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(54) Title of the Invention: **Lifting device and plastering apparatus**
Abstract Title: **Lifting device and plastering apparatus**

(57) Disclosed is a lifting device (100). The lifting device comprises a first-stage lifting mechanism (20), a second-stage lifting mechanism (40) and a driving mechanism (60). The first-stage lifting mechanism comprises at least two lifting frames (21), wherein a rear lifting frame is connected to a front lifting frame, the front lifting frame can independently drive the rear lifting frame to ascend and descend, a first guide member (30) is arranged on a side portion of each lifting frame, the second-stage lifting mechanism comprises a support (41) and a mounting base (42) vertically movably arranged on the support, the mounting base is used for being connected to an actuator, at least two first matching members (50) are arranged on a side portion of the support, and the driving mechanism can drive the support to sequentially ascend and descend along the at least two lifting frames. Further disclosed is a plastering apparatus, comprising the lifting device (100). The lifting device and the plastering apparatus can improve the coverage range for plastering.

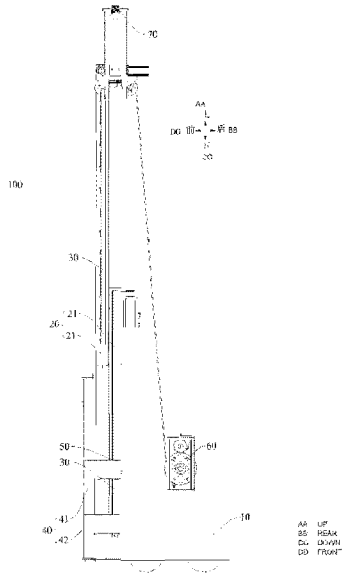

图 1

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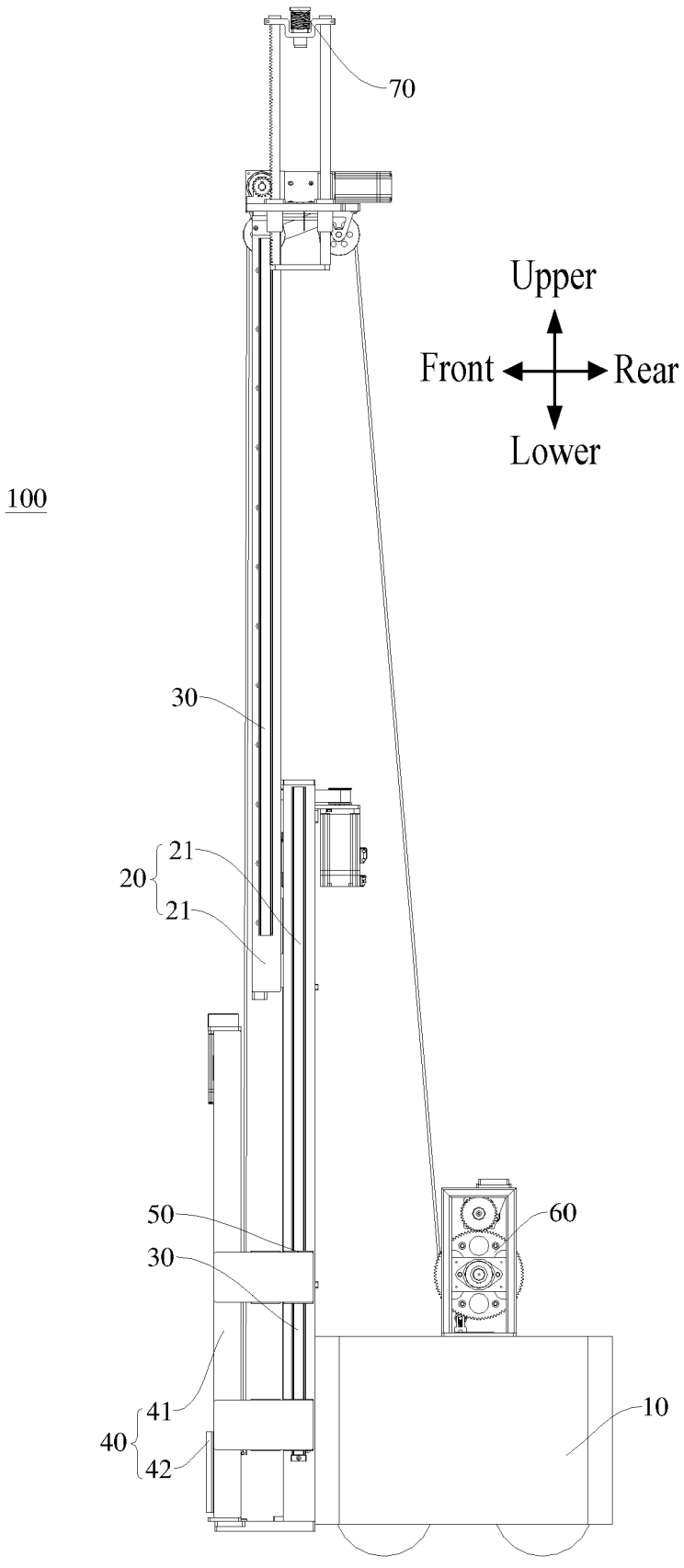
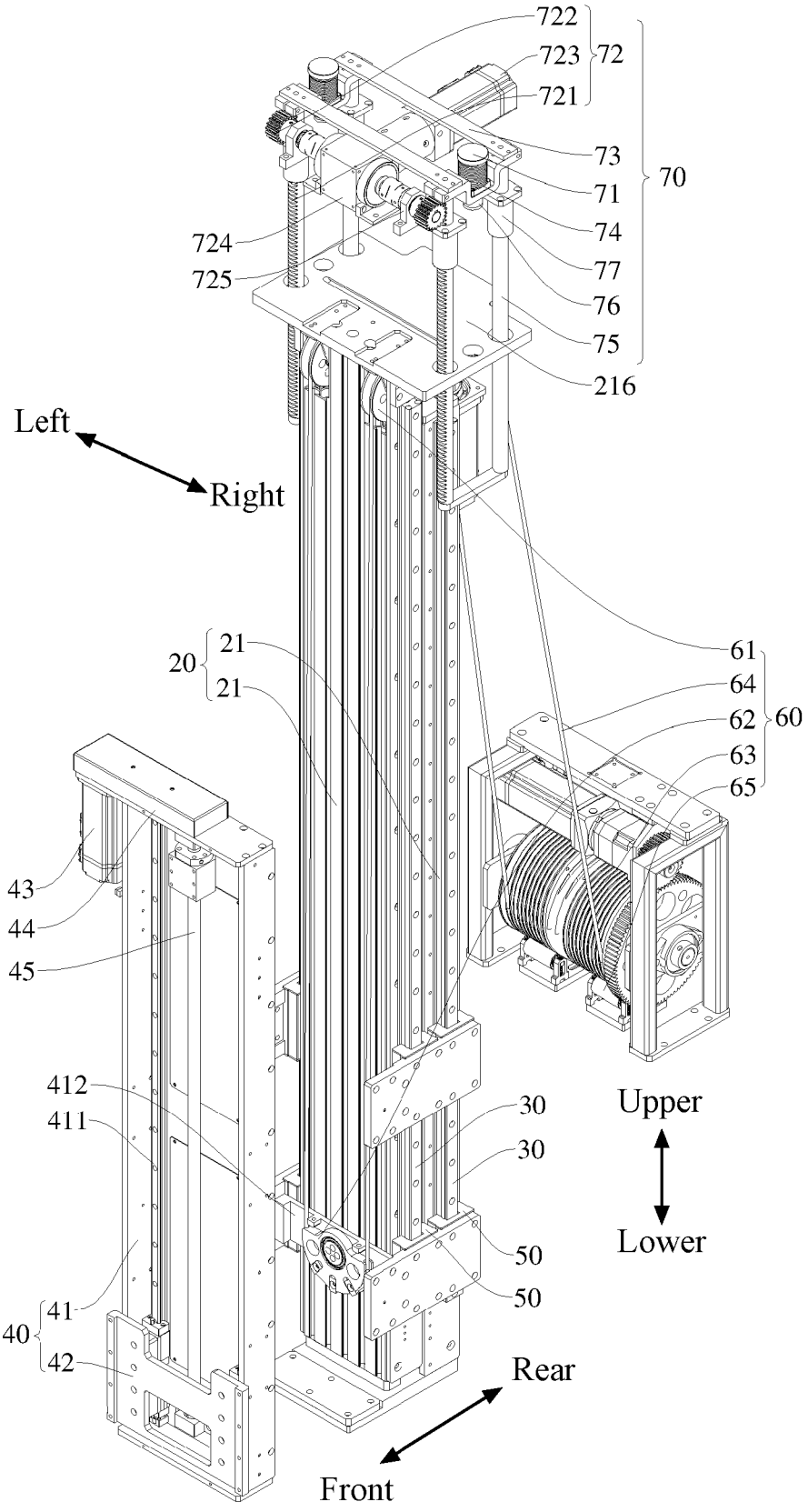


