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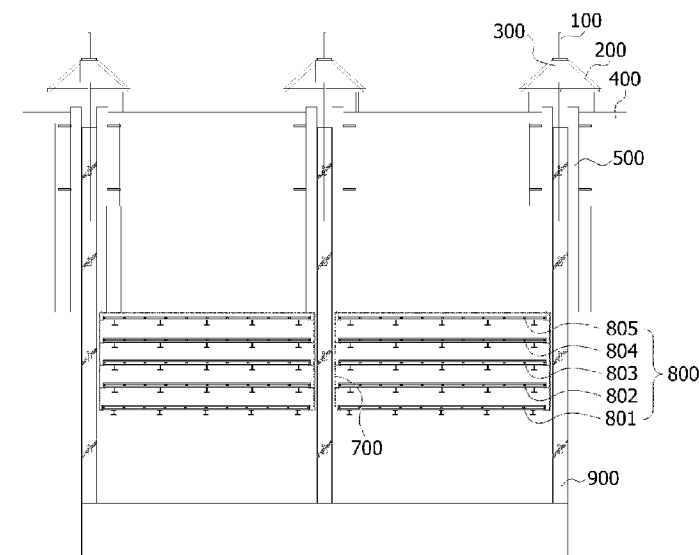
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(54) Title: MULTI-HORIZONTAL STRUCTURE MEMBER FORMING METHOD

[Fig. 1]



(57) Abstract: A method of forming multiple horizontal structural members is disclosed. The method includes building a vertical structural member by a sliding construction method, lifting a horizontal form frame unit using sliding construction equipment, installing a frame support structure under the horizontal form frame unit, casting concrete into the horizontal form frame unit to form a horizontal structural member, and simultaneously building the horizontal structural members to several stories.

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Description

MULTI-HORIZONTAL STRUCTURE MEMBER FORMING METHOD

Technical Field

- [1] The present invention relates, in general, to a construction method of installing vertical structural members of a building using a sliding construction method and installing horizontal structural members of the building in reverse order from a given story, and forming several stories simultaneously. More particularly, the present invention relates to a novel construction method of previously constructing vertical structural members of a building through a sliding construction method, and installing horizontal structural members supported by the constructed vertical structural members in reverse order from several given points, thus reducing the time required to install the horizontal structural members, therefore enabling the rapid construction of the building.

Background Art

- [2] Generally, a sliding construction method is mainly used to construct a concrete structure, such as a pier, a large chimney, or a silo. According to the sliding construction method, while a form having a predetermined shape moves upwards at a predetermined speed, concrete is cast into the form, so that the concrete structure is constructed. Since the concrete is cast without the dismantlement or disassembly and reassembly of the form from the lowermost story to the uppermost story, a construction period is shortened, and construction costs are reduced due to the reduction in the costs of materials.
- [3] Further, the method of constructing a concrete structure through the sliding construction method allows a wall, column- or cylinder-shaped structure to be constructed within a short period of time at low costs.
- [4] Further, according to the sliding construction method, while the form for casting and curing concrete rises at a predetermined speed from the lowermost story to the uppermost story without the dismantlement or disassembly of the form, concrete is cured, so that the consumption of materials is reduced, labor costs are reduced and a construction period is shortened. Consequently, construction costs are reduced.
- [5] However, a general building having one horizontal structural member in each story cannot be rapidly constructed only by the sliding construction method, because of the installation of the horizontal structural members.

Disclosure of Invention

Technical Problem

- [6] Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a method of forming multiple horizontal structural members capable of shortening a construction period, and reducing management costs due to the short construction period, therefore reducing construction costs.

