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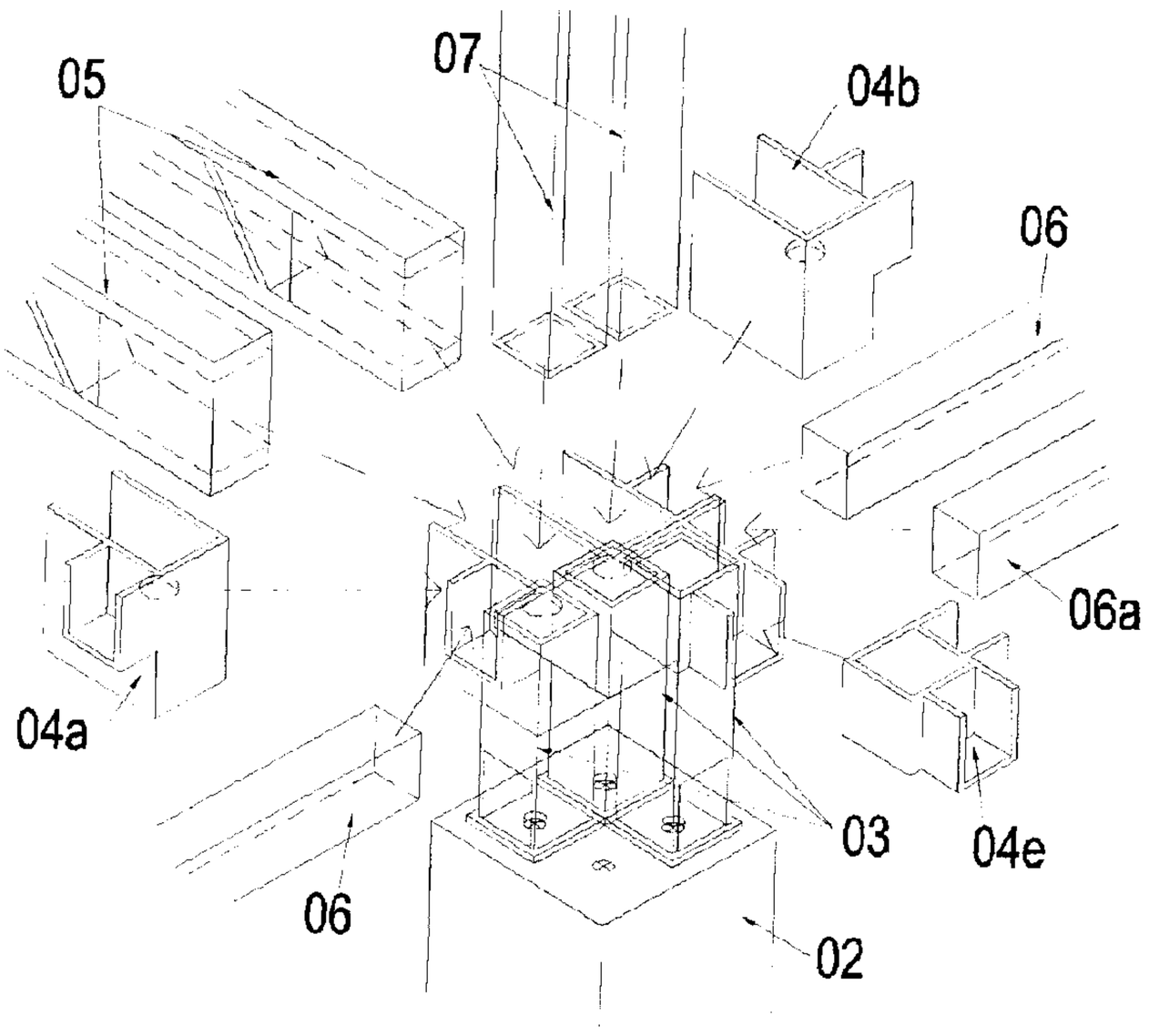
(72) Inventeur/Inventor:
VARIAS, NICHOLAS, CA

(73) Propriétaire/Owner:
VARIAS, NICHOLAS, CA

(74) Agent: NA

(54) Titre : SYSTEME MODULAIRE
(54) Title: MODULAR SYSTEM



(57) Abrégé/Abstract:
The present invention consists of a modular system, which creates square cuboid space modules that can be added, removed, or relocated within a three-dimensional square grid, by using four types of saddles, each one configured for every corner of such a module, to create three connection pockets to connect posts and beams, wherein these saddles are prefabricated from steel sheet, with nine plates continuously welded at the seams. In order to create a larger clear space without posts, four adjacent modules can be structurally merged by removing a central cluster of four main posts. Furthermore, parapet post extensions may be inserted during the initial construction, or during subsequent alterations and additions, without structural modifications, to support dual axis solar tracking devices, or mini wind turbines, or communication devices.

ABSTRACT

The present invention consists of a modular system, which creates square cuboid space modules that can be added, removed, or relocated within a three-dimensional square grid, by using four types of saddles, each one configured for every corner of such a module, to create three connection pockets to connect posts and beams, wherein these saddles are prefabricated from steel sheet, with nine plates continuously welded at the seams. In order to create a larger clear space without posts, four adjacent modules can be structurally merged by removing a central cluster of four main posts. Furthermore, parapet post extensions may be inserted during the initial construction, or during subsequent alterations and additions, without structural modifications, to support dual axis solar tracking devices, or mini wind turbines, or communication devices.

DESCRIPTION

(a) The Title of the Invention: ***MODULAR SYSTEM***

(b) Technical Field: Connection systems between the structural posts and beams in buildings.

(c) Background Art: Current conventional connection systems between the structural steel posts and steel beams in buildings are inflexible, do not facilitate prefabrication, and are difficult and expensive to modify for adaptation, expansion, or disassembly.

The present modular system provides a solution to this problem by introducing a novel connection system that facilitates prefabrication, helps achieve flexible growth, adaptation or relocation, and can help create building modules that can function as living architectural organisms. These modules, like living cells in the natural world, can create building blocks, which can grow, shrink, or be moved. Furthermore, the present invention facilitates the incorporation of solar panels and mini wind turbines to achieve energy self-sufficiency of buildings.

The idea behind the present modular system has originated from Nicholas Varias's winning design in Canada Mortgage and Housing Corporation's FlexHousing™ Design Competition of 1995, a model of which was built at the Canadian Centre for Housing Technology in Ottawa. The concept is made easy to understand by Amanda's story, which was edited and published by CMHC as *"The Circle of Life" in FlexHousing: Homes that Adapt to Life's Changes.*c1999, ISBN: 0660174114.