FIG. 1


722
723
721
72
73
71
70
74
724
77
725
76
75
216
Left
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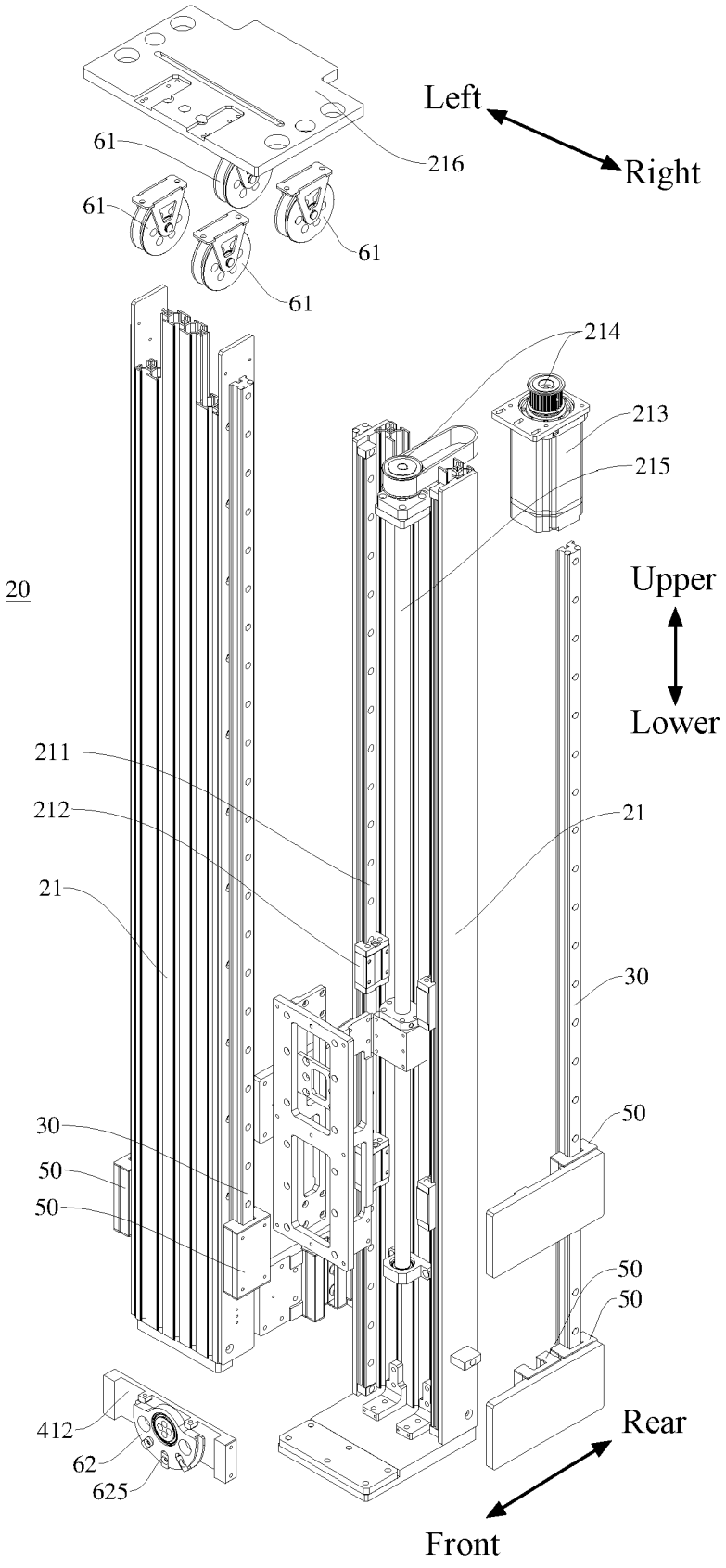
21
61
64
62
60
63
65
43
44
45
412
411
30
30
Upper
Lower
50
50
41
40
42
Rear
Front

FIG. 2


Left
Right
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61
61
61
216
214
213
215
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Upper
Lower
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212
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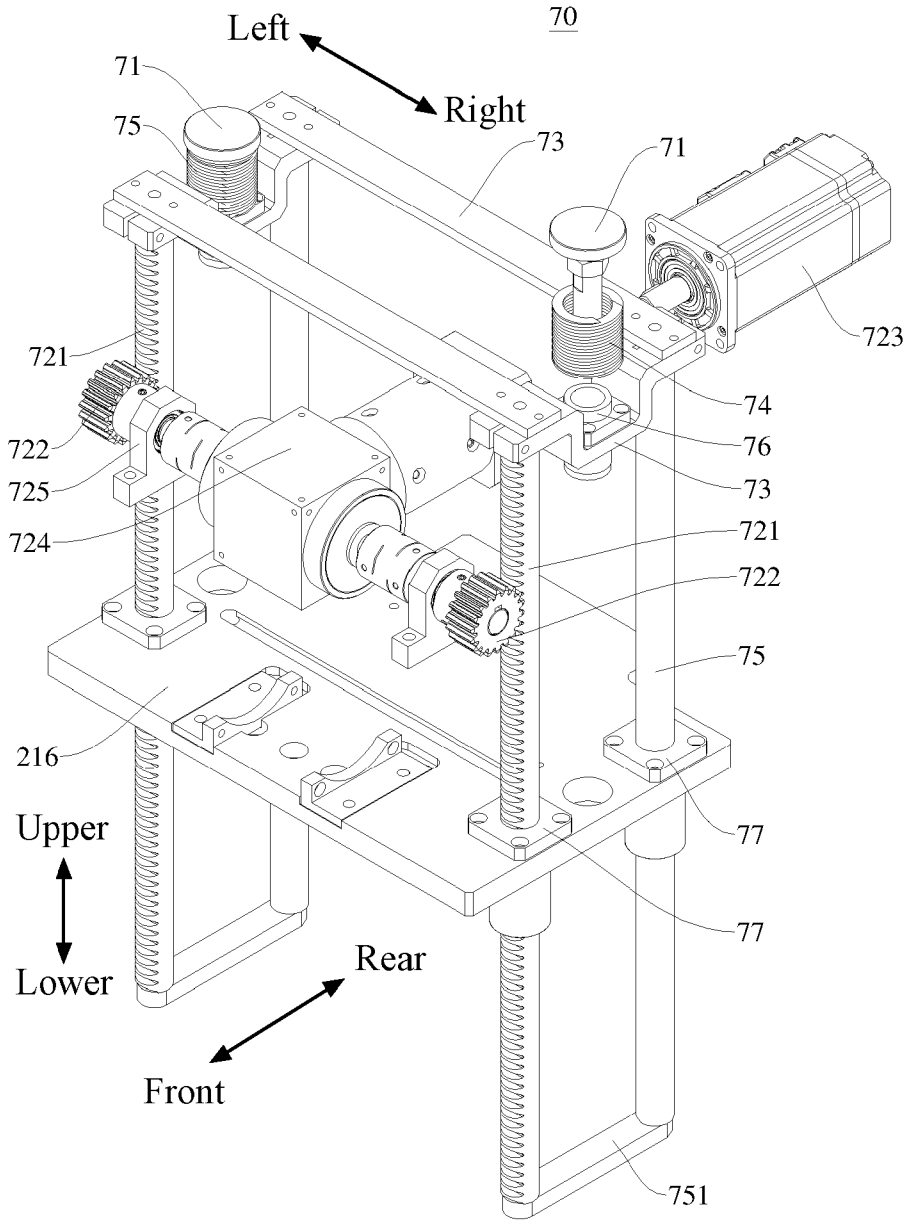
21
30
50
30
50
50
50
50
412
62
625
Rear
Front

FIG. 3


70
Left
Right
71
75
73
71
723
721
74
722
76
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724
721
722
75
216
77
77
Upper
Lower
Rear
Front
751

