

MOLD APPARATUS FOR PREFABRICATED ROOM UNIT AND METHOD FOR CONSTRUCTING THE SAME

Technical Field

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The invention relates to an apparatus for producing a prefabricated building unit, and a method for constructing the prefabricated building unit. More specifically, the invention relates to a mold apparatus for producing a prefabricated building unit, and a method for constructing the prefabricated building unit.

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Technical Background

Traditional residential or office buildings, especially high-rise buildings, are usually built with in-situ casting concrete at the construction site. However, this traditional cast-in-situ structure suffers defects such as complicated construction process, long construction period, intensive labor, and inconsistent quality. In addition, it will generate a large amount of construction waste and significant noise/dust pollution, causing great interference to the normal life of surrounding residents.

20 To this end, in the construction engineering project, prefabricated building units prepared in factories already, such as prefabricated kitchens, prefabricated bathrooms, prefabricated bedrooms, etc., are now gradually used. With the prefabricated building units being combined with cast-in-situ parts of the building, the on-site construction work load and work labor can be greatly reduced, the construction period can be shortened, and the interference to surrounding residents can be alleviated to a large extent.

For the production of an existing prefabricated building unit, an outer mold and an inner mold should be firstly installed, and then reinforcing bars are provided and

bundled between the inner mold and the outer mold. Subsequently, concrete is poured to form the building unit. After the concrete reaches sufficient strength, the outer mold is removed. Finally, the building unit is hoisted so that the prefabricated building unit is separated from the inner mold. However, in general, the contact surface between the inner mold and the building unit is relatively large, so that the bonding force therebetween is also large. Therefore, it is not easy to demold the prefabricated building unit from the inner mold, which often results that the prefabricated building unit is difficult to be hoisted. This is a problem in the production of prefabricated building units.

Summary of the Invention

Aiming to overcome the above-mentioned defects, the present invention proposes a mold apparatus for producing a prefabricated room unit, whereby the demolding procedure is easy, and a method for constructing the prefabricated room unit.

The mold apparatus for producing a prefabricated room unit according to the present invention comprises an outer mold, an inner mold, and a bottom table, the inner mold and the bottom table enclosing an operation space. The inner mold comprises a stationary mold plate and a movable mold plate, wherein the stationary mold plate is fixed on the bottom table, and the movable mold plate is connected to the bottom table and at least movable in a vertical direction.

In an embodiment, the movable mold plate includes a movable mold plate body, a first adapter mold plate, and a second adapter mold plate. A top surface of the stationary mold plate is connected to that of the movable mold plate body. The first adapter mold plate and the second adapter mold plate are each connected between a side of the movable mold plate body and a side of the stationary mold plate. A free

space in which the movable mold plate can move downwardly is provided under a bottom of the movable mold plate.

In an embodiment, the first adapter mold plate and the second adapter mold plate
5 each have a width gradually increasing along a direction from top to bottom.

In an embodiment, sides of the first adapter mold plate and the second adapter mold plate are connected to the sides of the movable mold plate body and the stationary mold plate through bolts. Bottoms of the first adapter mold plate and the
10 second adapter mold plate are connected to the bottom table through bolts in a height-adjustable manner. A bottom of the movable mold plate body is connected to the bottom table through bolts in a height-adjustable manner.

In an embodiment, the movable mold plate and the stationary mold plate are
15 connected with each other along a diagonal direction.

In an embodiment, a height-adjustable vertical support is provided between the bottom table and a top plate of the inner mold, a length-adjustable oblique support is provided between the bottom table and a side plate of the inner mold, and a
20 length-adjustable lateral support is provided along a width direction of the inner mold for connecting the stationary mold plate and a side plate of the movable mold plate.