There currently exist several patents for modular systems, and structural connection systems, which are modular, or demountable. However, the present invention is uniquely novel by introducing a specially configured saddle to connect posts and beams, and facilitate the erection and installation of the structural frame for each module, and its disassembling, relocation, and/or reuse, as needed. Thus, independent stand-alone modules are created. They can be added, removed and relocated, without disturbing the structure of adjacent modules.

(d) The Technical Problems and the Solutions:

The present invention solves the following problems:

i) How to facilitate the prefabrication of buildings for efficient and economic transportation, and for fast assembly or disassembly:

The present invention facilitates the design and manufacturing structural building components for easy transportation, and for their fast assembly or disassembly, with minimum manpower and equipment **(fig 5)**.

ii) How to achieve building flexibility, adaptability, reuse and relocation:

The present invention can create stand-alone structural modules, which can be added within a three-dimensional grid, or demounted and relocated as needed, without disturbing the adjacent modules **(fig 6, 7, 8, 9)**.

In order to create a larger clear space without columns, four adjacent modules can be structurally merged by removing the central cluster of four posts and saddles, and by joining and reinforcing the beams **(fig 7)**.

iii) How to achieve efficient installation, demountability and reuse of the building components:

The present invention provides four different types of steel saddles for the installation and connection of posts and beams **(fig 1, 2, 3)**, for accommodating each corner of the module.

iv) How to install pole-mounted solar panels, mini-wind turbines and communication devices on a rooftop terrace, without affecting the usable outdoor space, at any time during the life of the building:

The saddles (04a, 04b, 04c, 04d) used at the roof parapet, can accommodate parapet post extensions (09), which may be incorporated during construction or after completion, and, in addition to supporting the guardrails around the rooftop terrace, may also support pole-mounted solar panels, mini wind turbines, or communication devices, which are elevated overhead. **(fig 4, 5)**.

e) Description of figures:

The figures illustrate the configuration, the purpose and the various benefits that the present modular system can bring in the construction of prefabricated modular buildings, whose aim is to be flexible and adaptable in space and time, and also environmentally sustainable.

Figure 1 illustrates the design of a saddle type 04a, in an isometric view (a), view from above (b), view from below (c), side view from a primary beam (d) and side view from a secondary beam (d). The saddle is prefabricated from nine steel plates to create three connection pockets; a square pocket, which is open downward to secure a saddle on top of a lower main post (07), which said square pocket is created by a front-side vertical plate (8), a right-side vertical plate (5), a left-side vertical plate (6), a vertical plate (9) placed between, perpendicularly to, and near the mid-length of the right-side and left-side vertical plates (5 & 6), and a horizontal square plate (1) placed between, perpendicularly to, and near mid-height of the right-side and left-side vertical plates (5 & 6); a stepped pocket, which is open upward to support a primary beam (05) and an upper main post (07), which said stepped pocket is created by right-side vertical plate (5), left-side vertical plate (6), front-side vertical plate (8), vertical plate (9), and a horizontal plate (3) placed between the bottom edges of, and perpendicular to right-side and left-side vertical plates (5 & 6); a U-shaped pocket, which is open upward to support a secondary beam (06), which said U-shaped pocket is created by a right-side vertical plate (7), a left-side vertical plate (10), and a horizontal plate (4).

Figure 2 illustrates a cluster of four post/beam connections using four saddles (04a, 04b, 04c & 04d), and also shows the corresponding primary beams (05), secondary beams (06) and main posts (07).

Figure 3 illustrates a cluster of saddles (04a, 04b & 04e) located at the left-side of an entrance porch, which connect three crawl space posts (03), two main posts (07), two primary beams (05), two secondary beams (06) and an entrance porch beam (06a).

Figure 4 illustrates the insertion of two parapet post extensions (09) into two saddles (04b & 04c), which connect two main posts (07), two primary beams (05) and two secondary beams (06).

Figure 5 illustrates how the present modular system permits the insertion of a parapet post extension (09) into a saddle (04c) to support guardrails (10) and also a pole-mounted dual axis solar tracking device with four photovoltaic solar panels. This can be achieved during construction, or after the building was completed, as the need may arise.

Figure 6 illustrates an example of a square cuboid building module that can be created by using the present modular system for the main structural elements. The following building elements are show in order to illustrate the purpose of the present invention: footings (01), piers (02), helical foundations (02a), which pending soil conditions, could be used in lieu of footings (01) & piers (02), crawl space posts (03), saddles (04a, 04b, 04c & 04d), primary beams (05), triangular braces (05a), secondary beams (06), main posts (07), parapet post extensions (09), parapet guardrails (10).

Figure 7 illustrates how a saddle connection allows the removal of a cluster (a1-a2) of main posts and the reinforcing the primary beams (b1 & b2), in order to create a larger open area.

Figure 8 illustrates the three-dimensional expansion of a building with structural cuboid modules. The present modular system provides rigid moment connections between posts and beams, allowing the assembly of structural cuboid nodules to be made on the ground and then, their placing at higher levels to be done with a crane.

Figure 9 illustrates an example of applying the present modular system to construct a one-storey building block with four cuboid modules and the addition of a stair & greenhouse module, which provides access to the rooftop terrace. The following building elements are show in order to illustrate the purpose of the present invention: footings (01), piers (02), helical foundations (02a), which pending soil conditions, could be used in lieu of footings (01) & piers (02), crawl space posts (03), saddles (04a, 04b, 04c, 04d, 04e & 04f), primary

beams (05), triangular braces (05a), secondary beams (06), main posts (07), parapet post extensions (09), parapet guardrails (10), greenhouse (13), stair (14), elevator structure (15), dual axis solar tracking devices (17), mini wind turbines (28), communication devices (30).

The saddles at the roof parapet can accommodate the incorporation of parapet post extensions (09), which can support dual axis solar tracking devices (17), mini wind turbines (28), or communication devices (30), which are mounted on poles and do not interfere with the use of the rooftop terrace.

f) Plan to implement the invention:

Phase 1: Business Plan & Financing: Create a partnership, or joint venture, with a developer and/or builder for developing modular housing units, using the present invention.

Phase 2: Model Unit: Build a model housing unit, which will incorporate the present invention.

Phase 3: Promotion and marketing: Exporting the intellectual property of the present invention in Canada and abroad.

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A modular building connection system, which creates square cuboid space modules, by using four types of saddles, each one configured for either the north-west (04a), the north-east (04b), the south-east (04c) or the south-west (04d) corner of a space module, wherein each saddle connects a lower main post (07), an upper main post (07), a primary beam (05), and a secondary beam (06), and wherein each saddle is prefabricated from nine steel plates to create three connection pockets; a square pocket, which is open downward to secure a saddle on top of a lower main post (07), which said square pocket is created by a front-side vertical plate (8), a right-side vertical plate (5), a left-side vertical plate (6), a vertical plate (9) placed between, perpendicularly to, and near the mid-length of the right-side and left-side vertical plates (5 & 6), and a horizontal square plate (1) placed between, perpendicularly to, and near mid-height of the right-side and left-side vertical plates (5 & 6); a stepped pocket, which is open upward to support a primary beam (05) and an upper main post (07), which said stepped pocket is created by right-side vertical plate (5), left-side vertical plate (6), front-side vertical plate (8), vertical plate (9), and a horizontal plate (3) placed between the bottom edges of, and perpendicular to right-side and left-side vertical plates (5 & 6); a U-shaped pocket, which is open upward to support a secondary beam (06), which said U-shaped pocket is created by a right-side vertical plate (7), a left-side vertical plate (10), and a horizontal plate (4).