FIG. 4

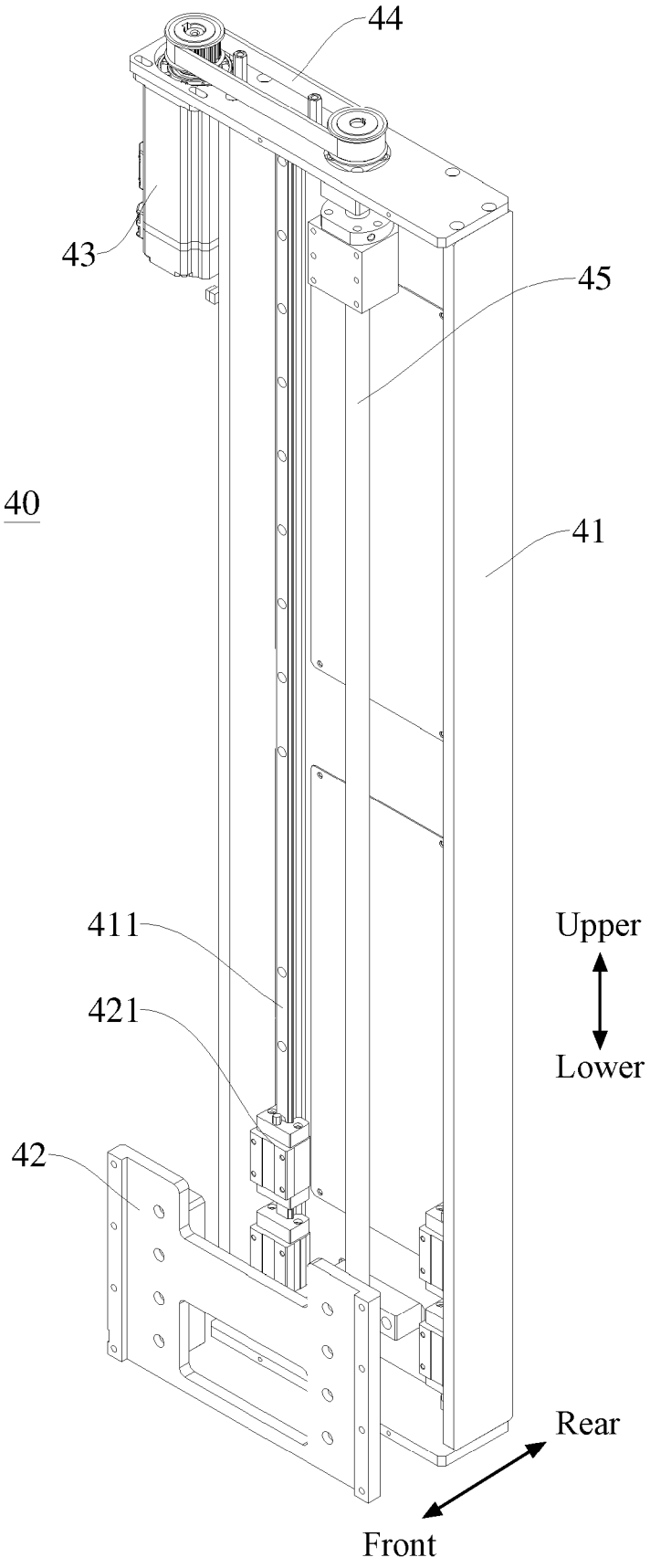
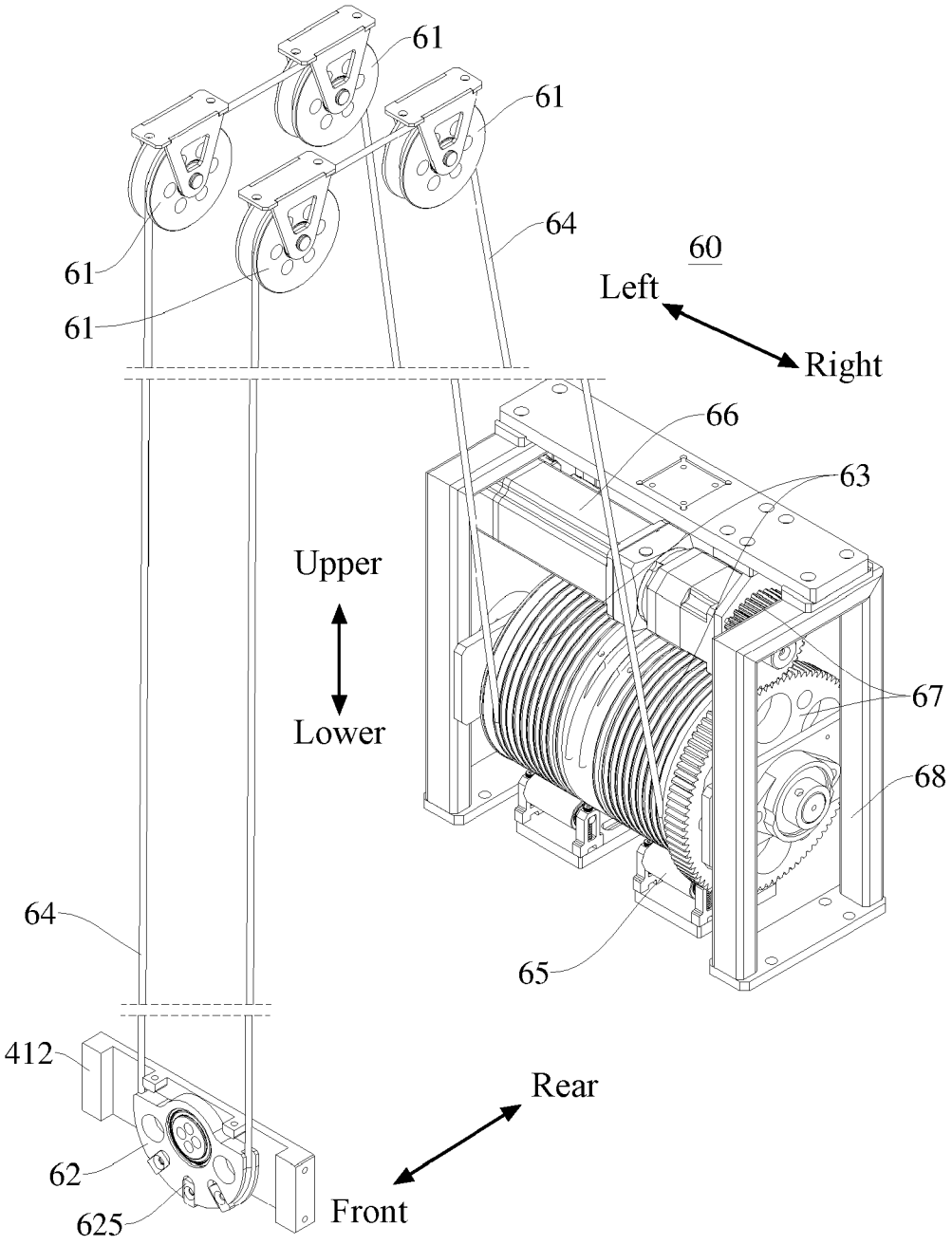


FIG. 5


61
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64
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61
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Left
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Upper
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67
68
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412
Rear
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Front

FIG. 6

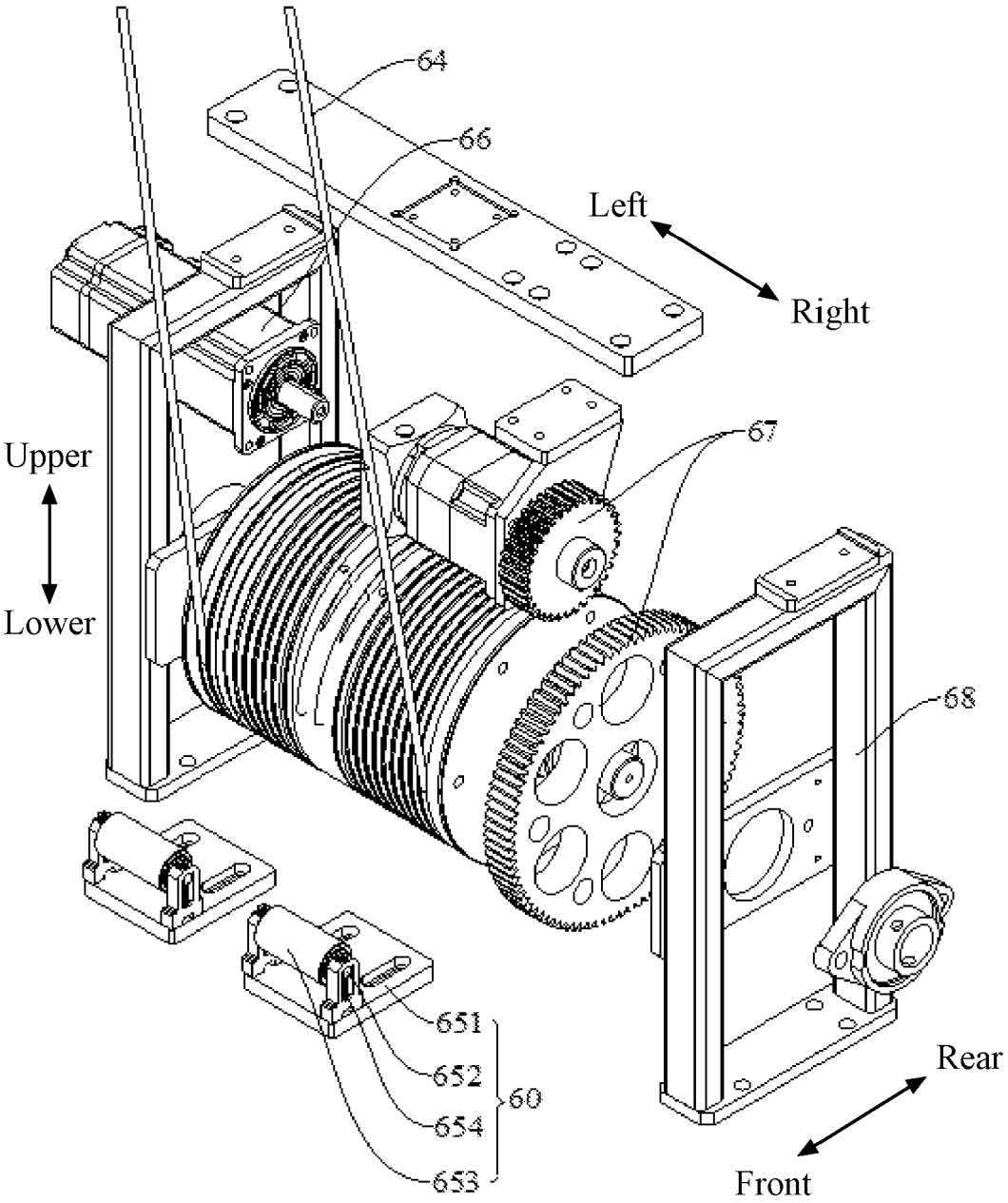
64
66
Left
Right
Upper
Lower
67
68
651
652
654
653
60
Rear
Front