In an embodiment, a bottom plate of the bottom table is provided with a hole at each of positions of the first adapter mold plate and the second adapter mold plate.
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The present invention further proposes a method of producing a prefabricated room unit with the above-mentioned mold apparatus, comprising the following steps: step A, mounting the inner mold on the bottom table, and bundling reinforcing bars around the inner mold; step B, mounting the outer mold; step C, pouring concrete

between the inner mold and the outer mold, and on the top of the inner mold, so as to form a wall body and a top plate of the prefabricated room unit; step D, removing the outer mold, adjusting the movable mold plate to move downwardly, and then hoisting the wall body and the top plate of the prefabricated room unit; and step E, transferring
5 the wall body and the top plate of the prefabricated room unit to a position above a prefabricated bottom plate, and pouring concrete so that the wall body and the top plate of the prefabricated room unit and the prefabricated bottom plate are combined together to form the prefabricated room unit.

10 In an embodiment, the movable mold plate includes a movable mold plate body, which has a top connected to the stationary mold plate, and a first adapter mold plate and a second adapter mold plate, each of which has sides connected to a side of the movable mold plate body and a side of the stationary mold plate, respectively. The method further comprises in said step D, the first adapter mold plate and the second
15 adapter mold plate re firstly moved downwardly, and then the movable mold plate body is moved downwardly.

In an embodiment, when the first adapter mold plate and the second adapter mold plate are adjusted, bolts arranged in the sides of the first adapter mold plate and
20 the second adapter mold plate and in the sides of the stationary mold plate and the movable mold plate body are removed firstly, and then bolts, which are arranged between the bottoms of the first adapter mold plate and of the second adapter mold plate and the bottom table, and a height-adjustable vertical support, which is arranged between the bottom table and a top plate of the inner mold, are adjusted, so that the
25 first adapter mold plate and the second adapter mold plate are moved downwardly. When the movable mold plate body is adjusted, bolts arranged between a bottom of the movable mold plate body and the bottom table are loosened firstly, and then the vertical support arranged between the bottom table and the top plate of the inner mold, an adjustable horizontal support arranged between side plates of the inner mold, and

an adjustable oblique support arranged between the inner mold and the bottom table are adjusted, so that the movable mold plate body is moved downwardly and contracted inwardly.

5 Compared with the prior arts, the present invention has the following technical advantages. The inner mold of the mold apparatus for a prefabricated room unit is formed by connecting a stationary mold plate and a separate, movable mold plate. When demolding, the movable mold plate is firstly moved downwardly and contracted inwardly. In this manner, the contact surface and thus the bonding force
10 between the inner mold and the prefabricated room unit can be significantly reduced. Therefore, the demolding and lifting of the product will be facilitated.

Brief Description of Drawings

15 Fig. 1 schematically shows the structure of a mold apparatus for a prefabricated room unit according to the present invention;

Fig. 2 is a schematic view showing an inner mold of the mold apparatus;

20 Fig. 3 schematically shows the fixing connection between a stationary mold plate and a bottom table;

Fig. 4 schematically shows the structure when a first adapter mold plate and a second adapter mold plate of the inner mold move downwardly;

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Fig. 5 schematically shows the structure when a movable mold plate body of the inner mold moves downwardly;

Fig. 6 schematically shows the vertical structures of the first adapter mold plate

and the second adapter mold plate;

Fig. 7 is a transverse cross-sectional view of the first adapter mold plate and the second adapter mold plate;

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Fig. 8 is a vertical cross-sectional view of the mold apparatus for the prefabricated room unit according to the present invention, along a lengthwise direction;

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Fig. 9 is a vertical cross-sectional view of the mold apparatus for the prefabricated room unit according to the present invention, along a widthwise direction;

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Fig. 10 is an enlarged view showing the connection between the movable mold plate body and the bottom table;

Fig. 11 schematically shows a prefabricated bottom plate of the prefabricated room unit;

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Fig. 12 schematically shows the state when a wall body and a top plate of the prefabricated room unit is combined with the bottom plate; and

Fig. 13 schematically shows the prefabricated room unit that has been completed already.

