and different prefabricated lightweight steel-reinforced concrete floors 2 may be welded together by lightweight steel skeleton(s) into a whole.

[0073] According to one embodiment of the present invention, a method for constructing the prefabricated lightweight steel reinforced concrete slab-column assembly as defined above which is a multilayer assembly comprises the steps of:

- 1) lifting and erecting prefabricated lightweight steel-reinforced concrete column sections 11 of the plurality of vertical prefabricated lightweight steel-reinforced concrete columns 1 on a foundation 10;
- 2) lifting and erecting prefabricated lightweight steel-reinforced concrete wall-like supports 3 on, and fixing them to, the foundation;
- 3) lifting and laying a prefabricated lightweight steel-reinforced concrete floor 2 on, and connecting it to, the sections of the prefabricated lightweight steel-reinforced concrete column 1;
- 4) lifting and disposing prefabricated lightweight steel-reinforced concrete column sections 11 for another layer on, and assembling them with, the respective prefabricated lightweight steel-reinforced concrete column sections 11 for the underlying layer;
- 5) lifting and erecting prefabricated lightweight steel-reinforced concrete wall-like supports 3 for the other layer on, and fixing them to, the prefabricated lightweight steel-reinforced concrete floor 2; and
- 6) repeating steps 3) to 5), until the prefabricated lightweight steel reinforced concrete slab-column assembly is completed.

[0074] Further, the prefabricated lightweight steel-reinforced concrete wall-like supports 3 may include interior wall-like supports 33 and exterior wall-like supports 34. Interior wall-like supports 33 for a layer are erected and fixed after the prefabricated lightweight steel-reinforced concrete column sections 11 for said layer have been disposed and assembled, and exterior wall-like supports 34 for said layer are erected and fixed together with the disposal and assembly of prefabricated lightweight steel-reinforced concrete column sections 11 for an overlying layer.

[0075] Further, in step 3, during the lifting and laying of the prefabricated lightweight steel-reinforced concrete floor 2, anti-seismic energy dissipation assemblies 5 may be mounted between the prefabricated lightweight steel-reinforced concrete wall-like supports 3 (interior wall-like supports 33) and the prefabricated lightweight steel-re-

inforced concrete column sections 11 or between portions of adjacent ones of the prefabricated lightweight steel-reinforced concrete column columns 11 proximal to the prefabricated lightweight steel-reinforced concrete floor 2.

[0076] In summary, prefabricated lightweight steel reinforced concrete slab-column assemblies and the methods for their construction according to embodiments of the present invention have the advantages as follows.

1. Load conditions of the structure are simple and definite, and the joints therein allow simple load transmission and easy assembly. In this structure, there are two load conditions: the wall-like supports provide the structure with necessary lateral stiffness during normal use and dissipate energy through the anti-seismic energy dissipation assemblies under extreme load conditions (earthquakes, etc.). Therefore, the structure is suitable for layer and high-rise buildings.
2. The structure has an increased component prefabrication rate which makes the structure suitable for massive industrial production. The structure can be constructed by a simplified process involving reduced wetting operations in the construction field. This allows a faster construction speed and lower construction costs.
3. The prefabricated components are standardized and modularized in terms of weight and dimensions and are adaptable to various needs. Real standardized design, industrial prefabrication and assembled construction can be achieved through quick selection of suitable prefabricated modular components, specifications and supporting joints for design drawings or standards based on the structure layout, number of layers and load requirements.

[0077] It is apparent that those skilled in the art can make various modifications and variations to the present invention without departing from the spirit and scope thereof. Accordingly, it is intended that all such modifications and variations are embraced in the scope of the invention if they fall within the scope of the appended claims and their equivalents.

Claims

1. A prefabricated lightweight steel reinforced concrete slab-column assembly, wherein the prefabricated lightweight steel reinforced concrete slab-column assembly is a monolayer or multilayer structure comprising a plurality of prefabricated lightweight steel-reinforced concrete columns vertically arranged therein, wherein the monolayer or each layer of the multilayer structure comprises a prefabricated lightweight steel-reinforced concrete floor and prefabricated lightweight steel-reinforced concrete wall-like

- supports, wherein the prefabricated lightweight steel-reinforced concrete floor of each layer is demarcated into a plurality of floor slabs by means of the plurality of prefabricated lightweight steel-reinforced concrete columns, and the plurality of floor slabs and the plurality of prefabricated lightweight steel-reinforced concrete columns are assembled into the prefabricated lightweight steel-reinforced concrete floor, wherein the prefabricated lightweight steel-reinforced concrete wall-like supports of each layer are separated apart by the plurality of prefabricated lightweight steel-reinforced concrete columns, and wherein each of the separated prefabricated lightweight steel-reinforced concrete wall-like support is disposed on the prefabricated lightweight steel-reinforced concrete floor and sandwiched between two adjacent prefabricated lightweight steel-reinforced concrete columns.
2. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 1, wherein each of the prefabricated lightweight steel-reinforced concrete column, the prefabricated lightweight steel-reinforced concrete floor and/or the prefabricated lightweight steel-reinforced concrete wall-like support comprises a lightweight steel frame comprised of shear-resistant steel parts and cast concrete encasing the frame.
 3. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 2, wherein each of the shear-resistant steel parts comprises a lightweight steel sheet and shear-resistant structures, wherein the shear-resistant structures are formed by punching holes in the lightweight steel sheet.
 4. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 2, wherein the frame of each prefabricated lightweight steel-reinforced concrete column is comprised of four vertically arranged shear-resistant steel parts serving as vertical side panels and horizontally arranged shear-resistant steel parts serving as tie panels connecting the vertically arranged shear-resistant steel parts.
 5. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 2, wherein the frame of each prefabricated lightweight steel-reinforced concrete wall-like support is assembled from vertically, horizontally and obliquely arranged shear-resistant steel parts.
 6. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 5, wherein the prefabricated lightweight steel-reinforced concrete wall-like support is a wall-like support without any opening, and a frame of the wall-like support without any opening is formed of four vertically arranged shear-resistant steel parts serving as vertical side panels, horizontally arranged shear-resistant steel parts serving as tie panels connecting the vertically arranged shear-resistant steel parts and obliquely arranged shear-resistant steel parts diagonally connecting the corners for oblique support.
 7. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 5, wherein the prefabricated lightweight steel-reinforced concrete wall-like support is a wall-like support defining a window opening and consisting of a plurality of frame sections, and wherein each of the frame sections is formed of four vertically arranged shear-resistant steel parts serving as vertical side panels, horizontally arranged shear-resistant steel parts serving as tie panels connecting the vertically arranged shear-resistant steel parts and obliquely arranged shear-resistant steel parts diagonally connecting the corners for oblique support.
 8. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 5, wherein the prefabricated lightweight steel-reinforced concrete wall-like support is a wall-like support defining a door opening and consisting of a plurality of frame sections, and wherein each of the frame sections is formed of four vertically arranged shear-resistant steel parts serving as vertical side panels, horizontally arranged shear-resistant steel parts serving as tie panels connecting the vertically arranged shear-resistant steel parts and obliquely arranged shear-resistant steel parts diagonally connecting the corners for oblique support.
 9. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 1, wherein anti-seismic energy dissipation assemblies are provided between upper portions of the prefabricated lightweight steel-reinforced concrete wall-like supports and the prefabricated lightweight steel-reinforced concrete columns and/or between portions of two adjacent prefabricated lightweight steel-reinforced concrete columns proximal to an overlying prefabricated lightweight steel-reinforced concrete floor.
 10. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 9, wherein each of the anti-seismic energy dissipation assemblies comprises a steel shell, a steel shaft, a steel ring, preload nuts and belleville springs, the steel shaft fixed within the steel shell by means of the preload nuts at both ends of the steel shaft so that there is a gap between the steel shaft and an

inner surface of the steel shell, the steel ring fixed around the steel shaft, the belleville springs disposed on opposing sides of the steel shaft so that each of the belleville springs abuts against the steel shaft at one side and against the inner surface of the steel shell at the other side.

11. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 10, wherein the anti-seismic energy dissipation assemblies are disposed between the upper portions of the prefabricated lightweight steel-reinforced concrete wall-like supports and the prefabricated lightweight steel-reinforced concrete columns, and wherein the steel shells of the anti-seismic energy dissipation assemblies are integrally prefabricated with the prefabricated lightweight steel-reinforced concrete wall-like support, and ends of the steel shells proximal to the prefabricated lightweight steel-reinforced concrete columns are rigidly connected or hinged to the prefabricated lightweight steel-reinforced concrete columns by connecting joints.
12. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 10, wherein the anti-seismic energy dissipation assemblies between portions of two adjacent prefabricated lightweight steel-reinforced concrete columns proximal to an overlying prefabricated lightweight steel-reinforced concrete floor are obliquely disposed, and wherein ends of the steel shells proximal to the prefabricated lightweight steel-reinforced concrete columns are rigidly connected or hinged to the prefabricated lightweight steel-reinforced concrete columns by connecting joints or rigid supports, and wherein ends of the steel shafts proximal to the overlying prefabricated lightweight steel-reinforced concrete floor are rigidly connected or hinged to the prefabricated lightweight steel-reinforced concrete floor by connecting joints.
13. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 11 or 12, wherein two of the anti-seismic energy dissipation assemblies are disposed in symmetry with each other between every two of the prefabricated lightweight steel-reinforced concrete columns.
14. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 1, wherein each of the prefabricated lightweight steel-reinforced concrete columns consists of prefabricated lightweight steel-reinforced concrete column sections that are vertically assembled together and are each as high as one or two layers.
15. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 14,

wherein each of the prefabricated lightweight steel-reinforced concrete column sections comprises an upper connecting structure and a lower connecting structure, and wherein every two of the prefabricated lightweight steel-reinforced concrete column sections are assembled together through fitting and welding the upper connecting structure of one prefabricated lightweight steel-reinforced concrete column section into the lower connecting structure of the other prefabricated lightweight steel-reinforced concrete column section.

16. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 15, wherein the upper connecting structure comprises a connecting section, a guide tongue, a buried sheet and an anchoring section, wherein the buried sheet is connected to the anchoring section and buried together with the anchoring section in top of the prefabricated lightweight steel-reinforced concrete column section, and wherein the connecting section is disposed on top of the prefabricated lightweight steel-reinforced concrete column section, the guide tongue is arranged laterally to the connecting section, and the connecting section and the guide tongue are both fixed to the buried sheet.
17. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 16, wherein the lower connecting structure comprises an anchoring section, a buried sheet and a connecting section, wherein the buried sheet is connected to the anchoring section and buried together with the anchoring section in bottom of the prefabricated lightweight steel-reinforced concrete column section, wherein the connecting section is disposed on bottom of the prefabricated lightweight steel-reinforced concrete column section and fixed to the buried sheet, and wherein the connecting section is in positional correspondence, and complementary in shape, to the guide tongue.
18. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 1, wherein the plurality of prefabricated lightweight steel-reinforced concrete columns is so arrayed that every four of the prefabricated lightweight steel-reinforced concrete columns delimit a floor slab of the prefabricated lightweight steel-reinforced concrete floor in each layer.
19. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 18, wherein each of the prefabricated lightweight steel-reinforced concrete columns is provided therearound with a column joint member, wherein each floor slab of the prefabricated lightweight steel-reinforced concrete floor is provided with a slab joint

member at each corner thereof proximal to a corresponding one of the prefabricated lightweight steel-reinforced concrete columns, and wherein joining and welding the column joint members and the slab joint members together results in assembly of the prefabricated lightweight steel-reinforced concrete floor with the prefabricated lightweight steel-reinforced concrete columns.

20. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 19, wherein the column joint member comprises a column upper sheet, a column connecting unit and a column lower sheet, the column connecting unit comprising two column web sheets vertically disposed between the column upper sheet and the column lower sheet as well as column notches disposed in the column lower sheet, the two column web sheets crossing each other at right angles.
21. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 20, wherein the slab joint member comprises a slab upper sheet, a slab connecting unit and a slab lower sheet, the slab connecting unit comprising two slab web sheets vertically disposed between the slab upper sheet and the slab lower sheet as well as two slab notches disposed in the upper sheet, the two slab web sheets perpendicularly arranged to each other, wherein the two column web sheets are in positional correspondence, and complementary in shape, to the respective two slab notches, and wherein the two slab web sheets are in positional correspondence, and complementary in shape, to the respective two column notches.
22. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 21, wherein those prefabricated lightweight steel-reinforced concrete columns assembled with four floor slabs are central columns, and wherein the column joint member of each of the central columns has four column connecting units which are fitted and welded into the respective slab connecting units in the slab joint members for adjacent four floor slabs so that the prefabricated lightweight steel-reinforced concrete floor is assembled with the central columns.
23. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 21, wherein those prefabricated lightweight steel-reinforced concrete columns assembled with two floor slabs are edge columns, and wherein the column joint member of each of the edge columns has two connecting units which are fitted and welded into the respective slab connecting units in the slab joint members for adjacent two floor slabs so that the prefabricated lightweight steel-reinforced concrete floor

is assembled with the edge columns.

24. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 21, wherein those prefabricated lightweight steel-reinforced concrete columns assembled with one floor slab are corner columns, and wherein the column joint member of each of the corner columns has one connecting unit which is fitted and welded into the slab connecting unit in the slab joint member for adjacent one floor slab so that the prefabricated lightweight steel-reinforced concrete floor is assembled with the corner columns.
25. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 1, wherein the prefabricated lightweight steel-reinforced concrete wall-like supports are welded or bolted to the prefabricated lightweight steel-reinforced concrete floor by means of steel structures.
26. The prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 1, wherein each prefabricated lightweight steel-reinforced concrete floor is constructed from a lightweight steel skeleton assuming a pattern of intersecting parallel lines and concrete, and wherein the prefabricated lightweight steel-reinforced concrete floors are welded together by lightweight steel skeleton(s) into a whole.
27. A method for constructing the prefabricated lightweight steel reinforced concrete slab-column assembly as defined in claim 1, comprising the steps of:
 - 1) lifting and erecting prefabricated lightweight steel-reinforced concrete column sections of the plurality of vertical prefabricated lightweight steel-reinforced concrete columns on a foundation;
 - 2) lifting and erecting prefabricated lightweight steel-reinforced concrete wall-like supports on, and fixing them to, the foundation;
 - 3) lifting and laying a prefabricated lightweight steel-reinforced concrete floor on, and connecting it to, the prefabricated lightweight steel-reinforced concrete column sections;
 - 4) lifting and disposing prefabricated lightweight steel-reinforced concrete column sections for another layer on, and assembling them with, the respective prefabricated lightweight steel-reinforced concrete column sections for the underlying layer;
 - 5) lifting and erecting prefabricated lightweight steel-reinforced concrete wall-like supports for the other layer on, and fixing them to, the prefabricated lightweight steel-reinforced concrete floor of the other layer; and

6) repeating steps 3) to 5), until the prefabricated lightweight steel reinforced concrete slab-column assembly is completed.

28. The method for constructing the prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 27, wherein the prefabricated lightweight steel-reinforced concrete wall-like supports include interior wall-like supports and exterior wall-like supports, wherein interior wall-like supports for a layer are erected and fixed after prefabricated lightweight steel-reinforced concrete columns for said layer have been disposed and assembled, and wherein exterior wall-like supports for said layer are erected and fixed together with disposal and assembly of prefabricated lightweight steel-reinforced concrete columns for an overlying layer.
29. The method for constructing the prefabricated lightweight steel reinforced concrete slab-column assembly according to claim 27, wherein in step 3), during the lifting and laying of the prefabricated lightweight steel-reinforced concrete floor, anti-seismic energy dissipation assemblies are mounted between the prefabricated lightweight steel-reinforced concrete wall-like supports and the prefabricated lightweight steel-reinforced concrete columns or between portions of two adjacent prefabricated lightweight steel-reinforced concrete columns proximal to the prefabricated lightweight steel-reinforced concrete floor.