FIG. 7

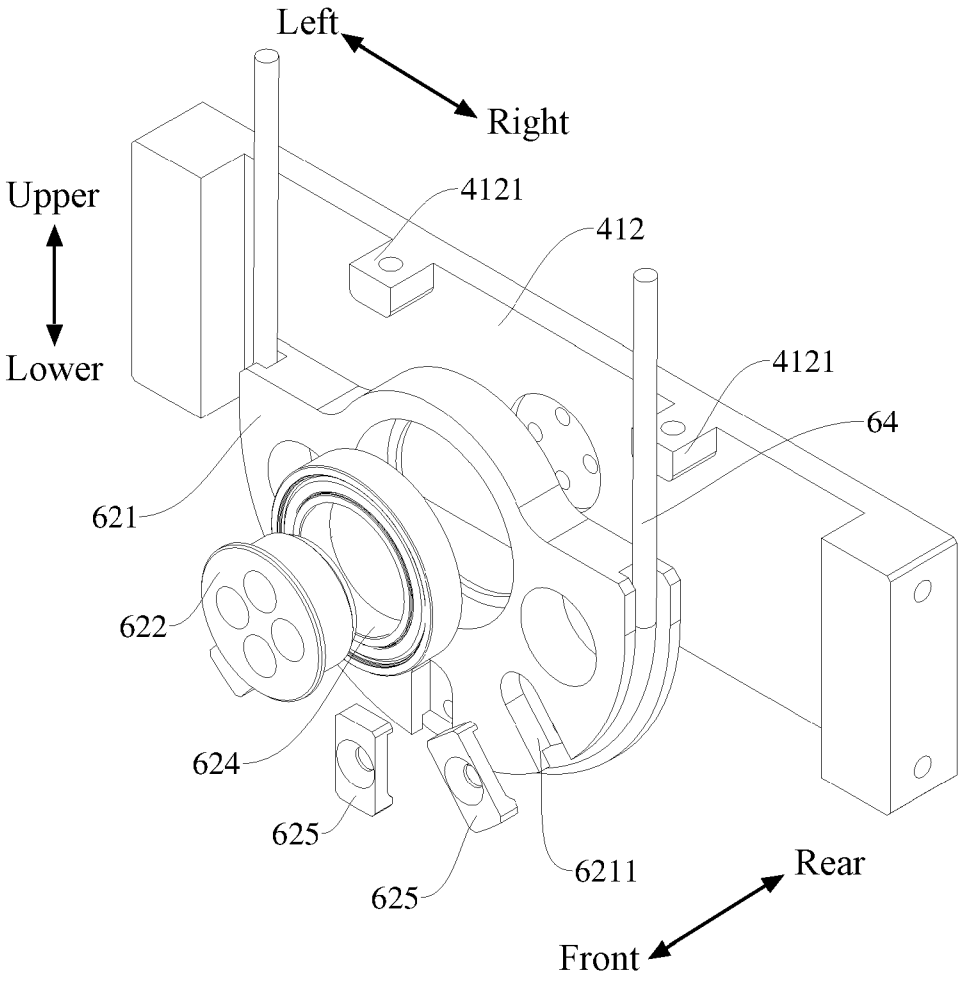
Left
Right
Upper
Lower
4121
412
4121
64
621
622
624
625
625
6211
Rear
Front