2. A modular building connection system as defined in Claim 1, wherein the horizontal plate (1) has a round hole (2) to allow the vertical transfer of electric cables from solar photovoltaic panels.

3. A modular building connection system as defined in Claims 1 & 2, wherein in order to create a clear space without posts, four adjacent square cuboid space modules can be structurally merged by removing a central cluster of four main posts (07), and by joining and reinforcing the primary beams (05) which were supported by the four main posts (07) to be removed.

4. A modular building connection system as defined in Claims 1, 2 & 3, wherein the roof parapet incorporates parapet post extensions (09), which in addition to supporting guardrails, may also support pole-mounted dual axis solar tracking devices (17) with PV solar panels, pole-mounted mini wind turbines (28), or pole-mounted communication devices (30), without interfering with the use of the rooftop terrace.

5. A modular building connection system as defined in Claims 1, 2, 3 & 4, wherein the square cuboid space modules are independent and stand-alone, and can be added, removed, or relocated within a square three-dimensional rectangular grid, without disturbing the adjacent square cuboid space modules.

Figure 1

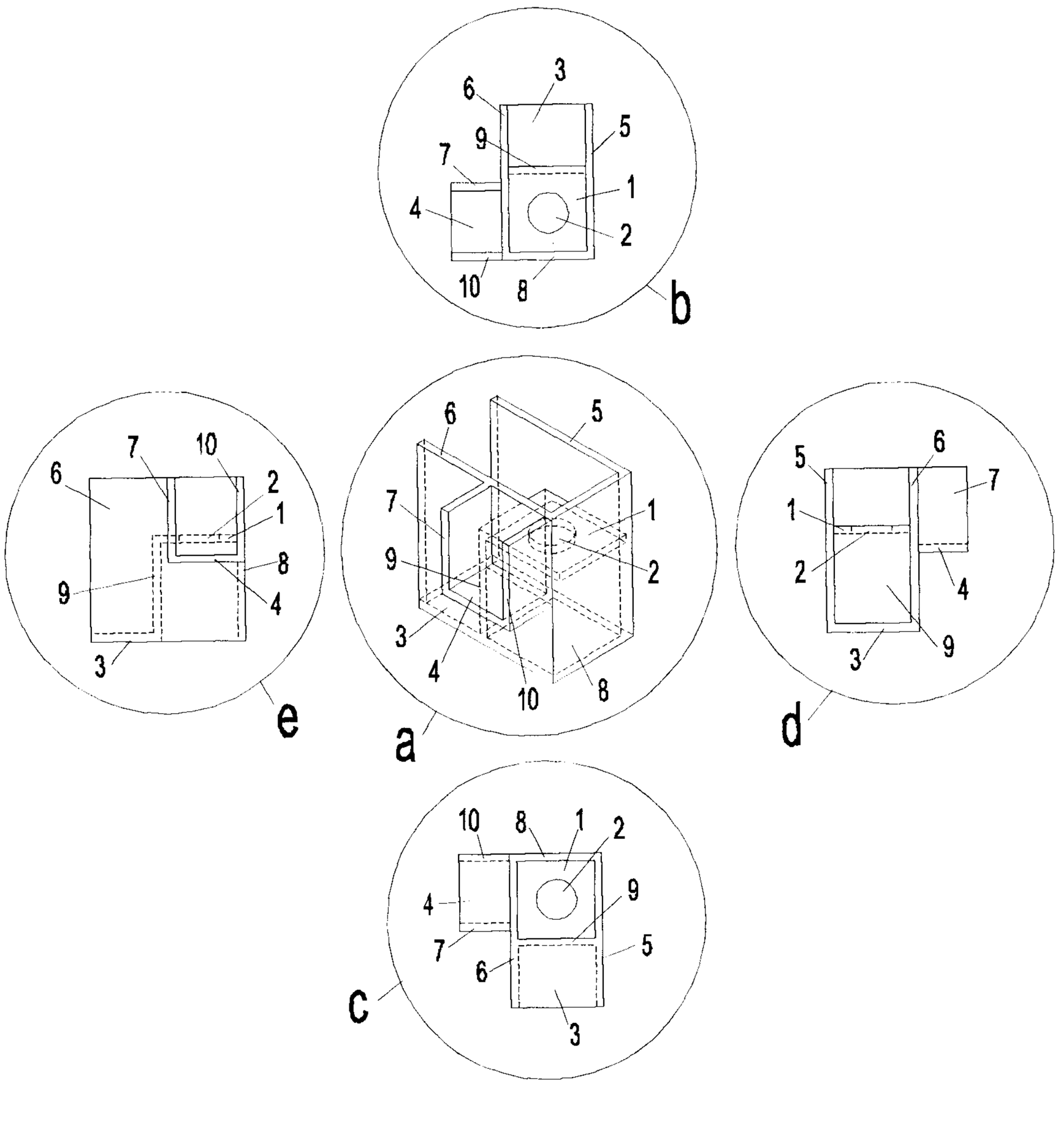