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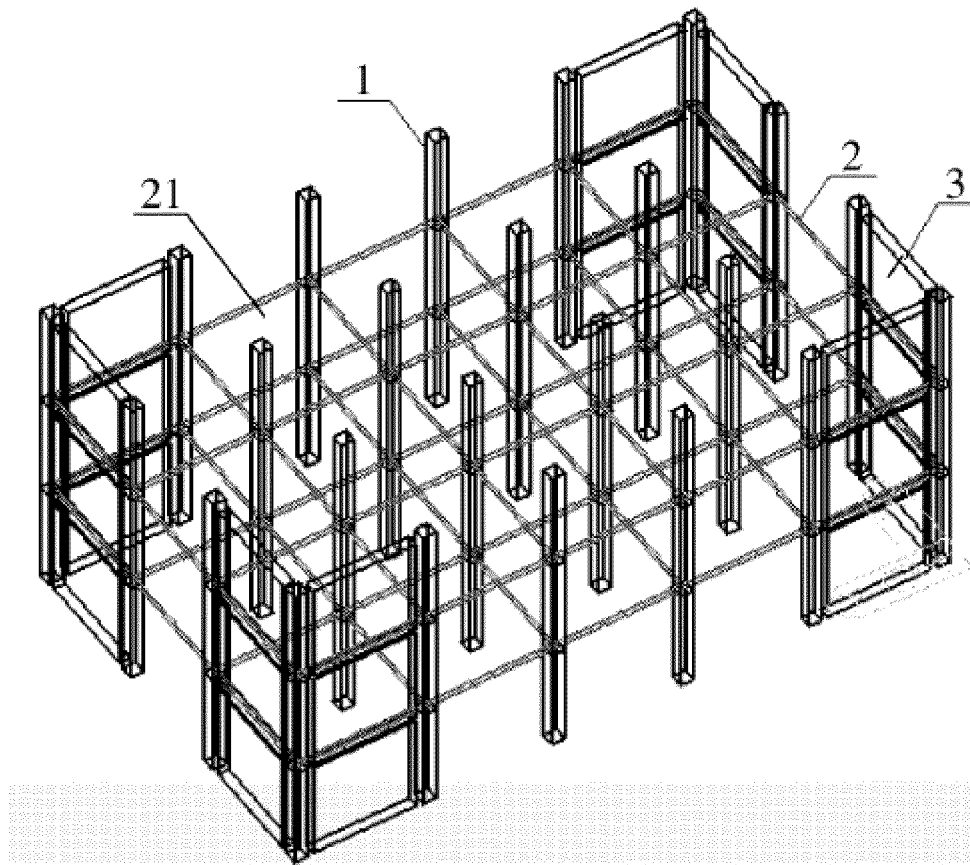