Technical Solution

- [7] In order to accomplish the above object, the present invention provides a method of forming multiple horizontal structural members, constructing a reinforced-concrete vertical structural member while a sliding form rises by a sliding construction method, securing at least one set of horizontal form frame units to sliding construction equipment so as to rise together, installing a frame support structure to the vertical structural member at a position under a predetermined location, at which at least one story of reinforced-concrete horizontal structural members is to be built, separating a horizontal form frame unit from the sliding construction equipment and moving the horizontal form frame unit downwards, so that the horizontal form frame unit is held on the frame support structure, forming a reinforced-concrete horizontal structural member using the horizontal form frame unit, and separating and moving downwards the horizontal form frame unit after the horizontal structural member is cured, thus holding the horizontal form frame unit on another frame support structure provided under the horizontal form frame unit, wherein the above steps are repeated one or more times.
- [8] The horizontal form frame unit may comprise a plurality of horizontal form frame units provided in a vertical direction. After the plurality of horizontal form frame units is separately secured at predetermined stories, a plurality of reinforced-concrete horizontal structural members is formed, and the horizontal form frame units are separated from the corresponding horizontal structural members and moved downwards, so that reinforced-concrete horizontal structural members are repeatedly formed at lower stories.
- [9] Further, a rack may be used to hold the set of horizontal form frame units, at the step of securing or separating the horizontal form frame units to or from the sliding construction equipment.
- [10] Meanwhile, when a horizontal form frame unit is separated from the sliding construction equipment and is moved downwards to the frame support structure, or when a horizontal form frame unit is separated from the reinforced-concrete horizontal structural member formed in the horizontal form frame unit and is moved downwards to another frame support structure of a lower story, the horizontal form frame unit may be held by a plurality of cables or may be moved downwards along a plurality of rails

secured to the vertical structural member.

Advantageous Effects

- [11] The present invention allows an inexpensive concrete construction method, such as a sliding form, to be applied to a general building, thus reducing costs and shortening a construction period.
- [12] Further, equipment for a sliding construction method may be reutilized 15 or more times, and a horizontal form frame unit may be reutilized 5 or more times, so that the consumption of materials is reduced.
- [13] Furthermore, the horizontal form frame unit is supported by a rack and is moved downwards to a frame support structure using a plurality of cables or rails.

Brief Description of the Drawings

- [14] FIG. 1 is a sectional view illustrating the first step according to the present invention;
- [15] FIG. 2 is a sectional view illustrating the state in which first horizontal form frame units are seated on frame support structures, after the step of FIG. 1;
- [16] FIG. 3 is a sectional view illustrating the state in which horizontal structural members are cast into the first horizontal form frame units, after the step of FIG. 2;
- [17] FIG. 4 is a sectional view illustrating the state in which horizontal structural members are cast into second horizontal form frame units, after the step of FIG. 3; and
- [18] FIG. 5 is a sectional view illustrating the state in which horizontal structural members are cast into third horizontal form frame units, after the step of FIG. 4.
- [19] <Description of reference characters of important parts>
- [20] 200: yoke 300: hydraulic jack
- [21] 400: worktable 500: sliding form
- [22] 700: rack 800: horizontal form frame units

Mode for the Invention

- [23] Hereinafter, the preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings. Reference now should be made to the drawings, in which the same reference numerals are used throughout the different drawings to designate the same or similar components. Further, for the clarity of description, known functions and constructions relating to the present invention will be omitted herein.
- [24] FIG. 1 is a sectional view illustrating the first step according to the present invention, FIG. 2 is a sectional view illustrating the state in which first horizontal form frame units are seated on frame support structures, after the step of FIG. 1, and FIG. 3 is a sectional view illustrating the state in which horizontal structural members are cast into the first horizontal form frame units, after the step of FIG. 2.
- [25] A method of forming multiple horizontal structural members according to the present

invention includes six steps. At the first step, a reinforced-concrete vertical structural member is constructed while a sliding form rises by a sliding construction method. After the first step, at least one set of horizontal form frame units are secured to sliding construction equipment so as to rise together, at the second step. After the second step, a frame support structure is installed to the vertical structural member at a position under a predetermined location, at which at least one story of reinforced-concrete horizontal structural members is to be built, at the third step. After the third step, an associated horizontal form frame unit is separated from the sliding construction equipment and is moved downwards so that the horizontal form frame unit is held on the frame support structure, at the fourth step. After the fourth step, a reinforced-concrete horizontal structural member is formed using the horizontal form frame unit, at the fifth step. After the fifth step, the horizontal structural member is cured, and thereafter the horizontal form frame unit is separated and moved downwards, so that the horizontal form frame unit is held on the frame support structure which is located under the horizontal form frame unit, at the sixth step. The steps are repeated one or more times.