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Preferred Embodiments of the Invention

In the following, embodiments of the present invention will be described in detail with reference to the accompanying drawings.

As shown in Figs. 1, 2 and 3, the mold apparatus for the prefabricated room unit according to the present invention is mainly composed of an outer mold 1, an inner mold, and a bottom table 2. The inner mold has a surrounding wall body, and a top plate for closing the top of the wall body. The bottom table 2 is formed by welding profile steel elements into a frame structure, on which a bottom plate 22 is fixedly arranged. The inner mold and the bottom table 2 together enclose a space in which workers can perform necessary operations. The present invention is characterized in that the inner mold comprises a stationary mold plate 3 and a movable mold plate 5, wherein the stationary mold plate 3 is fixed on the bottom table 2 through welding or other conventional means, while the movable mold plate 5 is connected to the bottom table 2 through a bolt or the like, but at least movable along a vertical direction. Correspondingly, a free space in which the movable mold plate 5 can move downwardly is provided under the movable mold plate 5. Thus, when demolding, the movable mold plate 5 can be easily separated from the prefabricated room unit through a downward movement, thereby greatly reducing the difficulty of demolding.

Generally, the prefabricated room unit is shaped as a substantially square. In the present embodiment, the stationary mold plate 3 and the movable mold plate 5 are connected to each other along a diagonal line of the square. In this manner, the design of the mold apparatus can be facilitated, and the components required for the connection can be reduced. The movable mold plate 5 includes three separate components, i.e., a movable mold plate body 51, a first adapter mold plate 52, and a second adapter mold plate 53.

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The top surface of the movable mold plate body 51 is connected to that of the stationary mold plate 3 through bolts or the like. As shown in Fig. 10, the bottom of the movable mold plate body 51 is connected to the bottom table 2 through an adjustable bolt 92, so that the height of the movable mold plate body 51 can be

adjustable. When the inner mold is assembled, a space having a height more than 150 mm is formed in the region where the bottom of the movable mold plate body 51 is connected to the bottom table 2.

- 5 The first adapter mold plate 52 and the adapter mold plate 53 are respectively located at both sides of the movable mold plate body 51, for connecting the side of the movable mold plate body 51 with the side of the stationary mold plate 3.

As shown in Figs. 6 and 7, the first adapter mold plate 52 and the second adapter
10 mold plate 53 may have the same structure, which has a width gradually increasing along a direction from top to bottom, and thus has a substantially trapezoidal elevation. A side plate 55 is disposed on each side of the first adapter mold plate 52 and the second adapter mold plate 53, and a plurality of rib plates 54 for strength improvement is fixed between two side plates 55 along the direction from top to
15 bottom at positions regularly spaced from each other. A plurality of threaded holes 56 is provided on each of the side plates 55 at positions regularly spaced from each other. Accordingly, a plurality of threaded holes is also provided at the side of the end surface of each of the movable mold plate body 51 and the stationary mold plate 3, each corresponding to a respective one of the threaded holes 56. Therefore, the sides
20 of the movable mold plate body 51 and the stationary mold plate 3 can be connected to the first adapter mold plate 52 and the second adapter mold plate 53 through bolts passing through these threaded holes. In addition, the bottoms of the first adapter mold plate 52 and the second adapter mold plate 53 are connected to the bottom table 2 by adjustable bolts 91 for height adjustment. When the inner mold is assembled, a
25 free space having a height more than 300 mm is formed in the region where the bottoms of the first adapter mold plate 52 and the second adapter mold plate 53 are connected to the bottom table 2. In order to facilitate the adjustment of the bolts 91, the bottom plate 22 of the bottom table 2 is provided with a hole 21 at each of the positions of the first adapter mold plate 52 and the second adapter mold plate 53, as

shown in Fig. 3.