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Figure 2

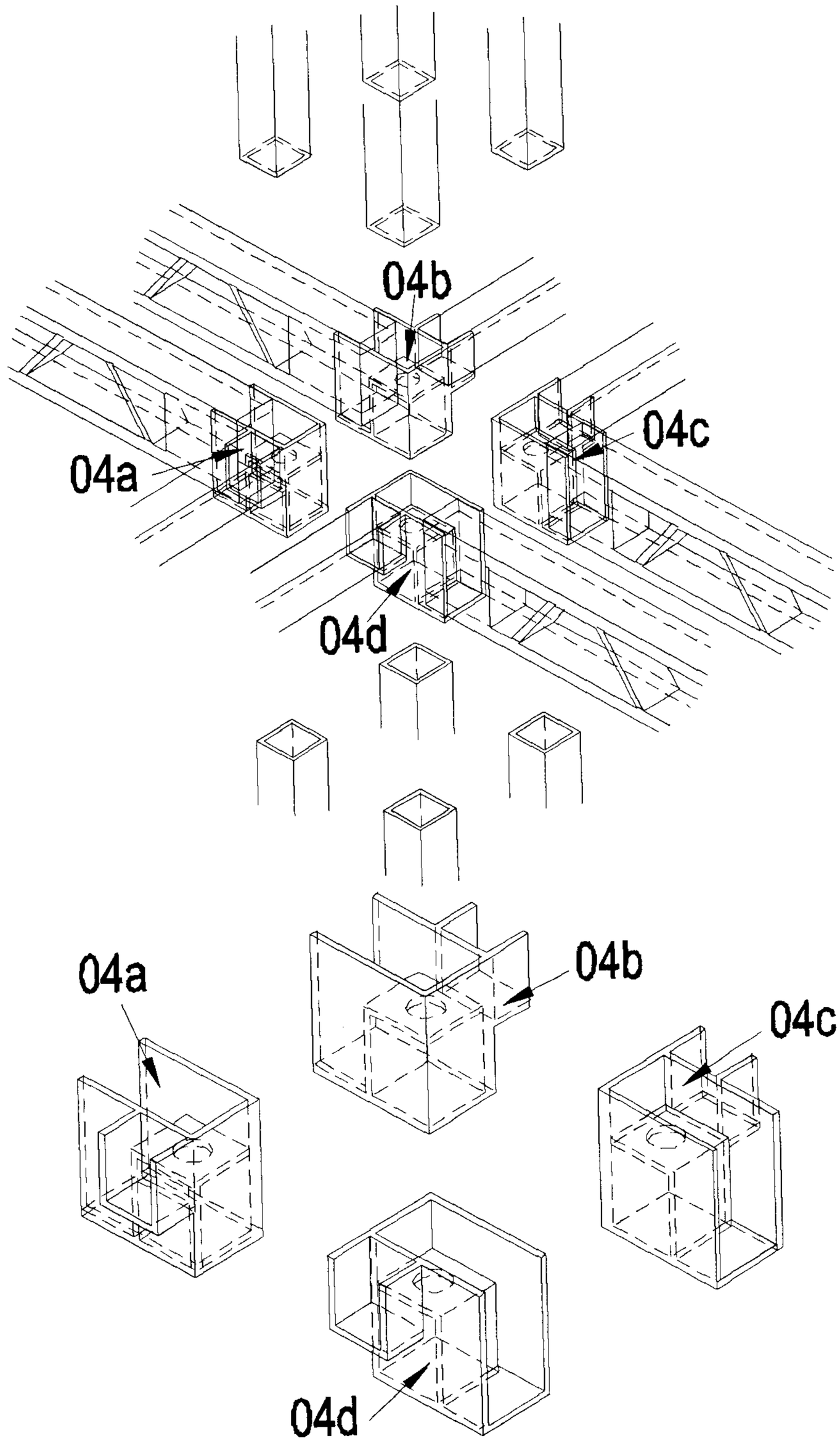


Figure 3

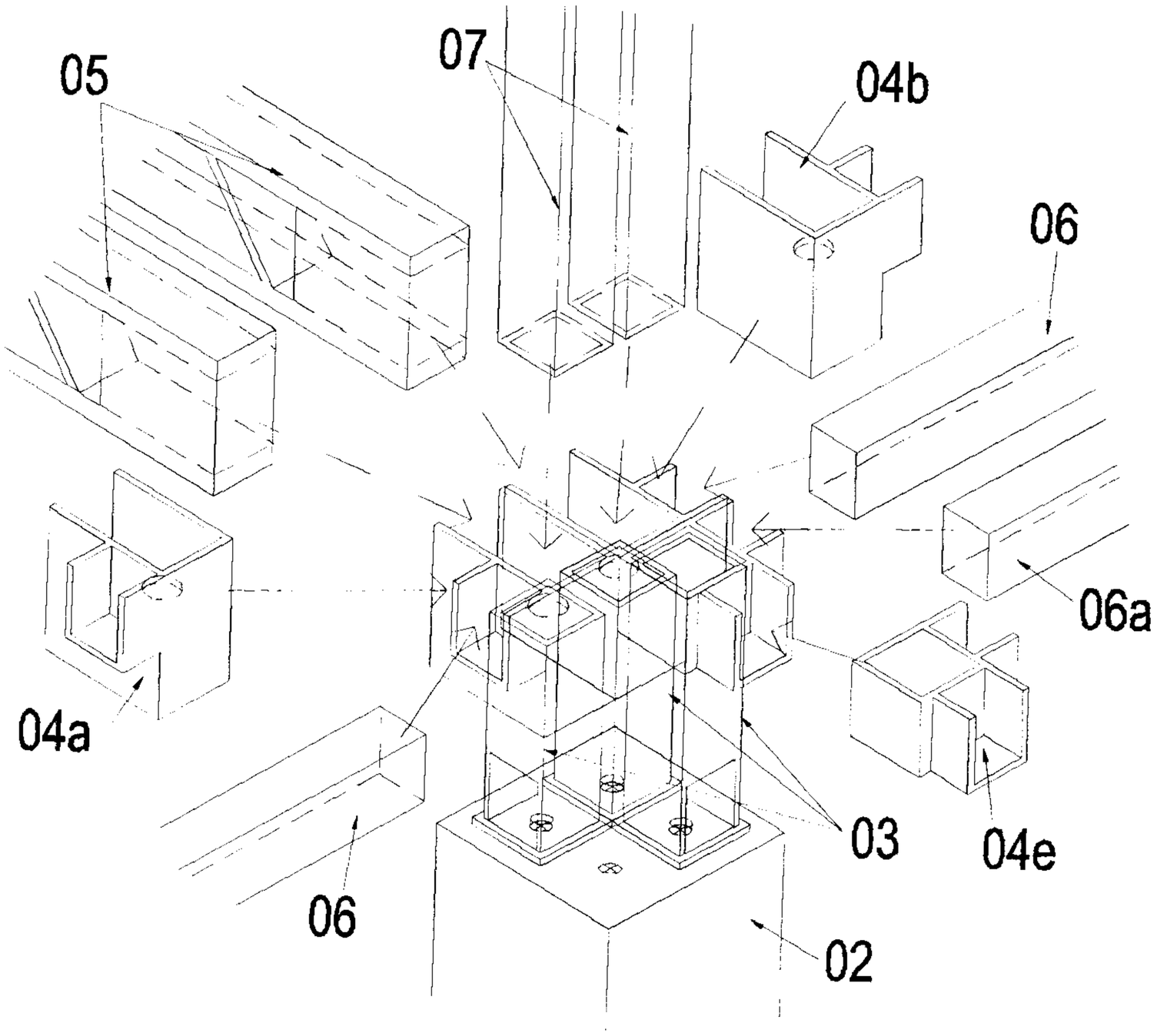


Figure 4

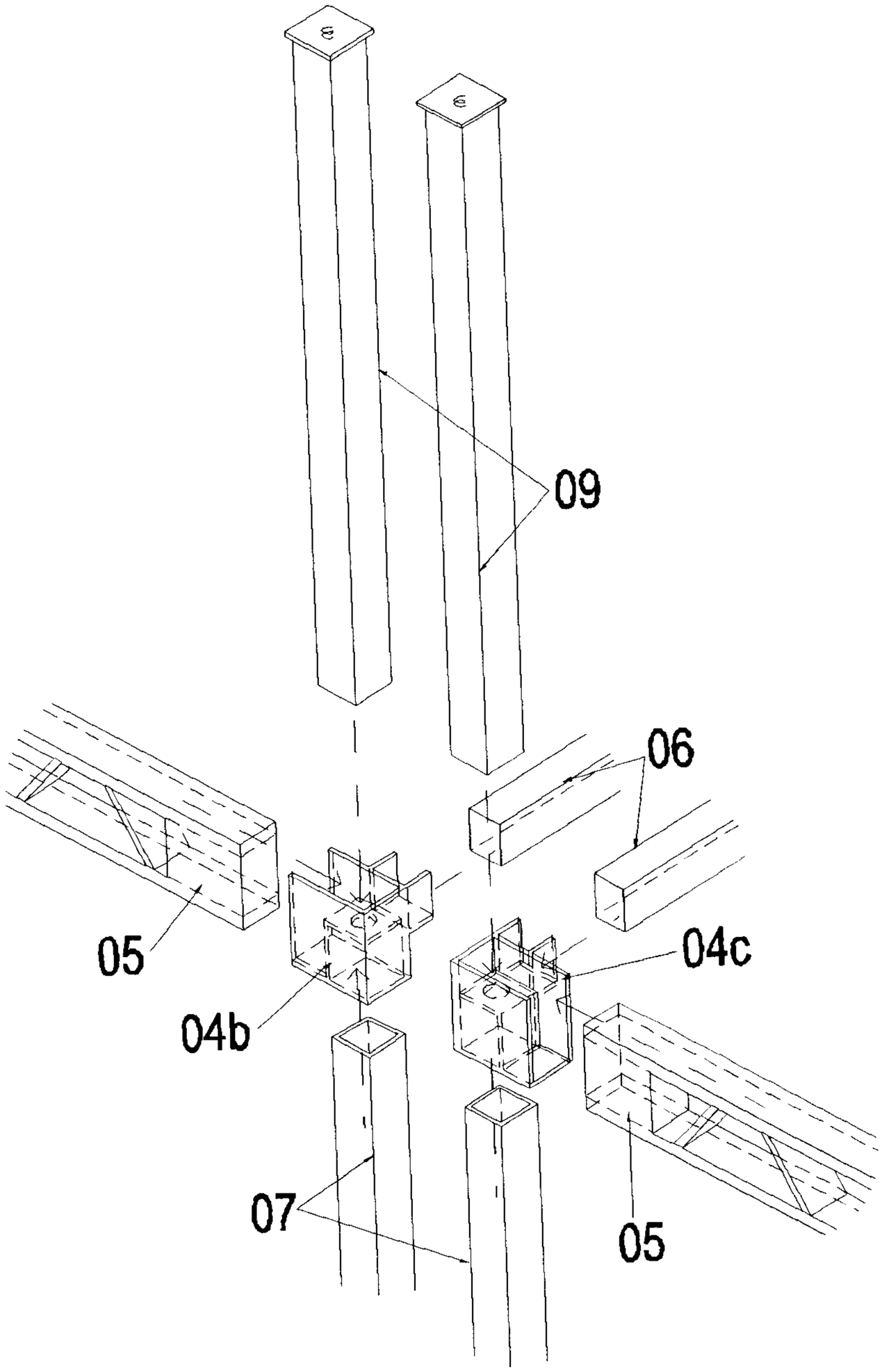


Figure 5

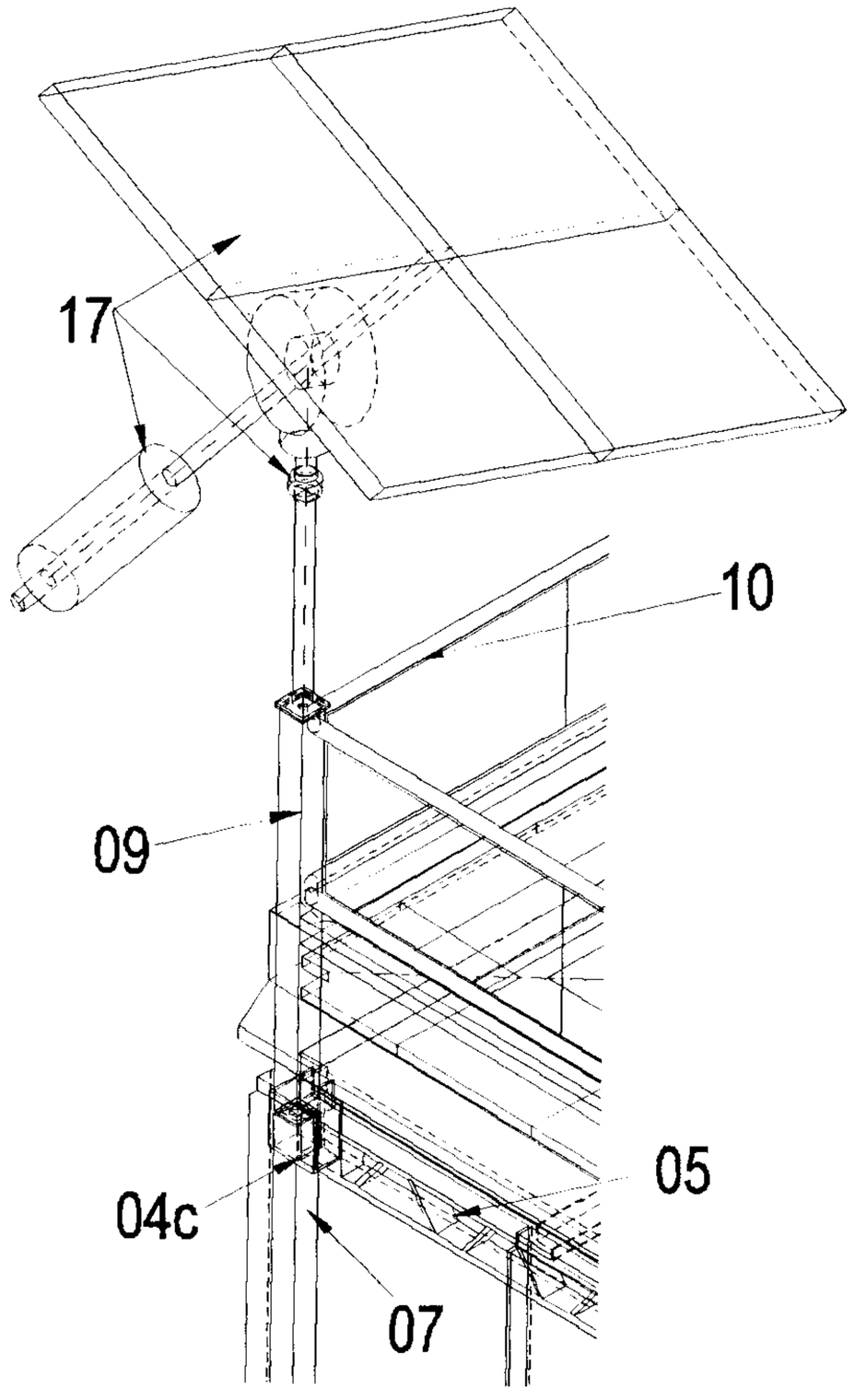
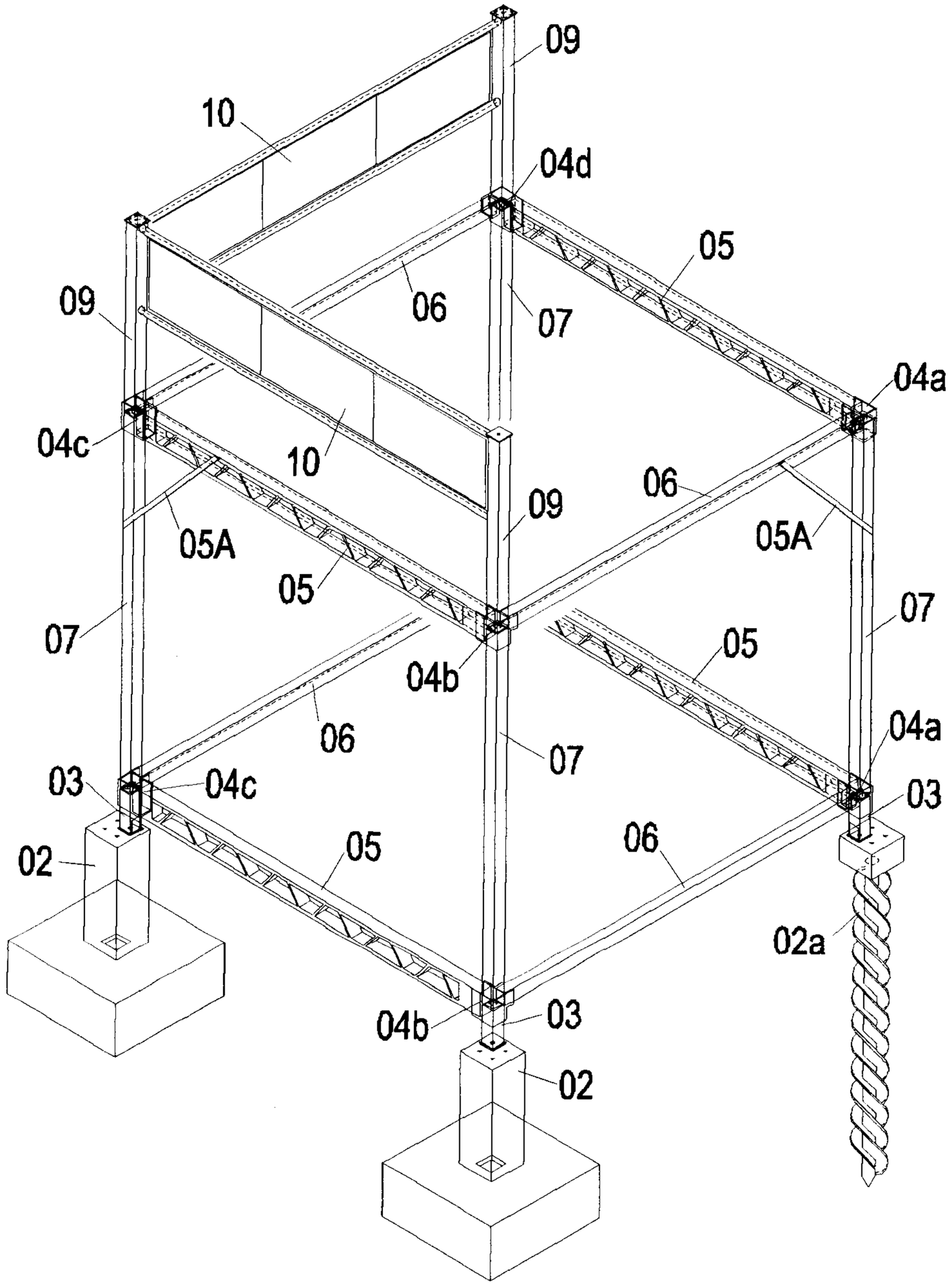


Figure 6


09
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04d
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Figure 7