Fig. 1

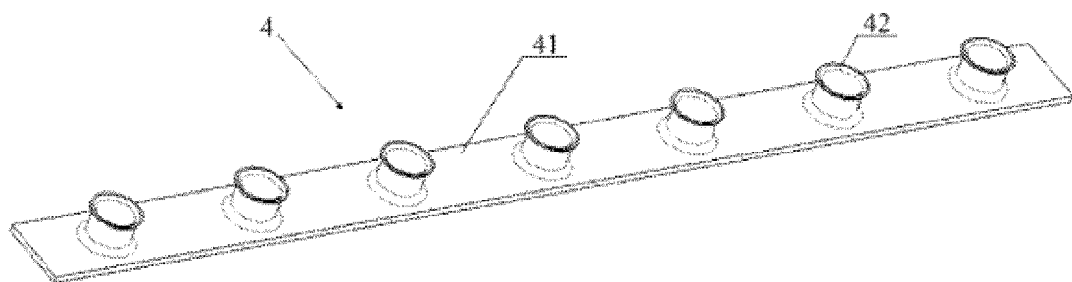


Fig. 2

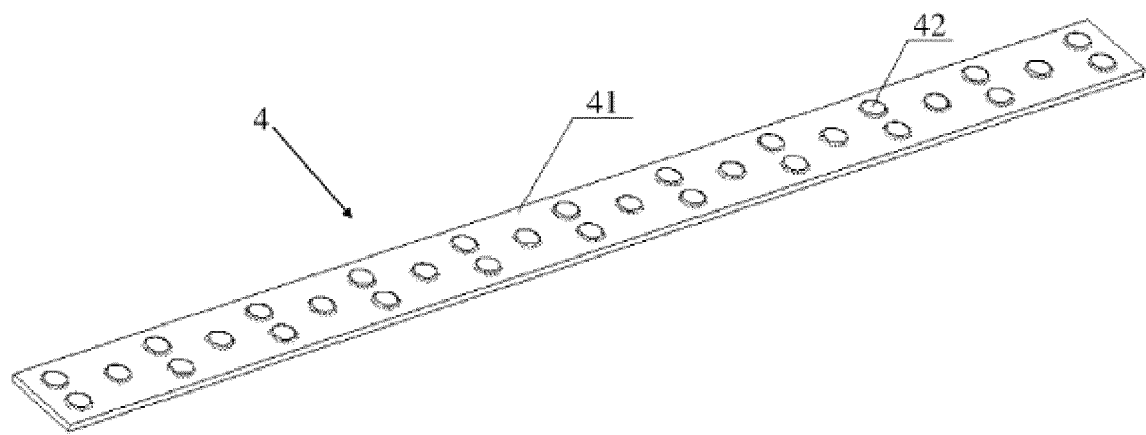


Fig. 3

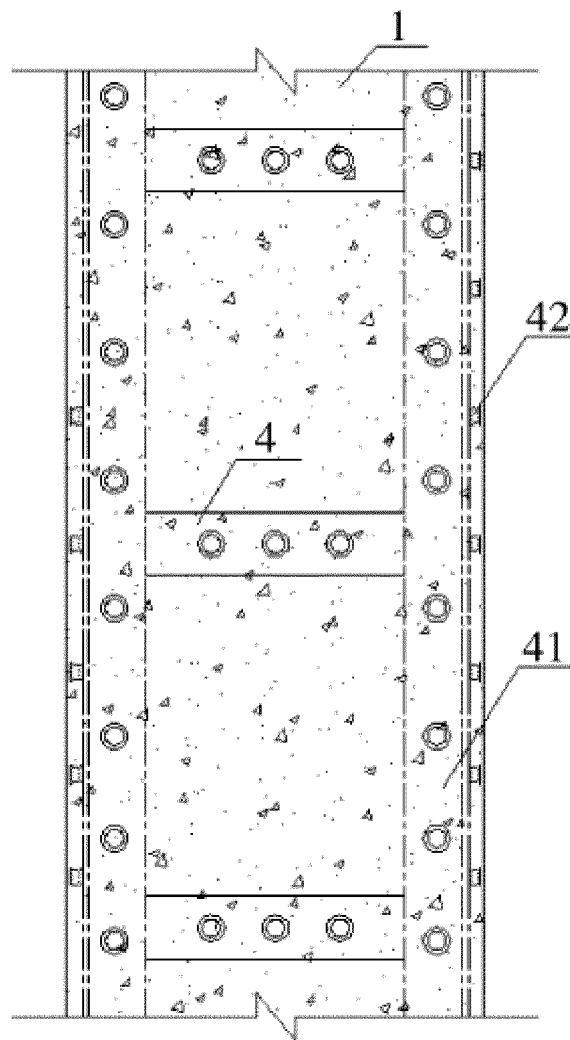


Fig. 4

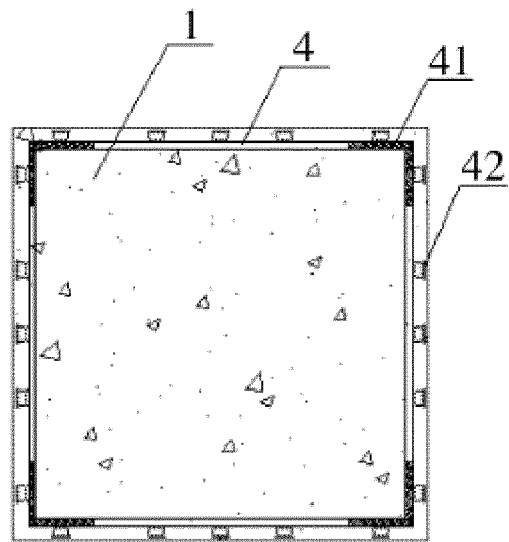


Fig. 5

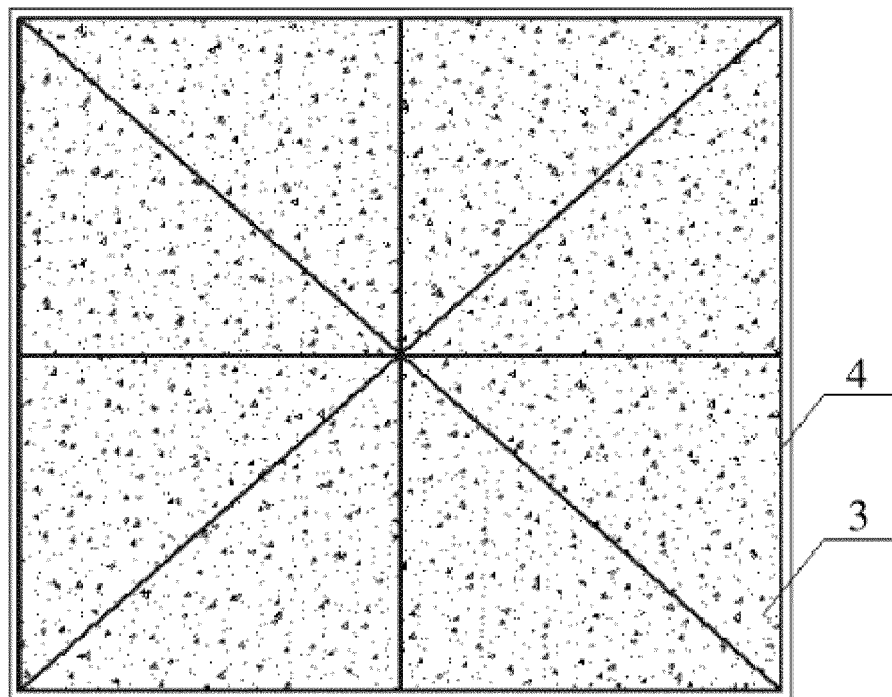


Fig. 6

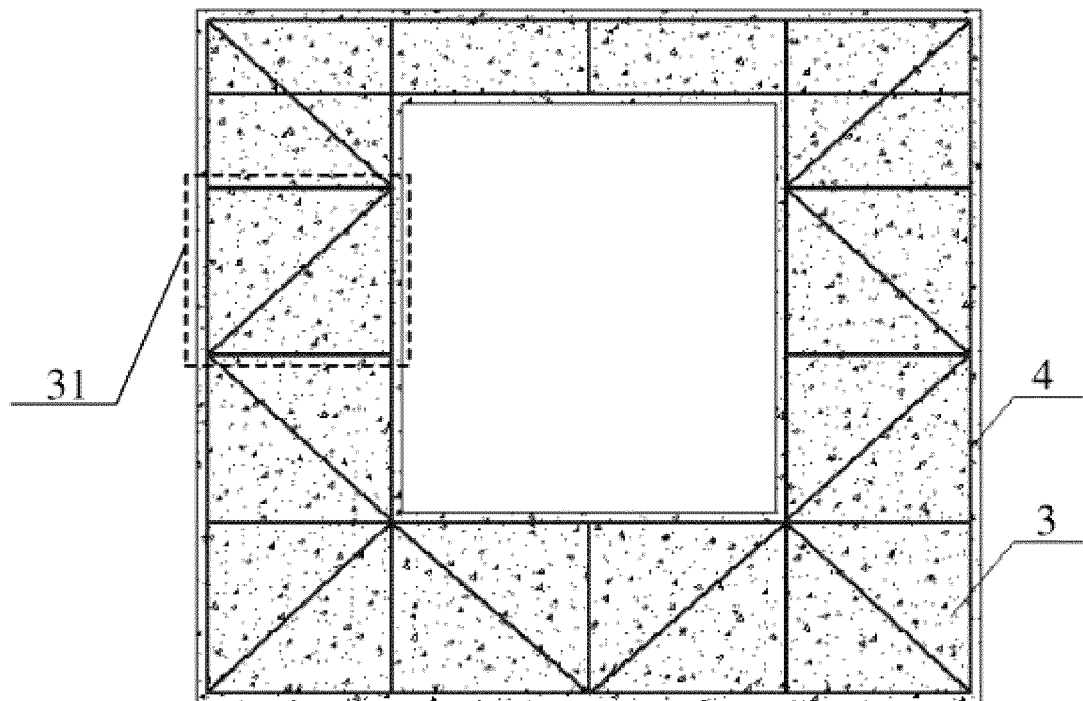


Fig. 7

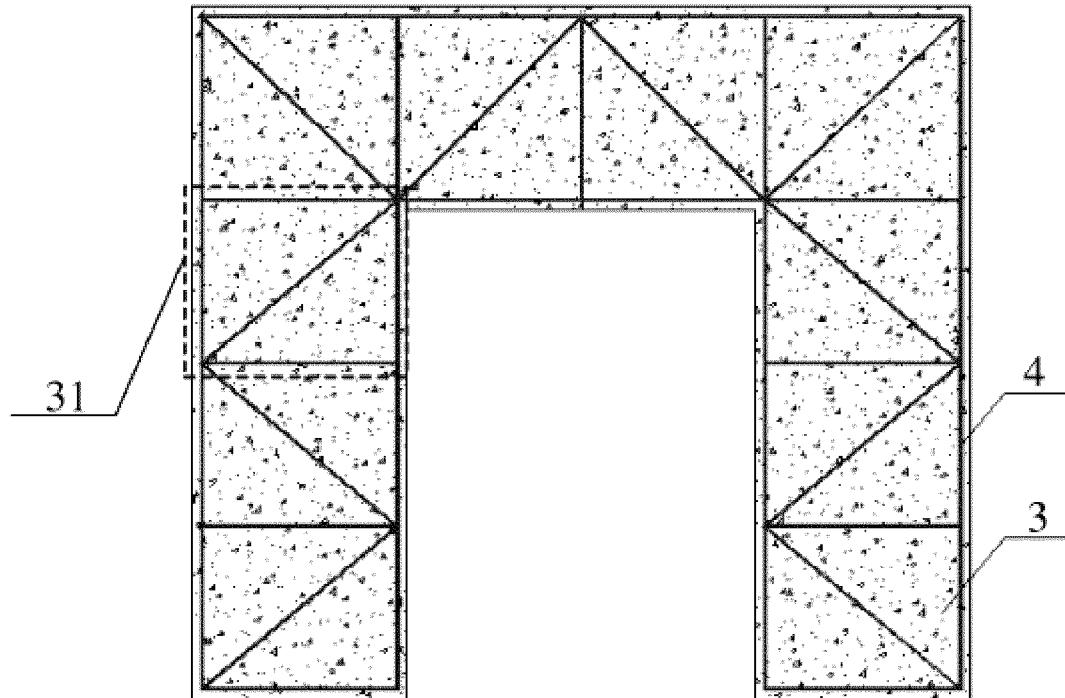


Fig. 8

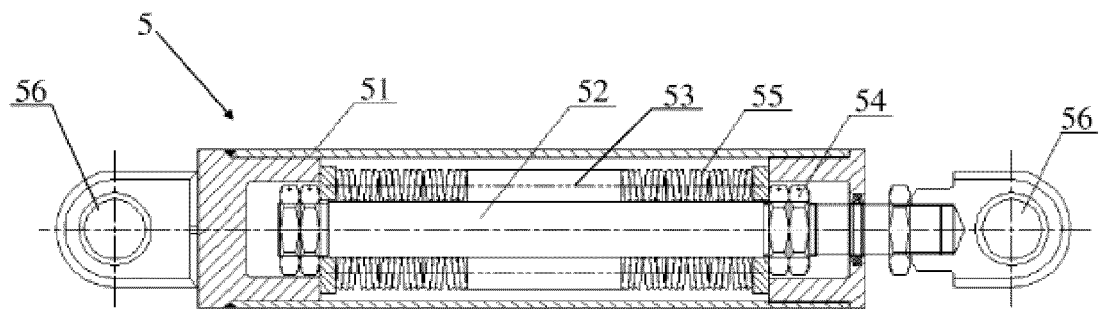


Fig. 9

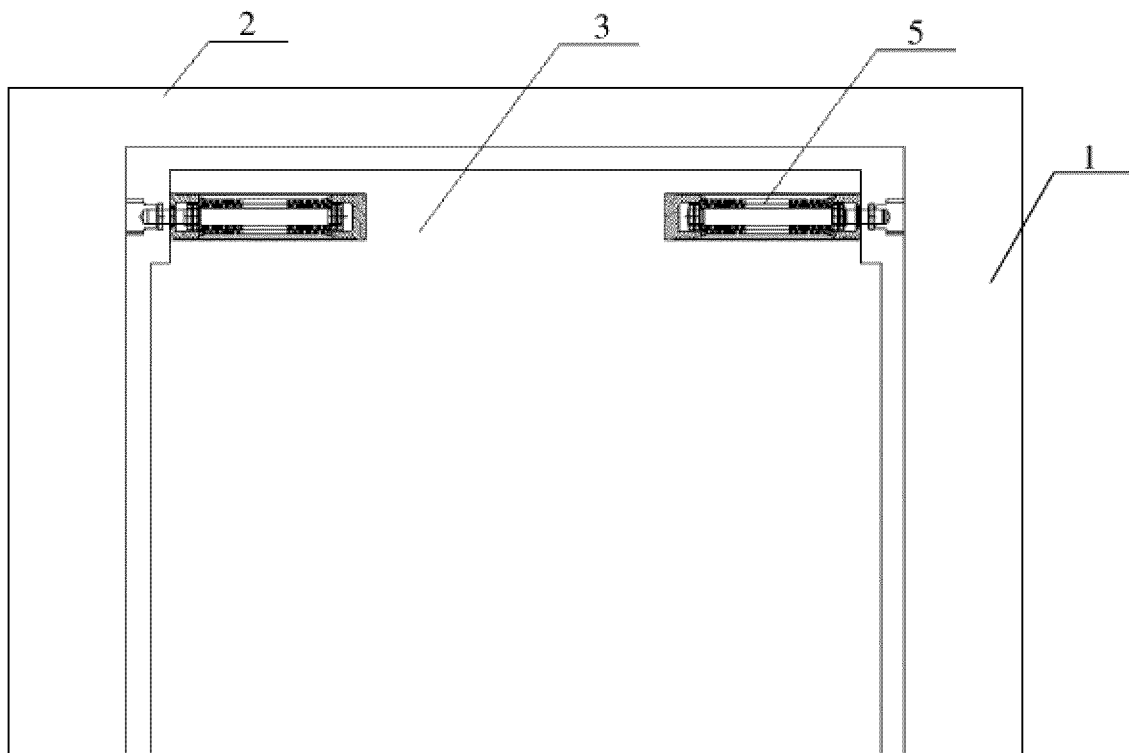


Fig. 10

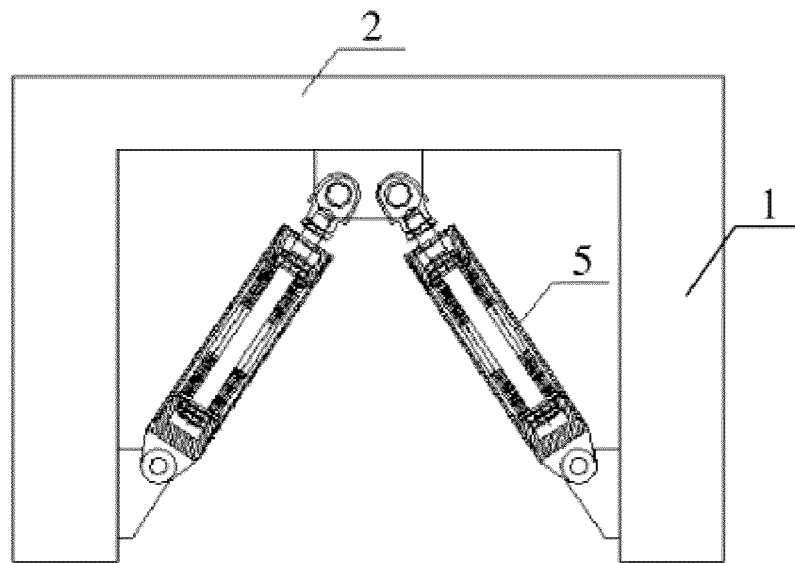


Fig. 11

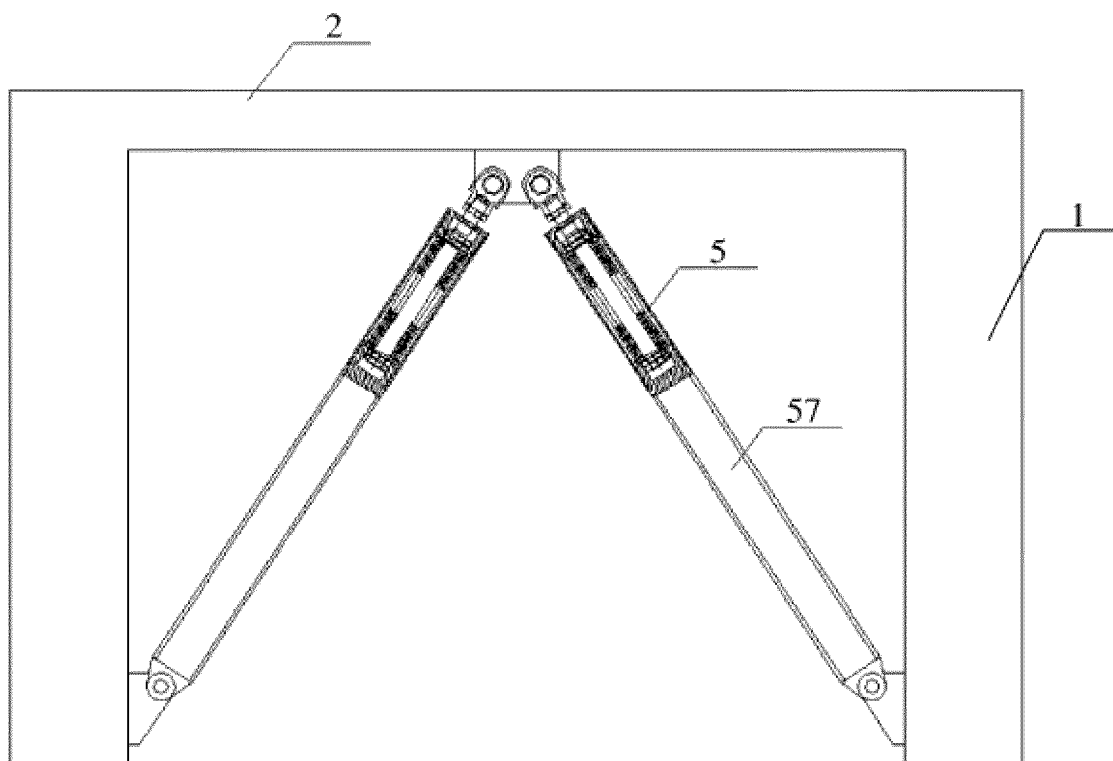


Fig. 12

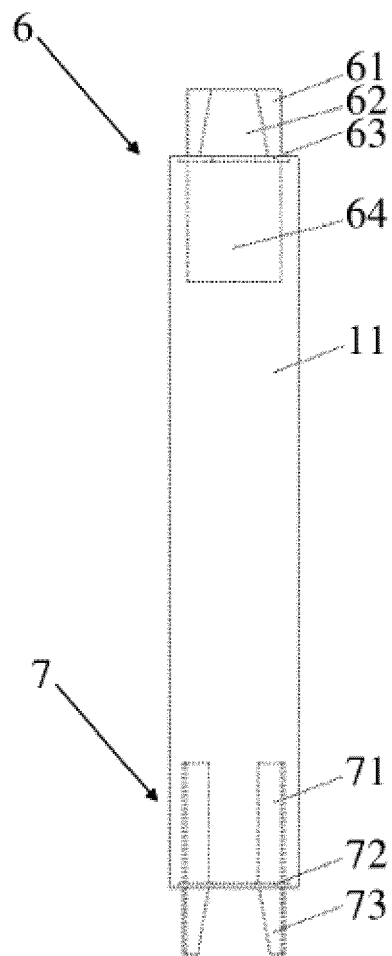


Fig. 13

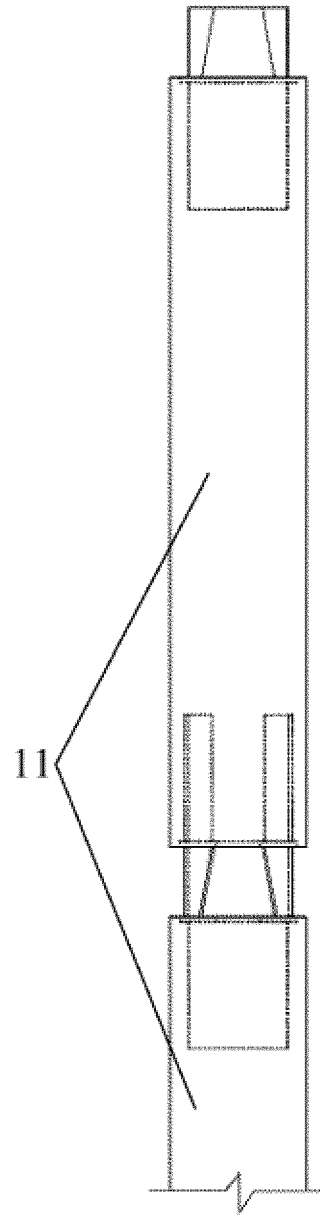


Fig. 14

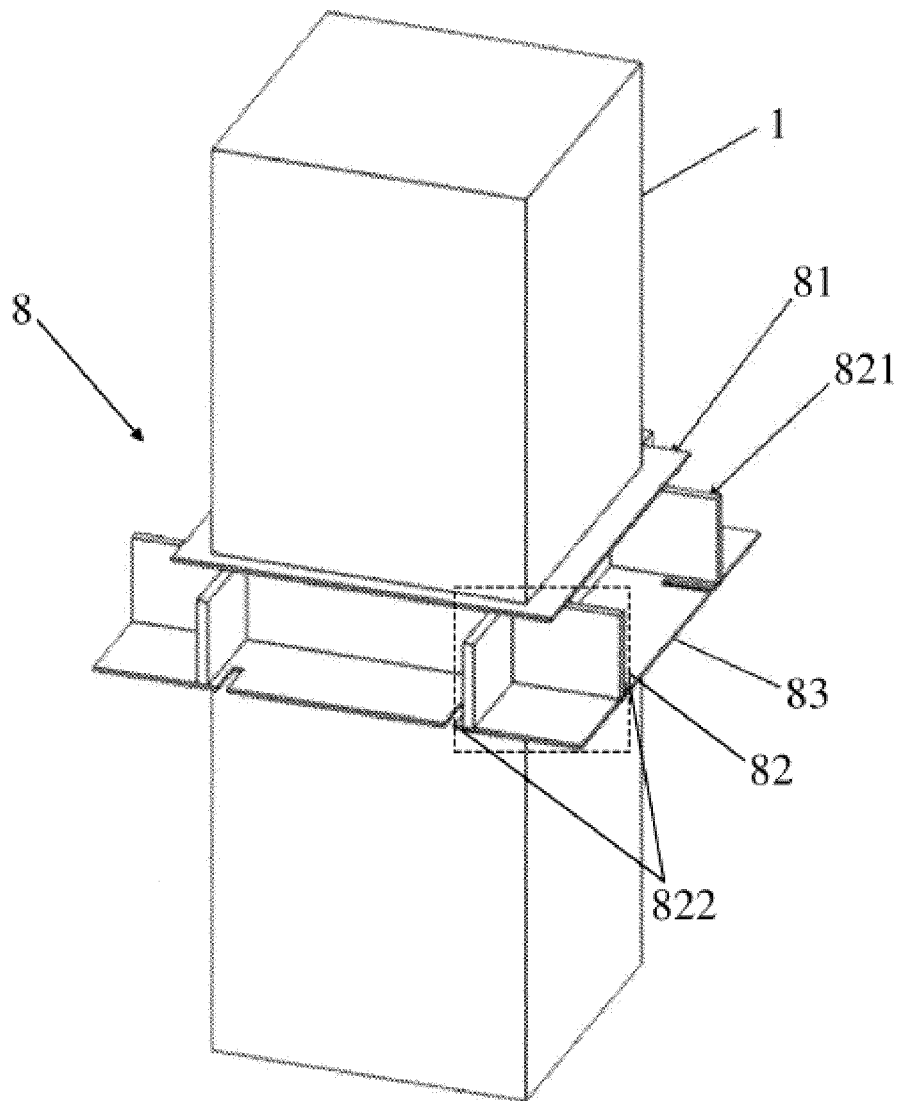


Fig. 15

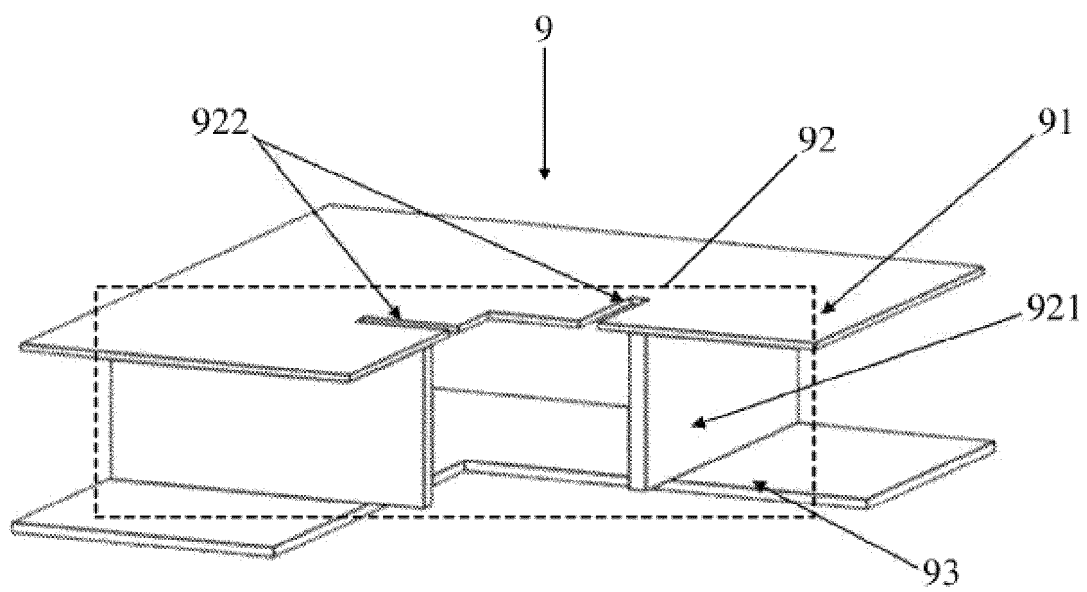


Fig. 16

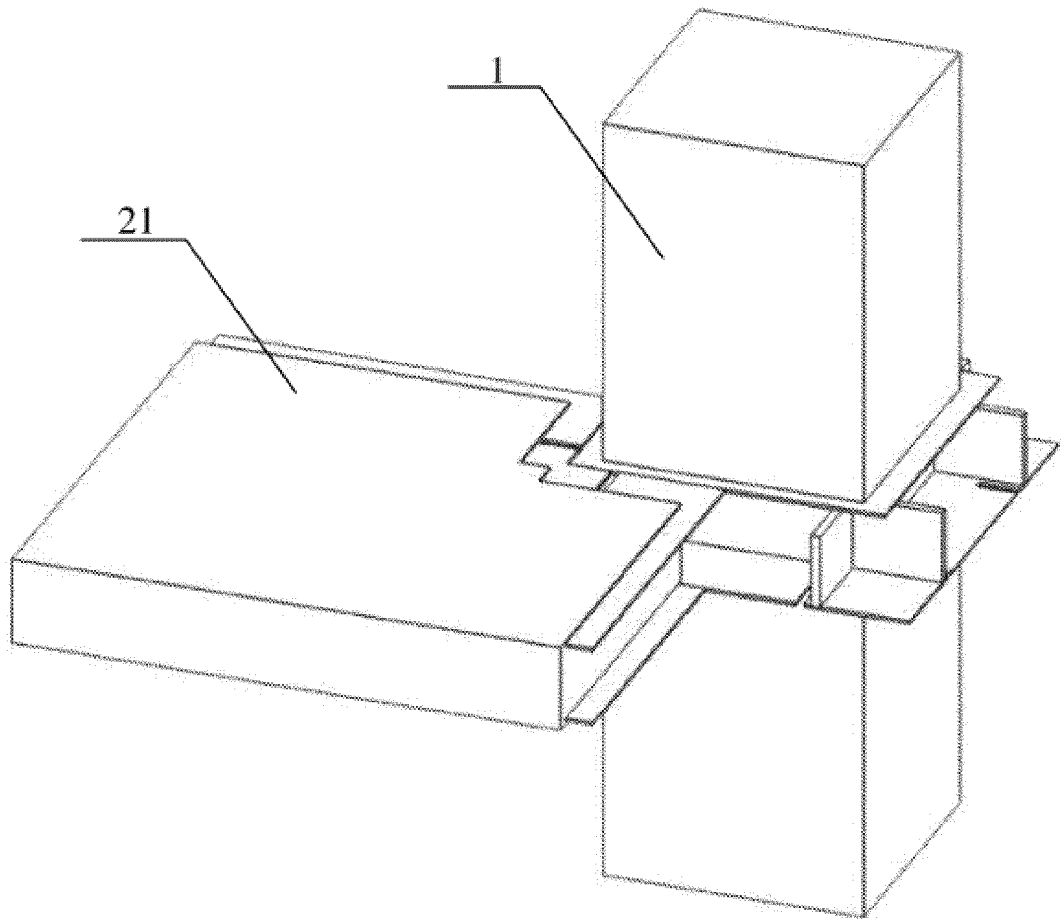