FIG. 8

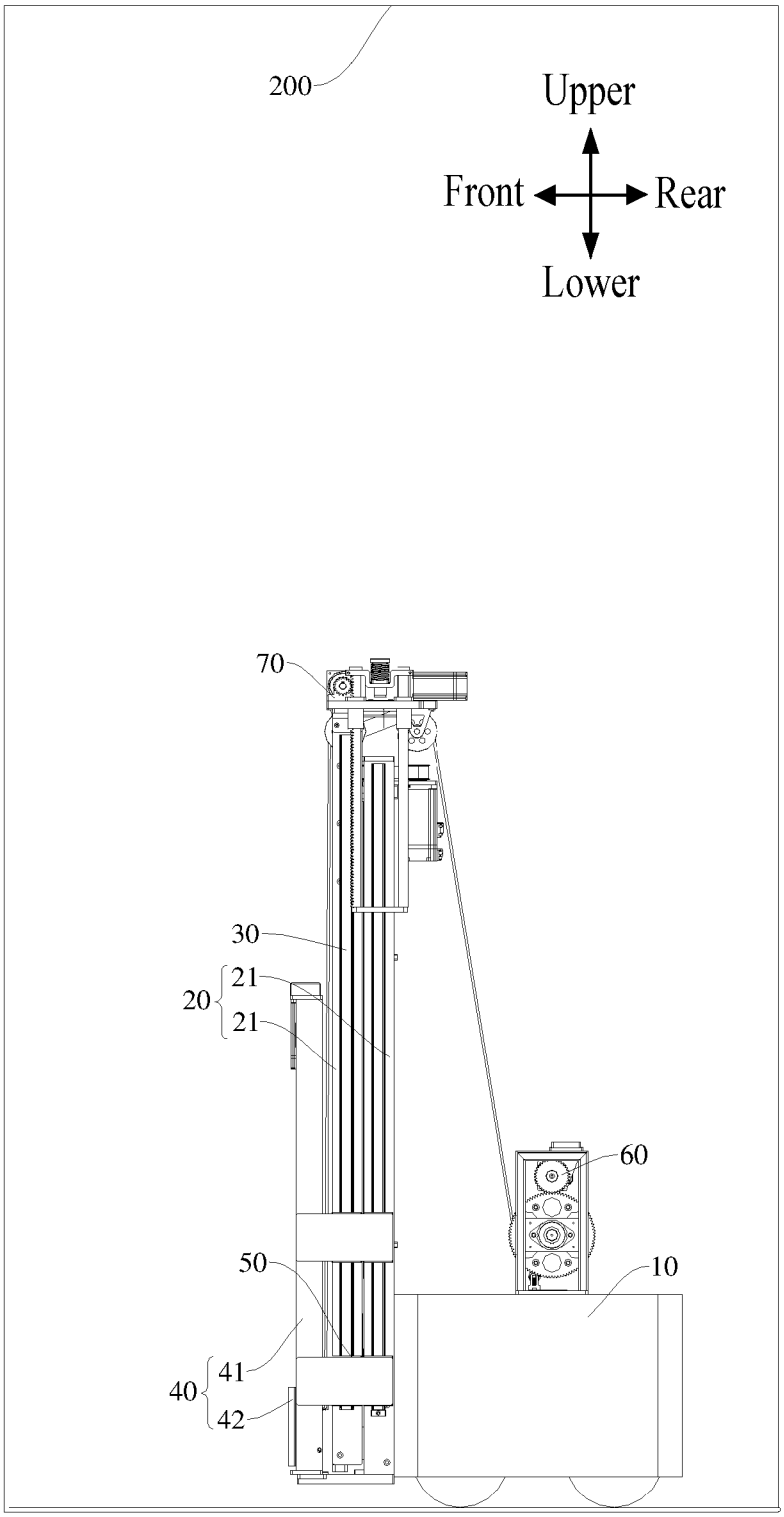

FIG. 9

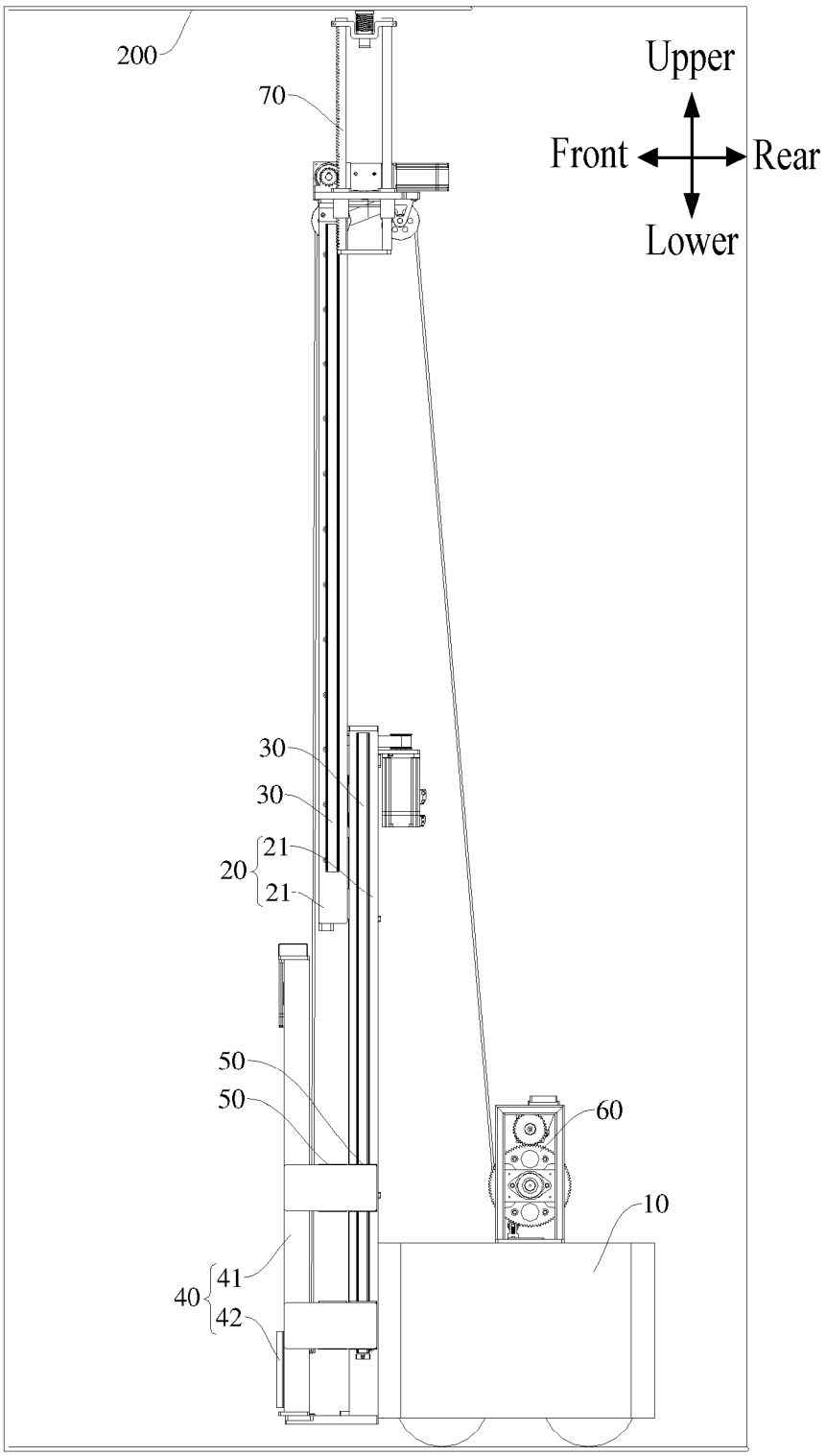

FIG. 10

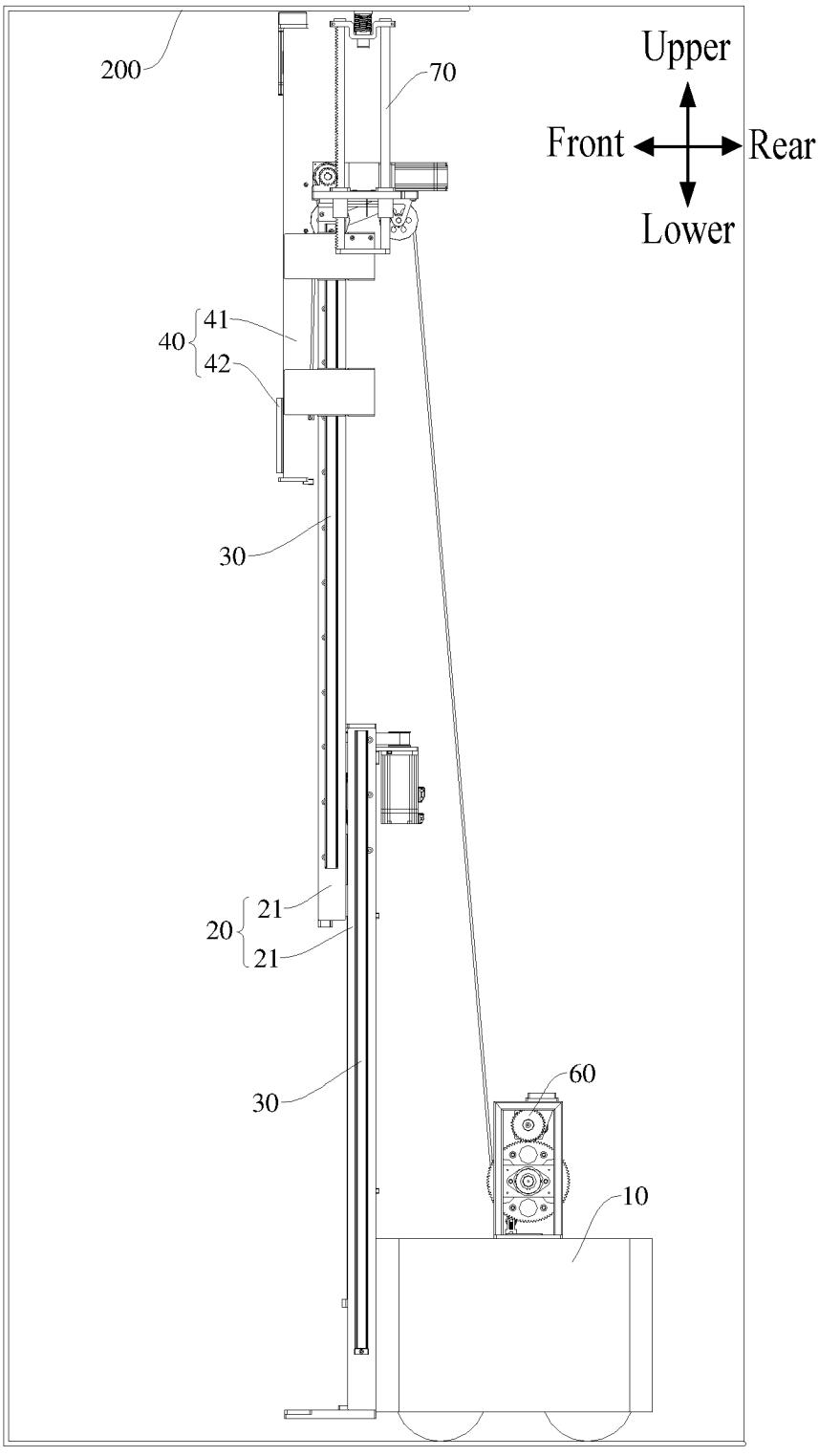

FIG. 11

LIFTING DEVICE AND PLASTERING APPARATUS

TECHNICAL FIELD

The present application relates to the field of lifting devices and, in particular, to a lifting device and a plastering apparatus.

BACKGROUND

Currently, a robot for construction on an interior wall of a room having a standard floor height has the following characteristics: The floor height that needs to be accommodated is generally 2850–3150 mm; the height of the doorway is generally 2050 mm; considering the lowest height of an ordinary construction lift is about 1850 mm, in order to achieve a construction surface of 3150 mm and make it convenient for the construction lift to pass through the doorway, two stages of lifting mechanisms or multiple stages of lifting mechanisms are generally required for an actuator at the end.

However, at present, the coverage of multiple stages of lifting mechanisms of a device on the market is limited, and thus the multiple stages of lifting mechanisms cannot be better adapted to interior facades of different heights; and various lifting mechanisms are required for construction on different facades. As a result, the construction costs increase greatly. Moreover, switching between lifting mechanisms results in a significant decrease in the work efficiency. In addition, the multiple stages of lifting mechanisms are mostly in a multi-drive transmission mode, and the overall size is not simplified enough. When an actuator is raised and lowered on the multiple stages of lifting mechanisms, due to a structural design problem, the actuator cannot move from the bottom to the top of the lifting mechanisms and cannot cover the entire facade.

SUMMARY

According to embodiments of the present application, a lifting device and a plastering apparatus are provided. The plastering apparatus is applied to the lifting device.

The lifting device includes a first-stage lifting mechanism, a second-stage lifting mechanism, and a drive mechanism.

The first-stage lifting mechanism includes at least two lifting frames. A second lifting frame of

two adjacent lifting frames is connected to a first lifting frame of the two adjacent lifting frames. The first lifting frame is configured to independently drive the second lifting frame. Here the second lifting frame is a next-section lifting frame after the first lifting frame. On a side of each lifting frame, a first guide member is disposed.

The second-stage lifting mechanism includes a bracket and a mounting base liftably disposed on the bracket. The mounting base is configured to connect an actuator. At least two first mating members are disposed on a side of the bracket.

The drive mechanism is configured to drive the bracket to ascend or descend along the at least two lifting frames in sequence. In the process in which the bracket is ascending or descending, first guide members on the at least two lifting frames sequentially mate with the at least two first mating members.