[26] Further, at the second step of securing the horizontal form frame units to the sliding construction equipment so that they rise together, the horizontal form frame unit comprises a plurality of horizontal form frame units which are provided in a vertical direction.

[27] Meanwhile, the first step of constructing reinforced-concrete vertical structural members while sliding forms are moved upwards by the sliding construction method will be described in detail below.

[28] At the first step, sliding forms 500 are prefabricated, and worktables 400 are prepared. Further, while concrete is cast into each sliding form 500, the sliding form 500 is moved upwards by 3m per day.

[29] The equipment used in the sliding construction method includes the sliding forms 500, the worktables 400 which are perpendicularly provided on the sliding forms 500, hydraulic jacks 300 which are located above the worktables 400, yokes 200 which are provided around the corresponding hydraulic jacks 300, and rods 100 which are connected to the corresponding yokes 200.

[30] Each sliding form 500 has the shape of an integrated form which completely covers the surrounding of a reinforced-concrete vertical structural member 900 which is made by casting concrete. Zinc and wax are used to reduce frictional force between the sliding form and the concrete.

[31] Further, each hydraulic jack 300 is the machine for lifting the corresponding yoke 200 via a hydraulic pipe. One hydraulic jack has a weight of from 3 to 10 tons. The hydraulic jacks maintain a state of being level and rise by the same length by an

automatic controller.

- [32] Each yoke 200 comprises an H-shaped steel material or channel, and serves as the part for coupling the hydraulic jack 300, the sliding form 500, and the worktable 400 to each other. Each rod 100 is an annular bar having the diameter of about 32mm and the length of about 3.4m, and functions to transmit all the load from the corresponding yoke 200 to the lower end of the reinforced-concrete vertical structural member 900.
- [33] After the first step has been completed, one or more sets of horizontal form frame units are secured to the sliding construction equipment to rise together, at the second step. At this step, as shown in FIG. 1, one or more sets of horizontal form frame units 800 are horizontally installed at two places. Thereafter, a plurality of frame units 801 to 805 of each set of horizontal form frame units 800, which are arranged in a vertical direction to be adjacent to each other, is lifted using a rack 700 such that a pre-determined distance is maintained between the frame units. While each sliding form 500 continues rising, each set of horizontal form frame units 800 is lifted up to the height of the sixth story.
- [34] After the second step has been completed, at the third step, frame support structures are installed to the vertical structural members at positions under predetermined locations, at which one or more stories of reinforced-concrete horizontal structural members are to be built. That is, the first frame unit 801 of the horizontal form frame units 800, which is located at the lowermost position, is lifted to the height of the sixth or higher story. Subsequently, one or more frame support structures 810 are installed at one or more positions between the sixth story and the second story in such a way as to be located under the first frame unit 801.
- [35] After the third step has been completed, the horizontal form frame units are separated from the sliding construction equipment, and thereafter are moved downwards, so that the horizontal form frame units are held on the frame support structures, at the fourth step. As shown in FIG. 2, the upper ends of cables 720 are secured to the worktables 400, while the horizontal form frame units 800 are connected to the lower ends of the cables 720. Thereafter, the first frame unit 801 of each set of horizontal form frame units 800 is separated from the remaining frame units and subsequently is moved downwards to be seated on the top of the corresponding frame support structure 810. The remaining frame units, that is, the second to the fifth frame units 802, 803, 804, and 805 are continuously supported by the rack 700.
- [36] Here, the cables 720 are used only when the first frame unit 801 is separated from each sliding form 500 and is mounted on the frame support structure 810. After the first frame unit 801 has been mounted on the frame support structure 810, the cables 720 are removed.
- [37] After the fourth step has been completed, reinforced-concrete horizontal structural

members are formed using the horizontal form frame units, at the fifth step. At this step, the reinforced-concrete horizontal structural members are cast to be perpendicular to the reinforced-concrete vertical structural members. That is, concrete is cast into each first frame unit 801 supported by the corresponding frame support structure 810 and is cured for a predetermined period of time.