Fig. 17

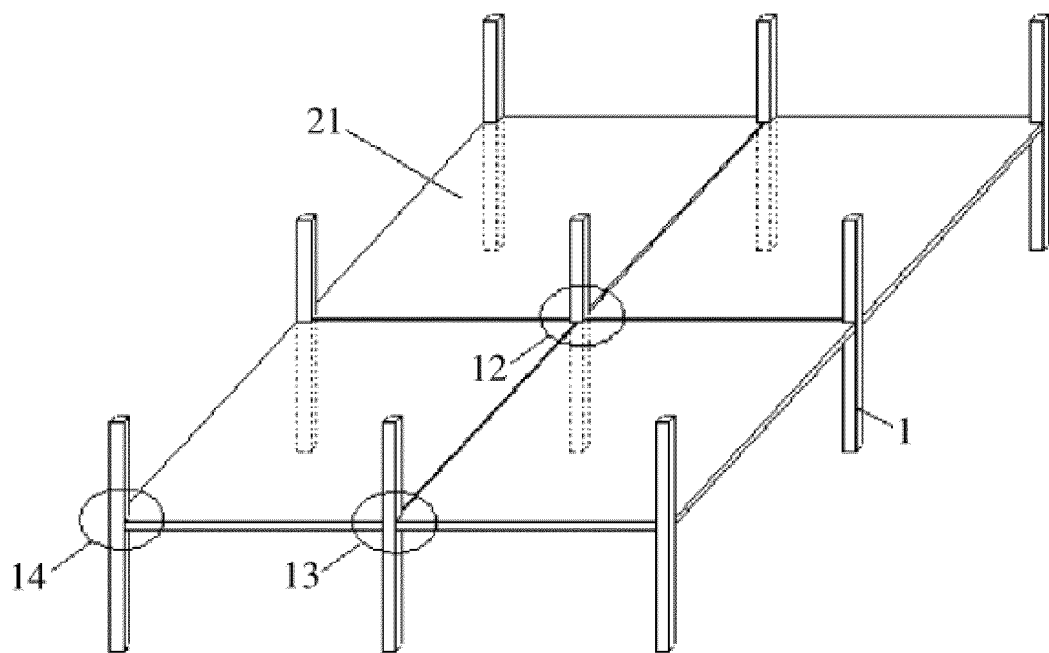


Fig. 18

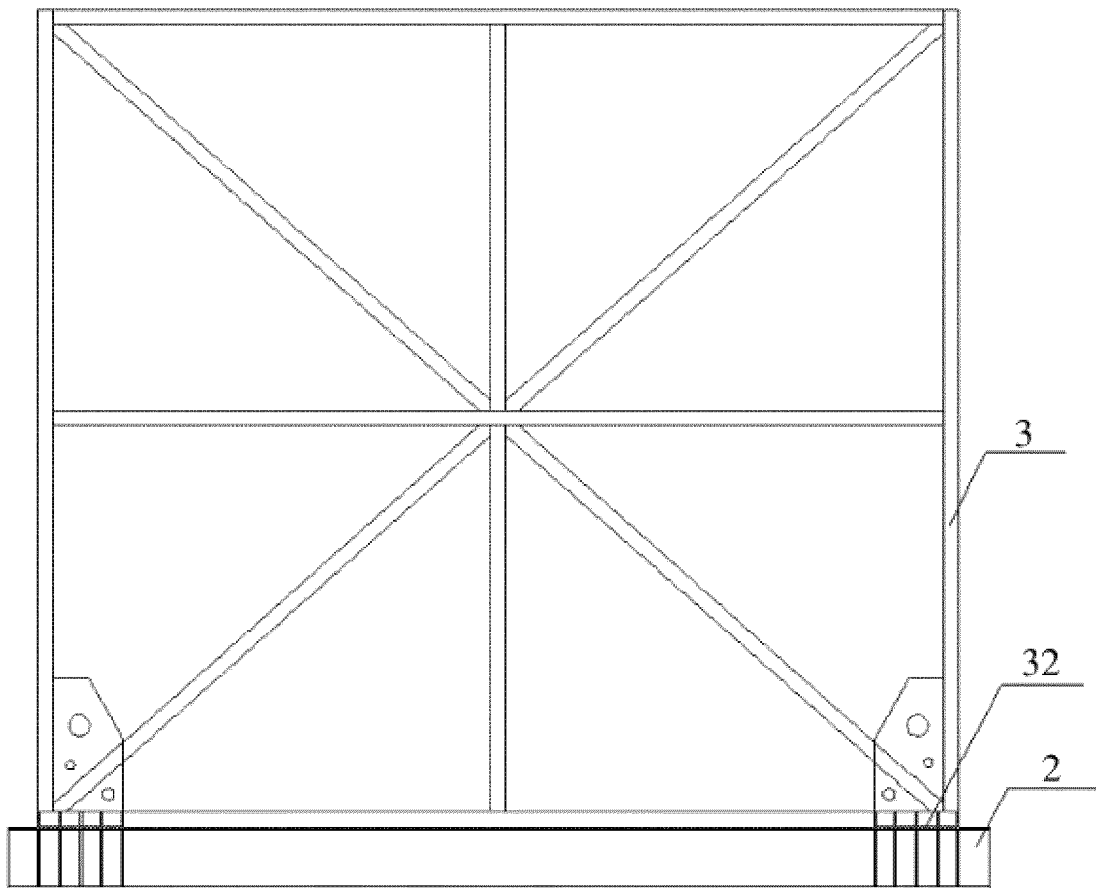


Fig. 19

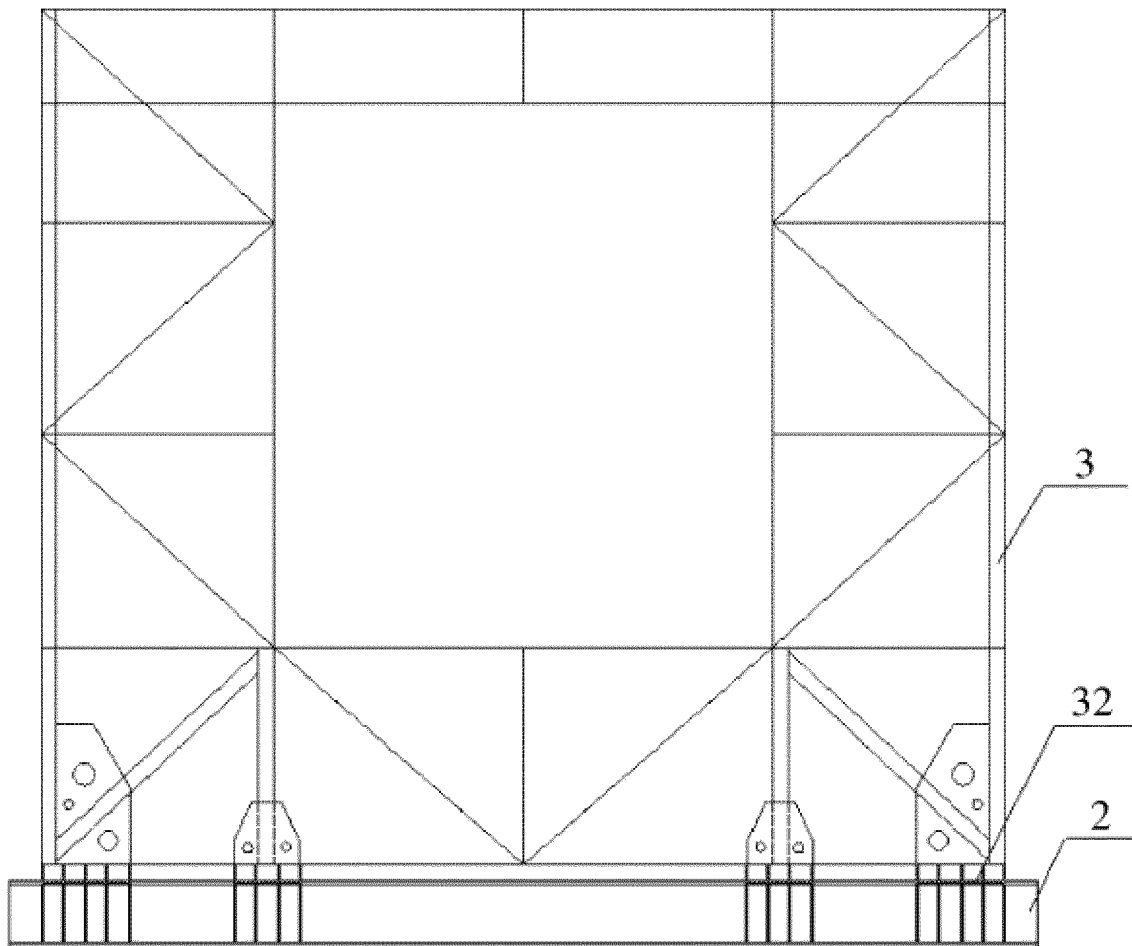


Fig. 20

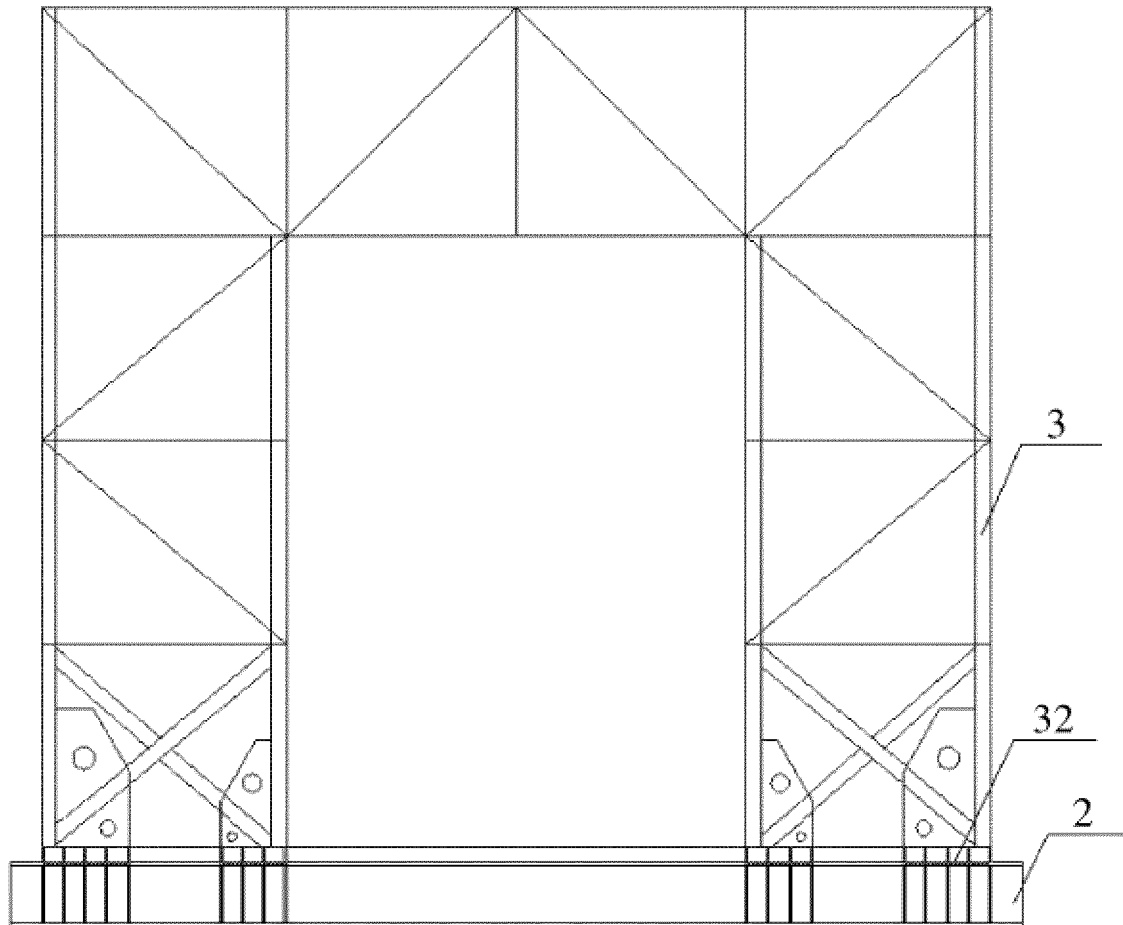


Fig. 21

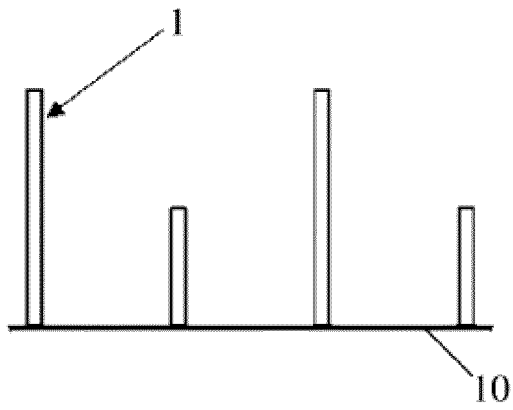


Fig. 22

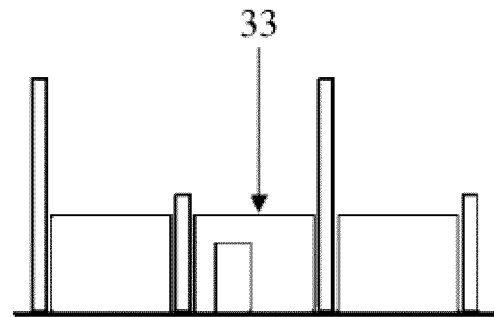


Fig. 23

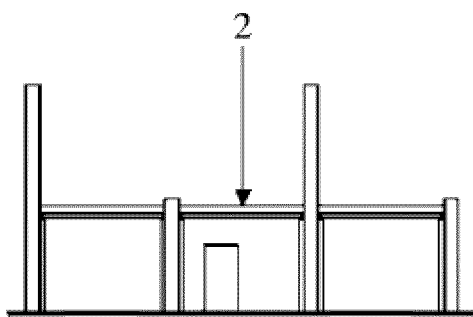


Fig. 24

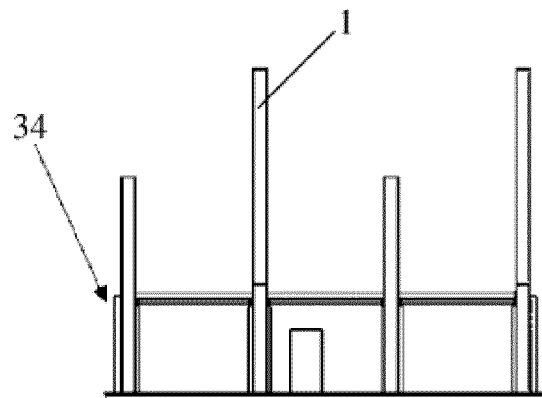


Fig. 25

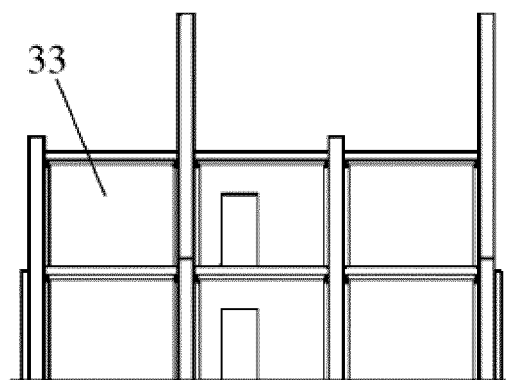


Fig. 26

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2016/085141

A. CLASSIFICATION OF SUBJECT MATTER

E04B 1/30 (2006.01) i; E04B 5/43 (2006.01) i; E04B 1/98 (2006.01) i; E04B 1/21 (2006.01) i; E04B 1/61 (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)

E04B

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)