In one embodiment, the first guide member is a guide bar mounted on a side of each lifting frame. The first mating member is a guide seat mounted on a side of the bracket. Each guide seat is provided with a guide hole configured to mate with the guide bar.

In one embodiment, the first guide member is a guide rail mounted on a side of each lifting frame. The guide rail has a guide groove. The first mating member is a rolling member mounted on a side of the bracket. The rolling member is configured to mate with the guide groove.

In one embodiment, the first lifting frame is provided with a second guide member, and the second lifting frame is provided with a second mating member configured to mate with the second guide member. The second mating member is slidable along the second guide member.

In one embodiment, the first-stage lifting mechanism also includes a first independent drive disposed on the first lifting frame. The first independent drive includes a first drive motor, a first synchronous belt mechanism, and a first lead screw. The first lead screw is pivotally disposed on the first lifting frame. The second lifting frame is mounted on the first lead screw. One pulley of the first synchronous belt mechanism is connected to the first lead screw, another pulley of the first synchronous belt mechanism is connected to the first drive motor, and the first drive motor is configured to, when activated, drive the second lifting frame to ascend or descend.

In one embodiment, the bracket is provided with a third guide member, the mounting base is provided with a third mating member, and the third mating member is slidable along the third

guide member.

In one embodiment, the secondary lifting mechanism also includes a second independent drive on the mounting base. The second independent drive includes a second drive motor, a second synchronous belt mechanism, and a second lead screw. The second lead screw is pivotally disposed on the bracket. The mounting base is mounted on the second lead screw. One pulley of the second synchronous belt mechanism is drivingly connected to the second lead screw, and another pulley the second synchronous belt mechanism is drivingly connected to the output end of the second drive motor.

In one embodiment, the tail lifting frame is provided with a top seat. The lifting device also includes a support mechanism disposed on the top seat. The support mechanism includes a support member and a third-stage lifting mechanism for driving the support member to ascend or descend. The third-stage lifting mechanism is configured to, when a contact surface is disposed above the lifting device, drive the support member to abut against the contact surface.

In one embodiment, the third-stage lifting mechanism includes multiple racks, multiple gears, and a third drive motor. The racks pass through the top seat, are vertically slidably connected to the top seat, and connected to the support member. The gears are meshed with the racks in a one-to-one manner. The third drive motor is disposed on the top seat and drivingly connected to the gears.

In one embodiment, the racks are connected to the same connecting seat. The support member is vertically slidably disposed on the connecting seat. A first elastic member is disposed between the support member and the connecting seat.

In one embodiment, the tail lifting frame of the at least two lifting frames is provided with a top seat, and the drive mechanism includes two guide pulley sets spaced apart below the top seat, a hoisting pulley pivotally disposed on the bracket, two rotatable spool sets connected to each other, and a rope. The middle of the rope is in contact with and configured to mate with the hoisting pulley. Two ends of the rope are in contact with and configured to mate with the two guide pulley sets and are wound around the two spool sets in a one-to-one manner.

In one embodiment, below each spool set, an elastic rope pressing mechanism is disposed. The elastic rope pressing mechanism includes a base, a supporting base disposed on the base in a vertically movable manner, a rope pressing roller pivotally disposed on the supporting base, and

a second elastic member disposed between the supporting base and the base and is configured to make the rope pressing roller press the rope against the spool sets.

In one embodiment, the hoisting pulley is provided with a rope groove for accommodating the rope, and the hoisting pulley is provided with a protection mechanism for locking the rope. The protection mechanism includes multiple pressing blocks. The pressing blocks are spaced apart along the peripheral direction of the hoisting pulley to press the rope into the rope groove.

In one embodiment, the bracket is provided with an end mounting plate provided with two stop blocks spaced apart. The hoisting pulley is semicircular. The two stop blocks are located above the hoisting pulley.

In one embodiment, the hoisting pulley includes a pulley body and a rotary shaft. The rotary shaft is mounted on the end mounting plate. The pulley body is mounted on the rotary shaft. The rope groove is formed on the pulley body. The pulley body is provided with mounting grooves in correspondence with the pressing blocks. The mounting grooves communicate with the rope groove. The pressing blocks are in locking engagement with the mounting grooves.

In one embodiment, the drive mechanism also includes a mounting support and a fourth drive motor. The two spool sets are pivotally disposed on the mounting support. The fourth drive motor is disposed on the mounting support and drivingly connected to the spool sets.

The plastering apparatus includes a chassis, the preceding lifting device, and a plastering mechanism. The head lifting frame of the at least two lifting frames of the lifting device is mounted on the chassis. The plastering mechanism is disposed on the mounting base of the lifting device.

The details of one or more embodiments of the present application are set forth in the drawings and the description below. Other features, objects, and advantages of the present application are apparent from the description, drawings, and claims.

BRIEF DESCRIPTION OF DRAWINGS

For a better description and illustration of embodiments and/or examples of the application, reference may be made to one or more of the drawings. Additional details or examples used to describe the drawings should not be construed as limiting the scope of any of the application, the embodiments and/or examples, and the best modes of the application as presently

understood.

FIG. 1 is a diagram illustrating the structure of a lifting device according to an embodiment of the present application.

FIG. 2 is a partial exploded perspective view of a lifting device according to an embodiment of the present application.

FIG. 3 is an exploded perspective view of a first-stage lifting mechanism according to an embodiment of the present application.

FIG. 4 is an exploded perspective view of a support mechanism according to an embodiment of the present application.

FIG. 5 is an exploded perspective view of a second-stage lifting mechanism according to an embodiment of the present application.

FIG. 6 is exploded perspective view one of a drive mechanism according to an embodiment of the present application.

FIG. 7 is exploded perspective view two of a drive mechanism according to an embodiment of the present application.

FIG. 8 is exploded perspective view two of a hoisting pulley according to an embodiment of the present application.

FIG. 9 is diagram one of a lifting device operating in an indoor environment according to an embodiment of the present application.

FIG. 10 is diagram two of a lifting device operating in an indoor environment according to an embodiment of the present application.

FIG. 11 is diagram three of the lifting device in an indoor environment according to an embodiment of the present application.

Reference list

100 lifting device

10	chassis
20	first-stage lifting mechanism
21	lifting frame
211	second guide member
212	second mating member
213	first drive motor
214	first synchronous belt mechanism
215	first lead screw
216	top seat
30	first guide member
40	second-stage lifting mechanism
41	bracket
411	third guide member
412	end mounting plate
4121	stop block
42	mounting base
421	third mating member
43	second drive motor
44	second synchronous belt mechanism
45	second lead screw
50	first mating member
60	drive mechanism
61	guide pulley
63	spool set
64	rope
66	fourth drive motor
67	gear set
68	mounting support
62	hoisting pulley
621	pulley body
6211	mounting groove
622	rotary shaft
624	bearing
625	pressing block
65	elastic rope pressing mechanism

651 base
652 bearing base
653 rope pressing roller
654 second elastic member
70 support mechanism
71 support member
73 connecting seat
74 first elastic member
75 third guide bar
751 connecting plate
76 guild sleeve
77 sliding sleeve
72 third-stage lifting mechanism
721 rack
722 gear
723 third drive motor
724 speed reducer with double output shafts
725 bearing seat
200 contact surface

DETAILED DESCRIPTION

Embodiments of the present application are described in detail below, and examples of the embodiments are illustrated in the drawings, where the same or similar reference numerals indicate the same or similar elements or elements having the same or similar functions. The embodiments described below with reference to the drawings are illustrative and only for explaining the present application and not to be construed as limiting the present application.

In the description of the application, it is to be noted that spatially related or position related terms, including "center", "upper", "lower", "front", "rear" "left", "right", "vertical", "horizontal", "top", "bottom", "in", and "out" are described from the perspective of the drawings, intended only to facilitate the description of the application and simplify the description, instead of indicating or implying that the said instrument or elements must be at specific area or position or configured and operated at a specific area or position, and thus cannot be construed as a limitation to the application. In addition, a feature defined as a "first" feature or a "second" feature may explicitly or implicitly include one or more of such features, and is used to

distinguish and describe the features regardless of order or priority.

In the description of the application, unless otherwise stated, "plurality" means two or more.

In the description of the present application, it is to be noted that unless otherwise expressly specified and limited, the term "mounted", "connected to each other" or "connected" should be construed in a broad sense as permanently connected, detachably connected or integrally connected; mechanically connected or electrically connected; directly connected or indirectly connected via an intermediary medium; or internally connected of two elements. For those of ordinary skill in the art, the preceding terms can be construed depending on the actual situation in the application.

The lifting device 100 according to an embodiment of the application will be described below with reference to FIG. 1 to FIG. 11.

As shown in FIG. 1, a lifting device 100 according to an embodiment of the application includes a first-stage lifting mechanism 20, a first guide member 30, a second-stage lifting mechanism 40, a first mating member 50, and a drive mechanism 60.