[38] Further, at this step, the cables 720 have been already removed.

[39] FIG. 3 shows the state in which the first concrete curing operation is performed at the height of the sixth story.

[40] After the fifth step has been completed, each horizontal structural member is cured, and thereafter the horizontal form frame unit is separated and moved downwards to be held on another frame support structure which is positioned under the horizontal form frame unit, at the sixth step. The operation of the sixth step is performed one or more times.

[41] That is, when the concrete curing operation has been completed at the height of the sixth story, the first frame unit 801 used at the sixth story is moved to the fifth story. Further, the frame support structure 810 used at the sixth story is installed again under the first frame unit 801 which is moved to the fifth story.

[42] Further, if necessary, additional frame support structures 810 may be previously installed at the second to fifth stories, in addition to the frame support structure 810 used at the sixth story.

[43] Further, the cables 720, which are used to move the first frame unit 801 from the sixth story to the fifth story, are secured at the upper ends thereof to the reinforced-concrete horizontal structural member which is cast on the sixth story, and the lower ends of the cables are connected to the first frame unit 801. Thus, after the first frame unit 801 is seated on the frame support structure 810 which is provided on the lower portion of the fifth story, the cables are removed.

[44] Concrete is cast and cured in the first frame unit 801 which is provided on the fifth story through the above-mentioned operation, so that the reinforced-concrete horizontal structural member is provided on the fifth story. Using the same process, reinforced-concrete horizontal structural members are cast from the fourth story to the second story.

[45] Meanwhile, when the first frame unit 801 is separated from the sliding construction equipment and is moved downwards to the frame support structure 810, or is separated from the reinforced-concrete horizontal structural member formed at the position of the first frame unit 801 and is moved to the frame support structure 810 of the lower story, the first frame unit 801 can be moved downwards to the frame support structure 810 along a plurality of rails (not shown) which are provided on the vertical structural members 900.

- [46] FIG. 4 is a sectional view illustrating the state in which horizontal structural members are cast into second horizontal form frame units, after the step of FIG. 3, and FIG. 5 is a sectional view illustrating the state in which horizontal structural members are cast into third horizontal form frame units, after the step of FIG. 4.
- [47] The cables 720 are used only in the operation of mounting the first frame unit 801 on the upper end of the frame support structure 810 which is located at a lower position of the sixth story and thereafter are removed. While the cables 720 are pulled upwards again, the reinforced-concrete vertical structural members 900 are set up, and the second to fifth frame units 802, 803, 804, and 805 connected to the rack 700 are moved upwards until the second frame unit 802 is moved further upwards by five stories from the sixth story and reaches the height of the eleventh story.
- [48] The frame support structure 810 is provided under the second frame unit 802 which is positioned at the height of the eleventh story.
- [49] Concrete is cast into the second frame unit 802 to manufacture the reinforced-concrete horizontal structural member. The process of moving the second frame unit from the tenth story to the seventh story in stages and manufacturing the reinforced-concrete horizontal structural member is equal to the process of using the first frame unit 801.
- [50] Further, the process of using the third to fifth frame units 803, 804, and 805 is equal to that of using the first or second frame unit 801 or 802 except the the applied story is different.
- [51] When the fifth frame unit 805 is lifted to the height of the twenty-sixth story and a reinforced-concrete horizontal structural member of the twenty-sixth story has been completed, the sliding construction equipment is removed.
- [52] According to the present invention, after a plurality of frame units is separately secured to given stories, the reinforced-concrete horizontal structural members are formed. The respective horizontal form frame units which are used to form the reinforced-concrete horizontal structural members are separated from the reinforced-concrete horizontal structural members and then are repeatedly used at lower stories so as to form the reinforced-concrete horizontal structural members.
- [53] Further, if necessary, additional horizontal form frame units may be used to build a multi-storied building having twenty-six or more stories.
- [54] Meanwhile, the sliding construction equipment may be reutilized 15 or more times and the horizontal form frame units may be reutilized 5 or more times through the above process, thus reducing the consumption of materials.
- [55] Although the preferred embodiment of the present invention has been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of