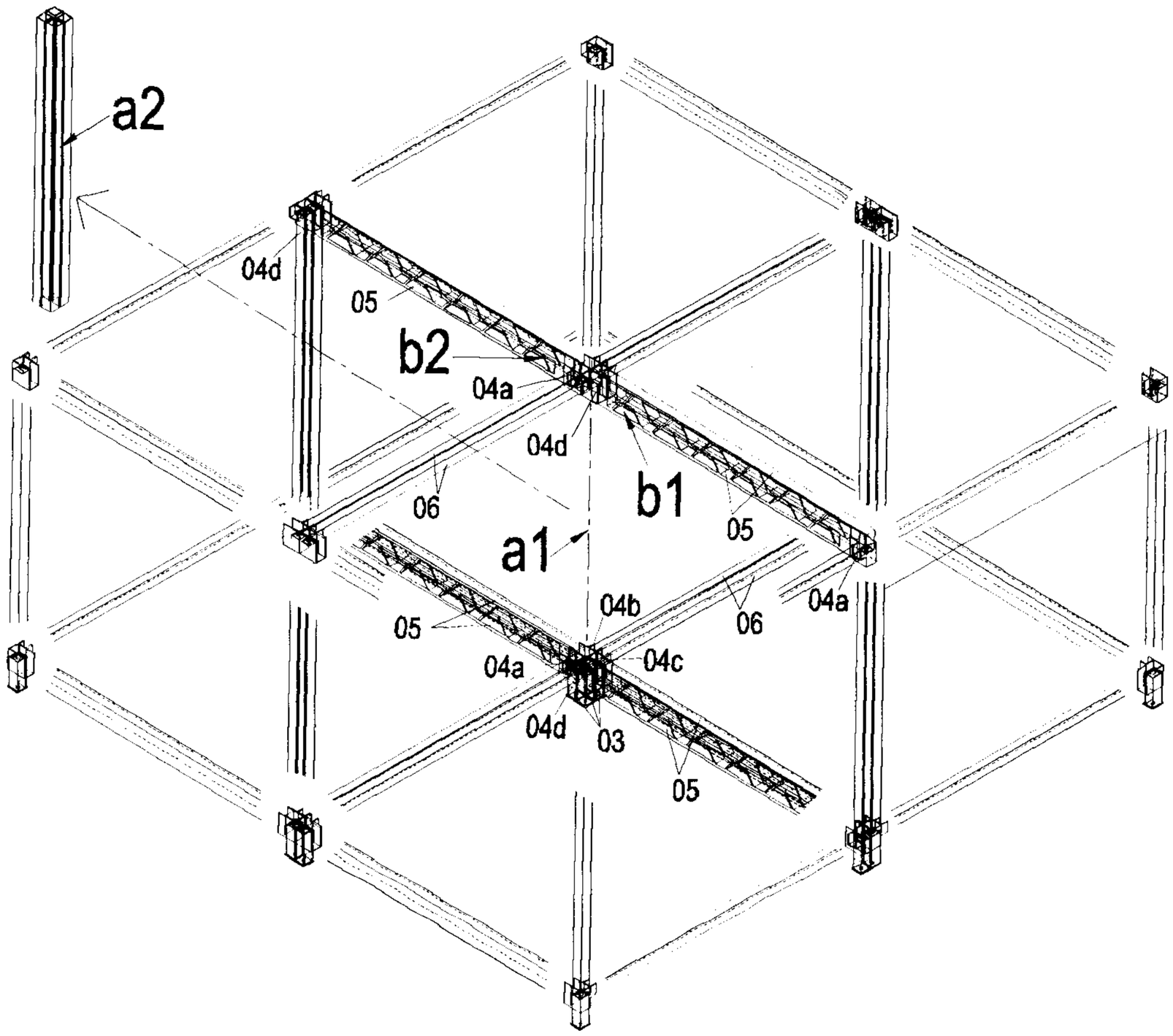

Figure 8

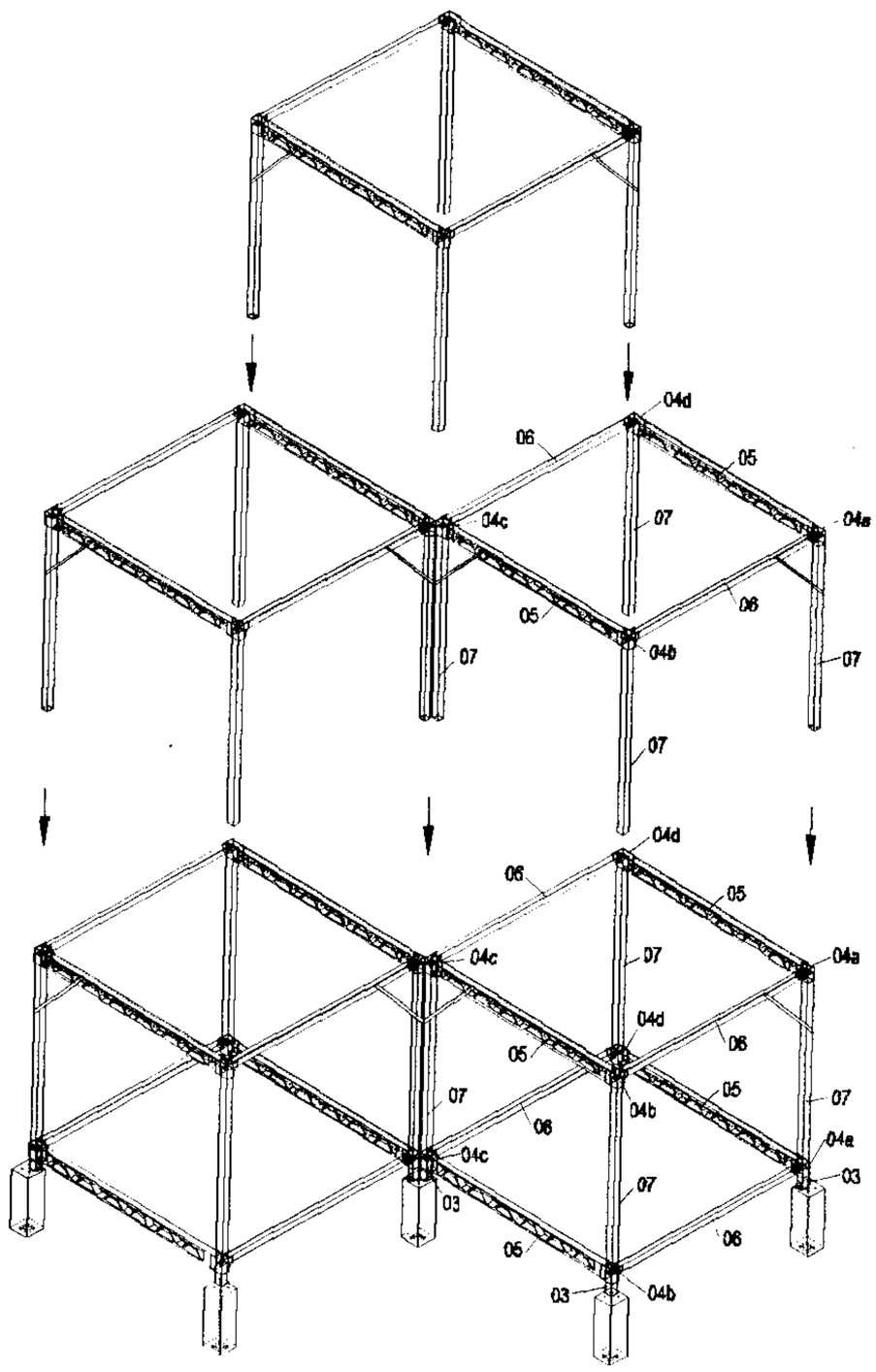
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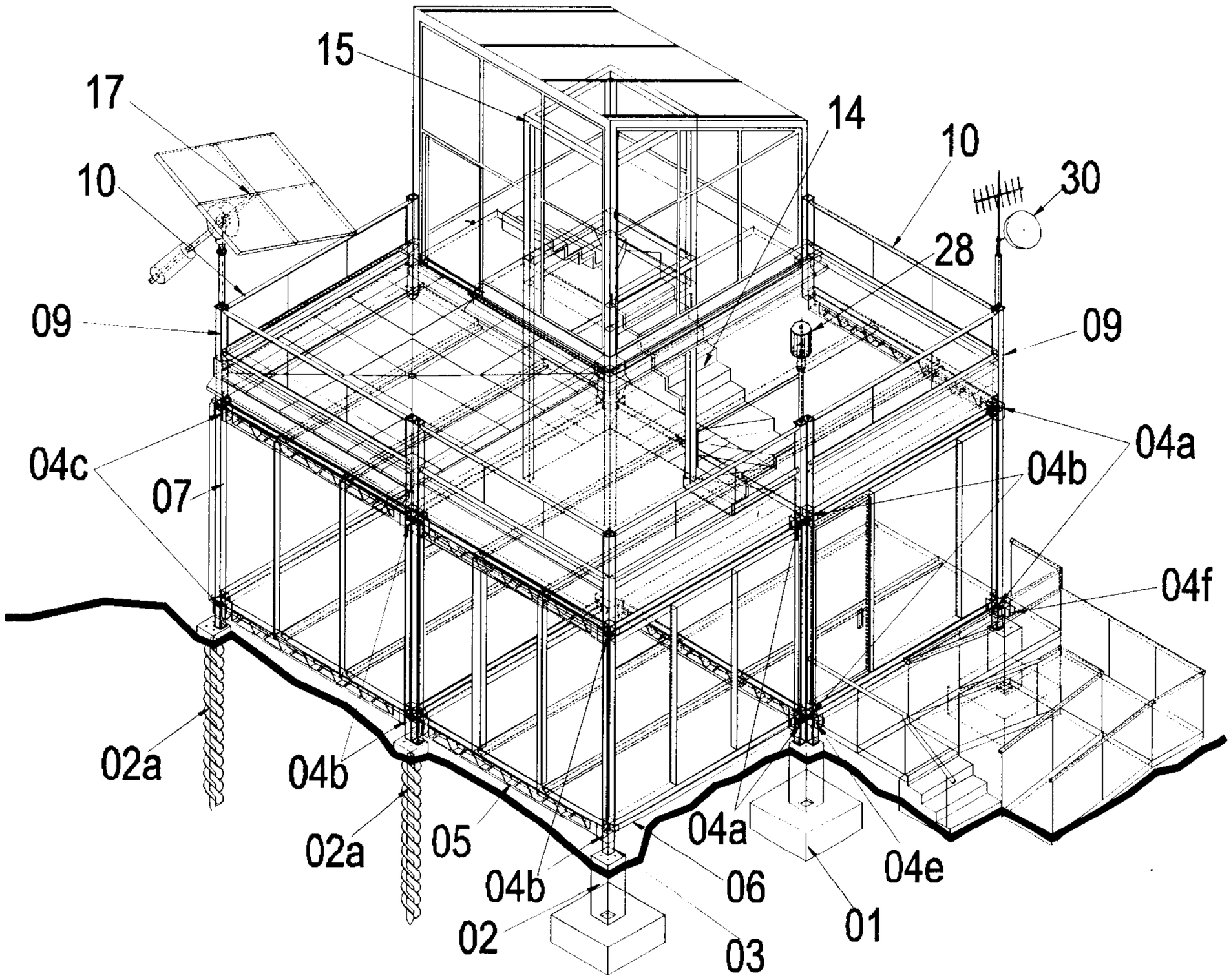