The first-stage lifting mechanism 20 includes at least two lifting frames 21. A second lifting frame 21 of two adjacent lifting frames is connected to a first lifting frame 21 of the two adjacent lifting frames, and the first lifting frame 21 is configured to independently drive the second lifting frame 21 to ascend or descend. Here the second lifting frame is a next-section lifting frame after the first lifting frame. On a side of each lifting frame 21, a first guide member 30 is disposed. That is, when lifting operation is performed, the first lifting frame 21 drives the second lifting frame 21 to ascend so that the at least two lifting frames 21 ascend or descend and have a large lifting height.

The second-stage lifting mechanism 40 includes a bracket 41 and a mounting base 42 liftably disposed on the bracket 41. The mounting base 42 is configured to connect an actuator, and the side of the bracket 41 is provided with at least two first mating members 50. That is, the mounting base 42 can be lifted and lowered on the bracket 41 so as it can drive the actuator to operate and perform the corresponding function.

The at least two first mating members 50 are connected to the bracket 41, and the first mating members 50 are disposed in one-to-one correspondence with first guide members 30. Each first

mating member 50 is configured to mate with a corresponding first guide member 30 in a slidable or rollable manner. That is, as shown in FIG. 9 to FIG. 11, the bracket 41 is connected to a lifting frame 21 by mating between a first mating member 50 and the first guide member 30. After the first-stage lifting mechanism 20 is unfolded, the bracket 41 of the second lifting mechanism 40, by mating with the first guide member 30 of the lifting frame 21 at different height positions by the first mating members 50, can move from the bottom to the top and realize full coverage on the unfolded first-stage lifting mechanism 20. The unfolded first-stage lifting mechanism 20 constitutes the main body frame of the entire lifting device 100, and the first mating member 50 and the first guide member 30 are combined to constitute the guide mechanism so that the secondary lifting mechanism 40 can be stably lifted and lowered on the main body frame and the overall movement is reliable.

The drive mechanism 60 is configured to drive the bracket 41 to ascend or descend along at least two lifting frames 21 in sequence. First guide members 30 on at least two lifting frames 21 mate with at least two first mating members 50 in sequence in the process in which the bracket 41 is ascending or descending. That is, the drive mechanism 60 provides power to move the bracket 41 from bottom to top of a first-stage lifting mechanism 20. Since the second-stage lifting mechanism 40 itself has a lifting stroke, the height at which the actuator on the mounting base 42 can be operated can be extended to a maximum range, thereby achieving full bottom-up coverage of the processing facade.

According to the lifting device 100 in an embodiment of the present application, the first-stage lifting mechanism 20 formed by at least two lifting frames 21 can realize multi-stage lifting, and the overall coverage is expanded. The first guide member 30 is disposed on each of the lifting frames 21, and the first mating member 50 can realize movement of the second-stage lifting mechanism 40 from the bottom to the top of the entire lifting device 100 by mating with the first guide member 30. At the same time, since the second-stage lifting mechanism 40 has an independent lifting stroke, an actuator can fully cover the lifting height. In addition, since multiple lifting frames 21 are independently driven and can be unfolded upwardly and retracted, the lifting device 100 is highly integrated so that the size is small and can be adapted to operations in various spaces.

In some embodiments, the first guide member 30 is a guide bar (not shown) mounted on a side of each lifting frame 21, and the first mating member 50 is a guide seat (not shown) mounted on a side of the bracket 41. Each guide seat is provided with a guide hole (not shown) configured to mate with the guide bar. In this manner, the bracket 41 and the lifting frame 21 can mate with

each other in a sliding and guiding manner. The structure is simple and the guiding effect is good.

In some embodiments, as shown in FIG. 2 and FIG. 3, the first guide member 30 is a guide rail mounted on a side of each lifting frame 21. The first mating member 50 is a slider mounted on the side of the bracket 41, and the slider is configured to mate with the guide rail.

In some embodiments, the first guide member 30 is a guide rail mounted on a side of each lifting frame 21. The guide rail has a guide groove (not shown). The first mating member 50 is a rolling member (not shown) mounted on a side of the bracket 41, and the rolling member is configured to mate with the guide groove. When the bracket is lifting, the rolling member rolls along a guide groove of a guide rail so that the rolling member can play a guiding role and can reduce friction force, and the guiding effect is good. For example, the first guide member 30 is a two-axis linear guide rail, and the first mating member 50 is a V-shaped groove roller. In this manner, the first mating member 50 can be easily released and inserted into the two-axis linear guide rail, and the two-axis linear guide rail also has a self-dedusting effect.

In some embodiments, as shown in FIG. 2, FIG. 3, and FIG. 4, the tail lifting frame 21 of the at least two lifting frames is provided with a top seat 216, and the lifting device 100 also includes a support mechanism 70 disposed on the top seat 216. The support mechanism 70 includes a support member 71 and a third-stage lifting mechanism 72 for driving the support member 71 to ascend or descend. As shown in FIG. 9 and FIG. 11, when a contact surface 200 is provided above the lifting device 100, the third-stage lifting mechanism 72 drives the support member 71 to abut against the contact surface 200. For example, the lifting device 100 can be used for indoor operation. When the contact surface 200 is a ceiling on the top of a wall and the lifting device 100 is raised to a maximum height, the support member 71 can abut against the ceiling on the top of a wall so that both the bottom and the top of the lifting device 100 are supported. The lifting device 100 after lifting is changed from a cantilever structure to a two-point supporting structure, thereby greatly improving the overall rigidity and improving the stability. Therefore, the problem of shaking due to cantilever and eccentric loading can be solved, and the problem of large-size deviation can be solved. In this manner, the structural rigidity required for high-precision processing of a vertical facade can be met and the lifting device 100 can adapt to process interior facades of different heights. Of course, the lifting device 100 is not limited to indoor operation, but may also be used in conjunction with a fixing frame or surrounding support members. In this case, a contact surface 200 is formed on a fixing frame or support elements, and can also serve as a top support for the lifting device 100.

Optionally, as shown in FIG. 2 and FIG. 4, the third-stage lifting mechanism 72 includes multiple racks 721, multiple gears 722, and a third drive motor 723. The racks 721 pass through a top seat 216 and are vertically slidably connected to the top seat 216. The support member 71 is connected to the racks 721. The gears 722 are meshed with the racks 721 in a one-to-one manner. The third drive motor 723 is disposed on the top seat 216, and is drivingly connected to the gears 722 to drive the gears 722 to rotate. That is, the third drive motor 723 drives the gears 722 to rotate, and the gears 722 mesh with the rack 721s so that the racks 721 move upward or downward, thereby realizing the lifting of the support member 71. Since the third-stage lifting mechanism 72 is disposed between the support member 71 and the top seat 216, the support member 71 can independently ascend or descend to automatically abut against the contact surface 200, thereby further improving the adaptive height of the entire device and improving adaptability.

Optionally, as shown in FIG. 4, the racks 721 are circular racks, and the gears 722 mesh with the racks 721 so that the force between the support member 71 and the contact surface 200 is controlled by the torque of the third drive motor 723.

Optionally, as shown in FIG. 4, two racks 721 are provided, and also two gears are provided. The third drive motor 723 is connected to a speed reducer with double output shafts 724 to form a motor with the double output shafts. The two output shafts of the motor with the double output shafts are mounted on the top seat 216 through a bearing seat 725. The two output shafts of the motor with the double output shafts are connected to the two gears 722 in a one-to-one manner, so as to drive the two racks 721 to ascend or descend. In this manner, the number of drive motors can be reduced, the structure can be simplified, and the cost can be reduced. Of course, the number of the rack 721 and the gear 722 is not limited herein, and no further details are provided herein. Optionally, the racks 721 are connected to the same connecting seat 73, the support member 71 is vertically slidably disposed on the connecting seat 73, and a first elastic member 74 is disposed between the support member 71 and the connecting seat 73. The first elastic member 74 forms an elastic mechanism on the support member 71, and can act as a buffer when the pressure of the support member 71 on the contact surface 200 is excessively high, thereby improving safety.

Optionally, as shown in FIG. 4, multiple support members 71 are spaced apart on the connecting seat 73, and the first elastic member 74 is disposed between each of the support members 71 and the connecting seat 73. When the contact surface 200 is uneven, the first elastic members 74 at different positions will constricted adaptively so that the problem of imbalanced stress due to

the unevenness of the contact surface 200 can be solved.

Optionally, the first elastic member 74 is a spring, which costs little and has a good damping and buffering effect.

In some embodiments, as shown in FIG. 4, the third-stage lifting mechanism 72 also includes a third guide bar 75 and a sliding sleeve 77. Multiple third guide bars 75 and multiple sliding sleeves 77 are provided. The sliding sleeves 77 are disposed on the top seat 216, the third guide bars 75 are configured to vertically slidably mate with the corresponding sliding sleeves 77, and the third guide bars 75 are connected to the connecting seat 73. That is, the third guide bars 75 may have a guiding effect for the lifting of the racks 721 and the connecting seat 73, thereby improving the overall stability of the third-stage lifting mechanism 72.