the invention as disclosed in the accompanying claims. Thus, it is to be understood that the embodiment disclosed herein does not limit the scope of the present invention but is illustrative, and the scope of the invention is not limited by the embodiment. The scope of the invention is defined by any changes that fall within the limits and bounds of the appended claims, or the equivalence of such limits and bounds as are covered by the appended claims.

[56]

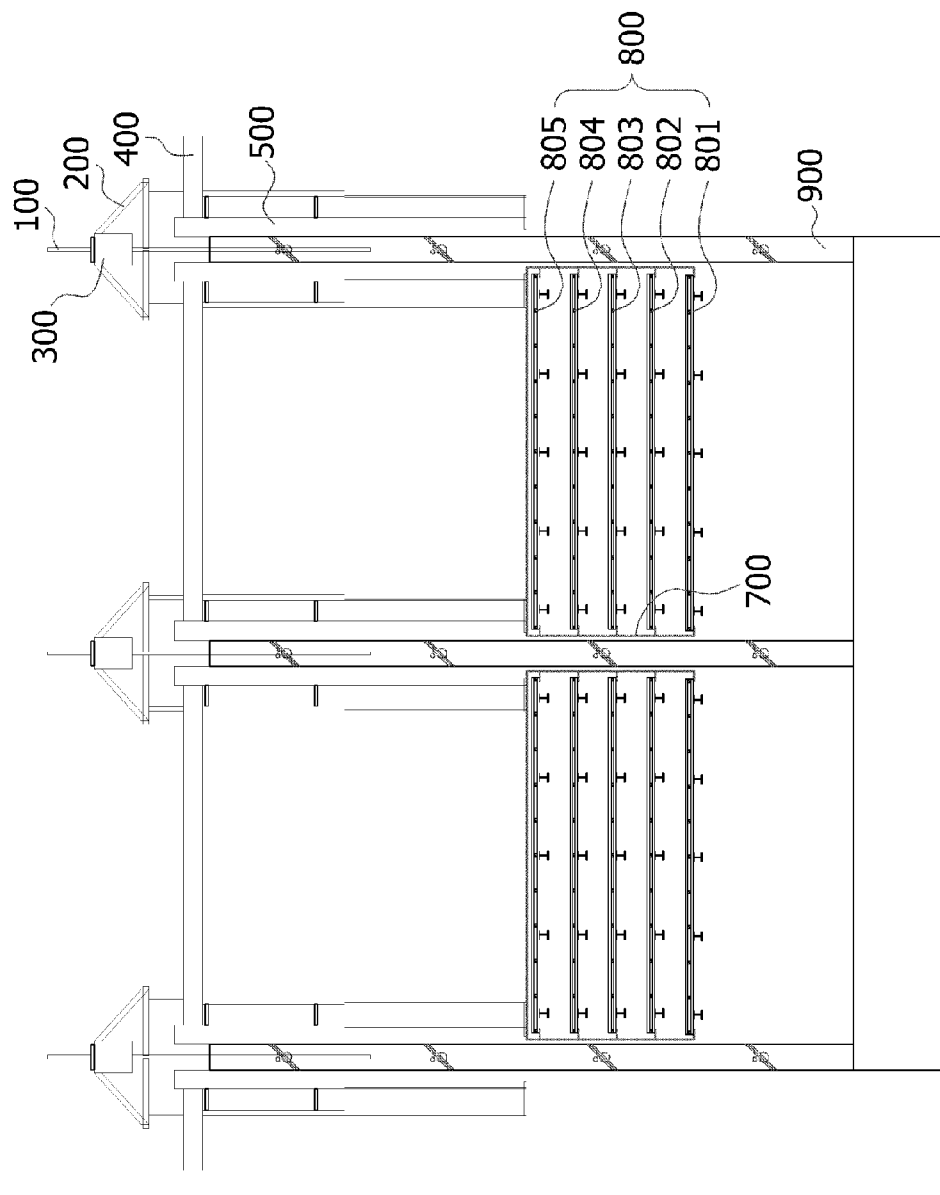
Claims

- [1] A method of forming multiple horizontal structural members, comprising the steps of:
constructing a reinforced-concrete vertical structural member while a sliding form rises by a sliding construction method;
securing at least one set of horizontal form frame units to sliding construction equipment so as to rise together;
installing a frame support structure to the vertical structural member at a position under a predetermined location, at which at least one story of reinforced-concrete horizontal structural members is to be built;
separating a horizontal form frame unit from the sliding construction equipment and moving the horizontal form frame unit downwards, so that the horizontal form frame unit is held on the frame support structure;
forming a reinforced-concrete horizontal structural member using the horizontal form frame unit; and
separating and moving downwards the horizontal form frame unit after the horizontal structural member is cured, thus holding the horizontal form frame unit on another frame support structure provided under the horizontal form frame unit,