As shown in Figs. 8 and 9, at least one height-adjustable vertical support 6 is provided between the bottom table 2 and the top plate of the inner mold, at least one
5 length-adjustable oblique support 7 is provided between the bottom table 2 and the side plate of the inner mold, and at least one length-adjustable horizontal support 8 is provided along the width direction of the inner mold for connecting the side plates of the stationary mold plate 3 and the movable mold plate 5. In addition to supporting and stabilizing the inner mold, these supports are further used to adjust the movement
10 of the movable mold plate 5.

The method of producing the prefabricated room unit with the above mold apparatus according to the present invention comprises the following steps.

15 In step 1, as shown in Fig. 11, the surrounding side plates are mounted on a plane, and concrete is poured into the space defined by the side plates after reinforcing bars are arranged, so as to form the bottom plate 101 of the prefabricated room unit.

In step 2, as shown in Fig. 1, the inner mold is mounted on the bottom table 2,
20 and reinforcing bars are arranged outside the inner mold;

In step 3, the outer mold is mounted;

In step 4, concrete is poured between the inner mold and the outer mold 1, and
25 on the top of the inner mold, so as to form a prefabricated member 102 including a wall body and a top plate.

In step 5, the outer mold is removed.

In step 6, the first adapter mold plate 52 and the second adapter mold plate 53 are adjusted to move downwardly (as shown in Fig. 4), and then the movable mold plate body 51 is adjusted to move downwardly and contract inwardly (as shown in Fig. 5), so that the prefabricated member 102 is separated from the movable mold plate 5.

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In step 7, as shown in Fig. 12, the prefabricated member 102 is demolded and hoisted to a position above the prefabricated bottom plate 101. After the prefabricated member 102 is positioned, concrete is poured so that the prefabricated member 102 and the prefabricated bottom plate 101 are combined together to form the prefabricated room unit 10 as shown in Fig. 13.

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When the first adapter mold plate 52 and the second adapter mold plate 53 are adjusted as mentioned in step 6, the bolts arranged in the sides of the first adapter mold plate 52 and the second adapter mold plate 53 and in the sides of the stationary mold plate 3 and the movable mold plate body 51 are removed firstly. Then, the bolts 91, which are arranged between the bottoms of the first adapter mold plate 52 and of the second adapter mold plate 53 and the bottom table 2, and the vertical support 6 are adjusted, so that the first adapter mold plate 52 and the second adapter mold plate 53 are moved downwardly by about 300 mm.

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When the movable mold plate body 51 is adjusted, the bolts 92 arranged between the bottom of the movable mold plate body 51 and the bottom table 2 are loosened firstly, and then the vertical support 6, the horizontal support 8 and the oblique support 7 are adjusted, so that the movable mold plate body 51 is moved downwardly by about 150 mm, and at the same time contracted inwardly. In this manner, the prefabricated member 102 is separated from the movable mold plate 5, thus facilitating the demolding between the inner mold and the prefabricated member 102.

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While the invention has been described in conjunction with the preferred

embodiments outlined above, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Various changes may be made without departing from the spirit and scope of the invention as defined in the following claims.

CLAIMS

1. A mold apparatus for a prefabricated room unit, comprising an outer mold (1),
an inner mold, and a bottom table (2), the inner mold and the bottom table (2)
5 enclosing an operation space,

characterizing in that the inner mold comprises a stationary mold plate (3) and a
movable mold plate (5), wherein the stationary mold plate (3) is fixed on the bottom
table (2), and the movable mold plate (5) is connected to the bottom table (2) and at
least movable in a vertical direction.

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2. The mold apparatus according to claim 1, characterizing in that the movable
mold plate (5) includes a movable mold plate body (51), a first adapter mold plate
(52), and a second adapter mold plate (53),

wherein a top surface of the stationary mold plate (3) is connected to that of the
15 movable mold plate body (51),

the first adapter mold plate (52) and the second adapter mold plate (53) are each
connected between a side of the movable mold plate body (51) and a side of the
stationary mold plate (3), and

a free space in which the movable mold plate (5) can move downwardly is
20 provided under a bottom of the movable mold plate (5).