CNPAT, CNKI, EPODOC, WPI: slab-column structure, shearing resistance, slab, plate, column, prefabricate, assemble, shear, shake, vibrate, seismic, earthquake, damping, spring, sleeve, shaft, axes, axis, joint, junction, flange, trough, slot, groove

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 105275120 A (SHANGHAI MECHANIZED CONSTRUCTION GROUP CO., LTD.), 27 January 2016 (27.01.2016), claims 1-29	1-29
PY	CN 104895229 A (SHANGHAI MECHANIZED CONSTRUCTION GROUP CO., LTD.), 09 September 2015 (09.09.2015), description, paragraphs [0049]-[0078], and figures 1-7	1-29
Y	CN 104428472 A (FUKUOKA UNIVERSITY), 18 March 2015 (18.03.2015), description, paragraphs [0042], [0047] and [0060]-[0066], and figures 1 and 10-14	1-29
Y	CN 204081122 U (YOU, Liang), 07 January 2015 (07.01.2015), description, paragraphs [0016]-[0023], and figure 2	10-13
Y	CN 104328839 A (SINO GREEN GROUP INVESTMENT CORP.), 04 February 2015 (04.02.2015), description, paragraphs [0056]-[0062], and figures 11-16	15-17
A	CN 104389374 A (CHINA UNIVERSITY OF MINING AND TECHNOLOGY, BEIJING), 04 March 2015 (04.03.2015), the whole document	1-29
A	CN 103696607 A (CHINA UNIVERSITY OF MINING AND TECHNOLOGY, BEIJING), 02 April 2014 (02.04.2014), the whole document	1-29

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

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"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	"&" document member of the same patent family

Date of the actual completion of the international search 26 August 2016 (26.08.2016)	Date of mailing of the international search report 09 September 2016 (09.09.2016)
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer LI, Yanqin Telephone No.: (86-10) 62084893

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2016/085141

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 103243804 A (NORTHEAST PETROLEUM UNIVERSITY), 14 August 2013 (14.08.2013), the whole document	1-29
A	JP H11336327 A (DAIWA HOUSE IND.), 07 December 1999 (07.12.1999), the whole document	1-29
A	KR 20060098218 A (SAMSUNG CORP.), 18 September 2006 (18.09.2006), the whole document	1-29

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2016/085141

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CN 104895229 A	09 September 2015	None	
CN 104428472 A	18 March 2015	US 2015191904 A1	09 July 2015
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		WO 2014007284 A1	09 January 2014
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