wherein the above steps are repeated one or more times.
- [2] The method of forming the multiple horizontal structural members according to claim 1, wherein the horizontal form frame unit comprises a plurality of horizontal form frame units provided in a vertical direction.
- [3] The method of forming the multiple horizontal structural members according to claim 1 or 2, wherein, after the plurality of horizontal form frame units is separately secured at predetermined stories, a plurality of reinforced-concrete horizontal structural members is formed, and the horizontal form frame units are separated from the corresponding horizontal structural members and moved downwards, so that reinforced-concrete horizontal structural members are repeatedly formed at lower stories.
- [4] The method of forming the multiple horizontal structural members according to claim 1 or 2, wherein a rack is used to hold the set of horizontal form frame units, at the step of securing or separating the horizontal form frame units to or from the sliding construction equipment.
- [5] The method of forming the multiple horizontal structural members according to claim 1 or 2, wherein, when a horizontal form frame unit is separated from the sliding construction equipment and is moved downwards to the frame support

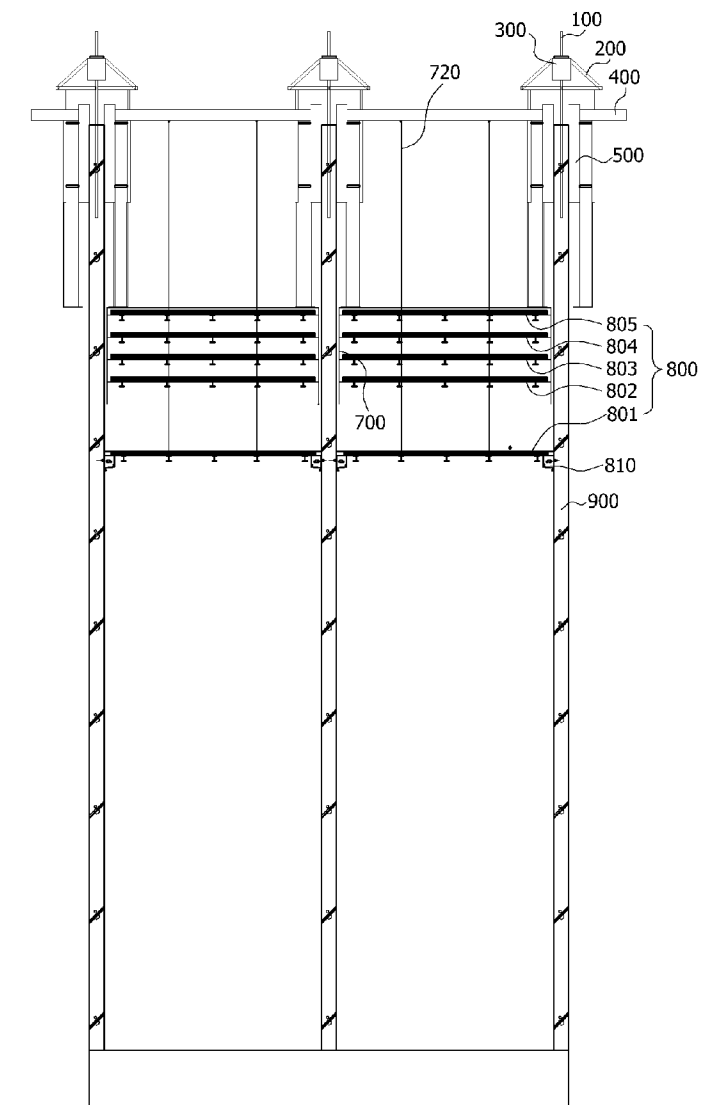
structure, or when a horizontal form frame unit is separated from the reinforced-concrete horizontal structural member formed in the horizontal form frame unit and is moved downwards to another frame support structure of a lower story, the horizontal form frame unit is held by a plurality of cables.