3. The mold apparatus according to claim 2, characterizing in that the first
adapter mold plate (52) and the second adapter mold plate (53) each have a width
gradually increasing along a direction from top to bottom.

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4. The mold apparatus according to claim 2, characterizing in that sides of the
first adapter mold plate (52) and the second adapter mold plate (53) are connected to
the sides of the movable mold plate body (51) and the stationary mold plate (3)
through bolts,

bottoms of the first adapter mold plate (52) and the second adapter mold plate (53) are connected to the bottom table (2) through bolts in a height-adjustable manner, and

5 a bottom of the movable mold plate body (51) is connected to the bottom table (2) through bolts in a height-adjustable manner.

10 5. The mold apparatus according to any one of claims 1 to 4, characterizing in that the movable mold plate (5) and the stationary mold plate (3) are connected with each other along a diagonal direction.

6. The mold apparatus according to any one of claims 1 to 4, characterizing in that a height-adjustable vertical support (6) is provided between the bottom table (2) and a top plate of the inner mold,

15 a length-adjustable oblique support (7) is provided between the bottom table (2) and a side plate of the inner mold, and

a length-adjustable lateral support (8) is provided along a width direction of the inner mold for connecting the stationary mold plate (3) and a side plate of the movable mold plate (5).

20 7. The mold apparatus according to claim 6, characterizing in that a bottom plate of the bottom table (2) is provided with a hole (21) at each of positions of the first adapter mold plate (52) and the second adapter mold plate (53).

25 8. A method of producing a prefabricated room unit with the mold apparatus according to claim 1, comprising the following steps:

step A, mounting the inner mold on the bottom table (2), and bundling reinforcing bars around the inner mold;

step B, mounting the outer mold;

step C, pouring concrete between the inner mold and the outer mold (1), and on

the top of the inner mold, so as to form a wall body and a top plate of the prefabricated room unit (10);

step D, removing the outer mold, adjusting the movable mold plate (5) to move downwardly, and then hoisting the wall body and the top plate of the prefabricated room unit (10); and

step E, transferring the wall body and the top plate of the prefabricated room unit (10) to a position above a prefabricated bottom plate (101), and pouring concrete so that the wall body and the top plate of the prefabricated room unit (10) and the prefabricated bottom plate (101) are combined together to form the prefabricated room unit (10).

9. The method according to claim 8, characterizing in that the movable mold plate (5) includes a movable mold plate body (51), which has a top connected to the stationary mold plate (3), and a first adapter mold plate (52) and a second adapter mold plate (53), each of which has sides connected to a side of the movable mold plate body (51) and a side of the stationary mold plate (3), respectively,

wherein in said step D, the first adapter mold plate (52) and the second adapter mold plate (53) are firstly moved downwardly, and then the movable mold plate body (51) is moved downwardly.

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10. The method according to claim 9, characterizing in that:

when the first adapter mold plate (52) and the second adapter mold plate (53) are adjusted, bolts arranged in the sides of the first adapter mold plate (52) and the second adapter mold plate (53) and in the sides of the stationary mold plate (3) and the movable mold plate body (51) are removed firstly, and then bolts, which are arranged between the bottoms of the first adapter mold plate (52) and of the second adapter mold plate (53) and the bottom table (2), and a height-adjustable vertical support (6), which is arranged between the bottom table (2) and a top plate of the inner mold, are adjusted, so that the first adapter mold plate (52) and the second adapter mold plate

(53) are moved downwardly; and

when the movable mold plate body (51) is adjusted, bolts arranged between a bottom of the movable mold plate body (51) and the bottom table (2) are loosened firstly, and then the vertical support (6) arranged between the bottom table (2) and the top plate of
5 the inner mold, an adjustable horizontal support (8) arranged between side plates of the inner mold, and an adjustable oblique support (7) arranged between the inner mold and the bottom table (2) are adjusted, so that the movable mold plate body (51) is moved downwardly and contracted inwardly.