Figure 9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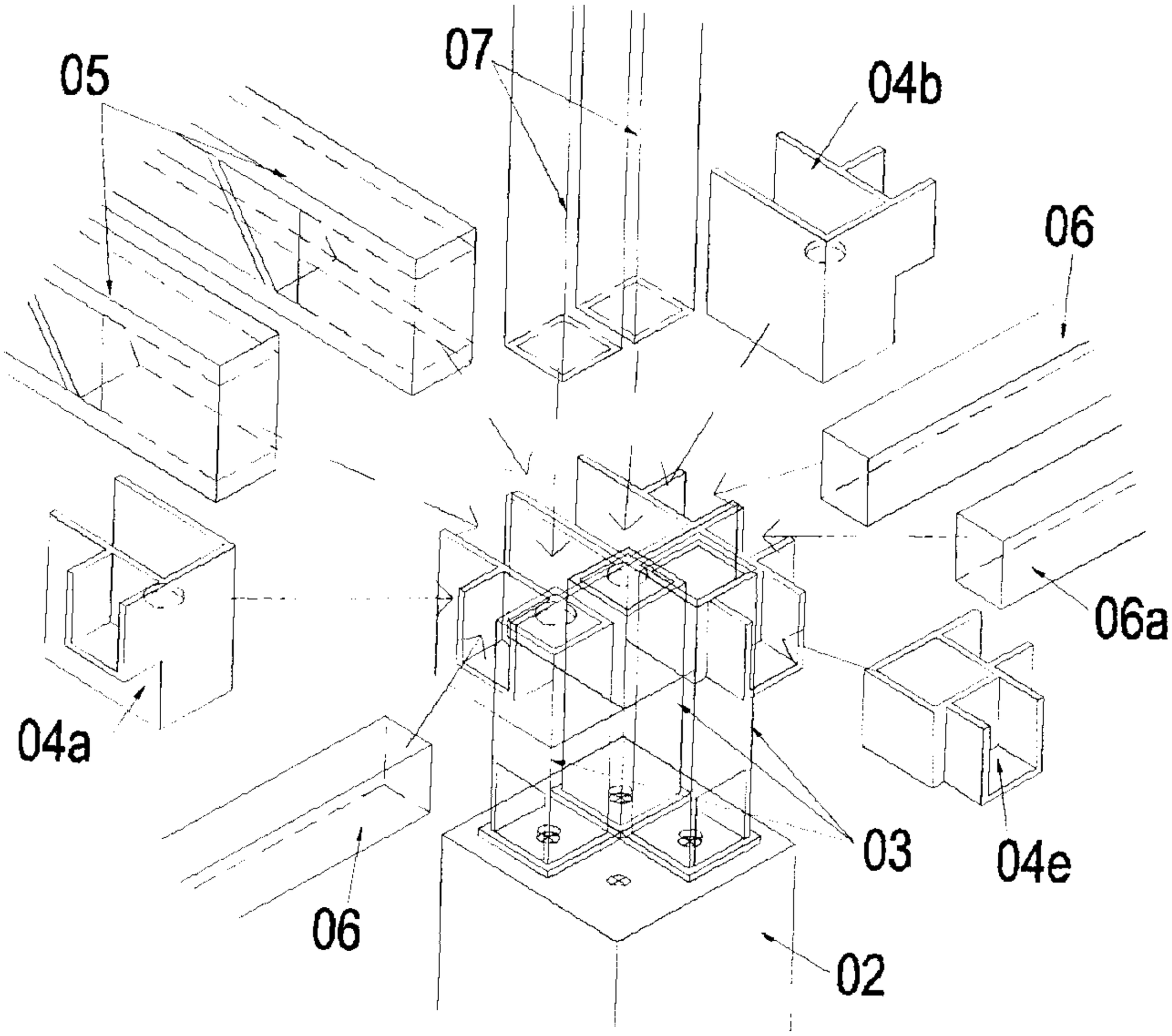
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