- [6] The method of forming the multiple horizontal structural members according to claim 1 or 2, wherein, when a horizontal form frame unit is separated from the sliding construction equipment and is moved downwards to the frame support structure, or when a horizontal form frame unit is separated from the reinforced-concrete horizontal structural member formed in the horizontal form frame unit and is moved downwards to another frame support structure of a lower story, the horizontal form frame unit is moved downwards along a plurality of rails secured to the vertical structural member.

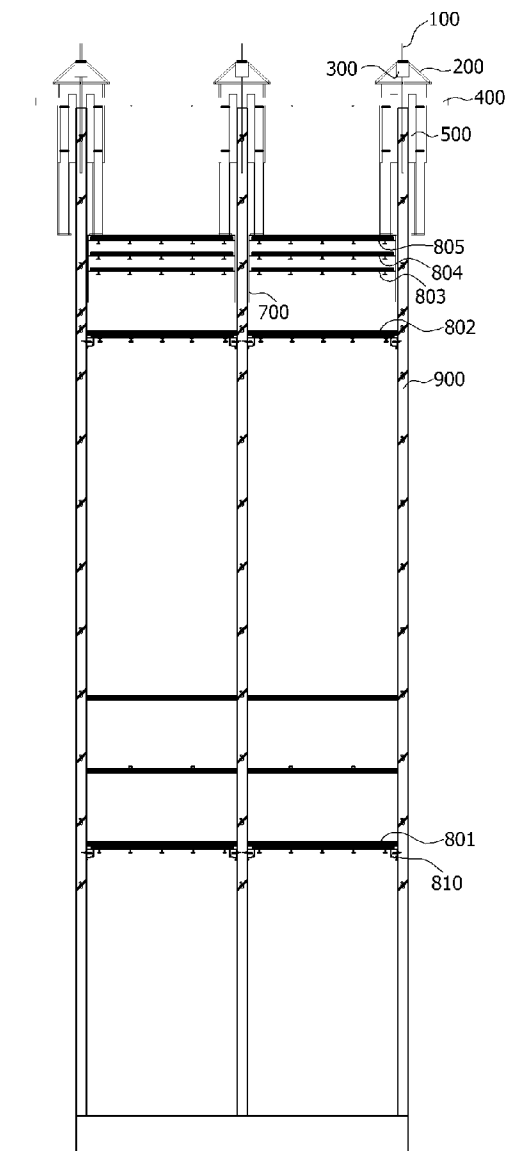
[Fig. 1]



[Fig. 2]



[Fig. 4]



[Fig. 5]