Optionally, as shown in FIG. 4, when the racks 721 are circular racks, the circular racks are configured to mate with the corresponding sliding sleeves 77 in a vertically slidable manner. For example, if two circular racks are provided, and two third guide bars 75 and four sliding sleeves 77 are provided, then the two circular racks are configured to mate with the two sliding sleeves 77, and the two third guide bars 75 are configured to mate with the other two sliding sleeves 77. That is, the sliding sleeves 77 provide supporting and guiding for the movement of the third guide bars 75 and the racks 721.

Optionally, the sliding sleeves 77 may be linear bearings.

Optionally, as shown in FIG. 4, multiple third guide bars 75 are provided in one-to-one correspondence with multiple racks 721. A connecting plate 751 is disposed at the bottom of the third guide bars 75, and the other end of the connecting plate 751 is connected to the racks 721 so that two ends of the racks 721 are connected to the third guide bars 75, thereby further improving the stability and the reliability of the movement of the racks 721 on the connecting seat 73.

Optionally, as shown in FIG. 4, the connecting seat 73 is formed as an arcuate plate recessed downwardly in the middle, whereby the structural strength of the connecting seat 73 can be improved. The middle of the arcuate plate is provided with a guide sleeve 76 with which the support member 71 is configured to mate, so that a vertical sliding of the support member 71 on the connecting seat 73 is achieved.

In some embodiments, as shown in FIG. 2, first guide members 30 are disposed on both sides of a lifting frame 21 in the lifting direction, and first mating members 50 are disposed on both sides of the bracket 41 in the lifting direction. It is to be understood that both sides of the bracket 41 and both sides of the lifting frame 21 are connected to the first guide member 30 by the first mating member 50 so that both sides of the bracket 41 are evenly guided to improve the stability in the process in which the bracket 41 is ascending or descending, and the first guide member 30 is disposed on a side of each lifting frame 21 to guide the lifting of the second-stage lifting mechanism 40.

In some embodiments, as shown in FIG. 3, the first-stage lifting mechanism 20 also includes a first independent drive on the first lifting frame 21. The first independent drive includes a first drive motor 213, a first synchronous belt mechanism 214, and a first lead screw 215. The first lead screw 215 is pivotally disposed on the first lifting frame 21. The second lifting frame 21 is mounted on the first lead screw 215. One pulley of the first synchronous belt mechanism 214 is connected to the first lead screw 215, and another pulley of the first synchronous belt mechanism 214 is connected to the first drive motor 213, and the first drive motor 213 when started drives the lifting frame 21 to ascend or descend.

In some embodiments, as shown in FIG. 3, the first lifting frame 21 is provided with a second guide member 211, and the second lifting frame 21 is provided with a second mating member 212. The second guide member 211 is a slide rail and the second mating member 212 is a slide block. The stable lifting of the first lifting frame 21 on the second lifting frame 21 is achieved by making the slide rail mate with the slide block, thereby increasing the reliability of the lifting process.

In some embodiments, as shown in FIG. 5, the second-stage lifting mechanism 40 also includes a second independent drive on the mounting base 42. The second independent drive includes a second drive motor 43, a second synchronous belt mechanism 44, a second lead screw 45. The second lead screw 45 is pivotally disposed on a bracket 41, and the mounting base 42 is mounted on the second lead screw 45. One pulley of the second synchronous belt mechanism 44 is drivingly connected to the second lead screw 45, and another pulley of the second synchronous belt mechanism 44 is drivingly connected to the output end of the second drive motor 43. Then the second drive motor 43 when started drives the mounting base 42 to ascend or descend. Optionally, as shown in FIG. 5, a bracket 41 is provided with a third guide member 411, and the mounting base 42 is provided with a third mating member 421. The third guide member 411 is a slide rail and the third mating member 421 is a slide block. The mounting base

42 is configured to mate with the slide rail by the slide block in a slidable manner so that the mounting base 42 is stably lifted on the bracket 41.

As shown in FIG. 2, FIG. 6 and FIG. 7, the tail lifting frame 21 is provided with a top seat 216. The drive mechanism 60 includes two guide pulley sets 61, a hoisting pulley 62, two spool sets 63 and a rope 64. The two guide pulley sets 61 are spaced apart below the top seat 216. The hoisting pulley 62 is pivotally disposed on the bracket 41. The two rotatable spool sets 63 connected to each other. The middle of the rope 64 is in contact with and configured to mate with the hoisting pulley 62, and two ends of the rope 64 are in contact with and configured to mate with the two guide pulley sets 61 and are wound around the two spool sets 63 in a one-to-one manner. It is to be understood that the two spool sets 63 rotate to reel two ends of the rope 64, and that the two guide pulley sets 61 can adjust the direction of the rope 64, thereby facilitating mating of the rope 64 with the hoisting pulleys 62. As the length of the rope 64 outside the spool sets 63 decreases, the hoisting pulleys 62 can be driven to move upward, thereby lifting the bracket 41 and enabling the bracket 41 to ascend on multiple lifting frames 21, and likewise enabling the bracket 41 to descend. The drive mechanism 60 constitutes a double rope hoisting mechanism to power the lifting of the bracket 41.

It is to be noted that, as shown in FIG. 6 and FIG. 8, since the middle of the rope 64 is configured to mate with the hoisting pulley 62, and the hoisting pulley 62 can be rotated at a certain angle on a bracket 41, the hoisting pulley 62 can have a leveling effect. For example, when a drive mechanism 60 is operated, ropes 64 on both sides of the hoisting pulley 62 can adjust the tension of the ropes 64 on both sides of the hoisting pulley 62 adaptively, thereby ensuring the stress balance between the two sides of the ropes 64, thereby increasing the stress balance of the drive mechanism 60, and prolonging the service life.

In some embodiments, as shown in FIG. 6 and FIG. 7, the drive mechanism 60 also includes a mounting support 68 and a fourth drive motor 66. Both spool sets 63 are pivotally disposed on the mounting support 68, and the fourth drive motor 66 is disposed on the mounting support 68 and drivingly connected to the spool sets 63 via a gear set 67 to drive rotation of the spool sets 63.

Optionally, as shown in FIG. 6 and FIG. 7, below each spool set 63, an elastic rope pressing mechanism 65 is disposed. The elastic rope pressing mechanism 65 includes a base 651, a supporting base 652, a rope pressing roller 653 and a second elastic member 654. The supporting base 652 is disposed on the base 651 in a vertically movable manner. The rope

pressing roller 653 is pivotally disposed on the supporting base 652. The second elastic member 654 is disposed between the supporting base 652 and the base 651, and the second elastic member 654 is configured to make the rope pressing roller 653 press the rope 64 against the spool sets 63. That is, by the elastic action of the second elastic member 654, for example, when the second elastic member 654 is in a compressed state, the second elastic member 654 moves the supporting base 652 upwardly so that the rope pressing roller 653 presses the rope 64 against the spool set 63. In this manner, the rope can be arranged and the rope 64 can be prevented from fitting into a wrong groove on the spool set 63.

Optionally, as shown in FIG. 7, the base 651 is provided with two lug seats which are spaced apart. Both the two lug seats are provided with chutes. Two ends of the rope pressing roller 653 are pivotally connected to the supporting base 652. The two supporting bases 652 are configured to mate with the two chutes in a one-to-one manner, and two ends of the second elastic member 654 abut against the supporting base 652 and the base 651 respectively. In this manner, the chute provides a guide effect for the upper and lower movement of the supporting base 652, and two ends of the rope pressing roller 653 are slidably engaged with the two lug seats of the base 651 so that the force is balanced, and the stability of the rope pressing roller 653 can be improved.

Optionally, two ends of the rope pressing roller 653 are pivotally disposed on the supporting base 652. The supporting base 652 is vertically slidably mounted on the base 651 by the guide post, and the second elastic member 654 is sleeved on the guide post. One end of the second elastic member 654 is supported on the supporting base 652 and the other end of the second elastic member 654 is supported on the base 651 so that the rope pressing roller 653 can be stably moved up and down.

Optionally, a second elastic member 654 is a spring, which costs little and has a good damping and buffering effect.

In some embodiments, as shown in FIG. 6, the hoisting pulley 62 is provided with a protective mechanism to lock the rope 64. The protective mechanism includes multiple pressing blocks 625 spaced apart along the circumference of the hoisting pulley 62 to press the rope 64 into the rope groove of the hoisting pulley 62. It is to be noted that the locked pressing block 625 is capable of securing the rope 64 to the hoisting pulley 62 so that even if one side of the rope 64 is broken, the other side of the rope 64 will not be detached from the hoisting pulley 62. That is, it is ensured that the double rope hoisting mechanism constituted by the drive mechanism 60

does not immediately fail, but continues to power the lifting, thereby greatly reducing the potential safety hazard caused by the failure or breaking of the rope 64.

Optionally, as shown in FIG. 8, the bracket 41 is provided with an end mounting plate 412 on which two stop blocks 4121 are spaced apart. The hoisting pulley 62 is semicircular, and the two stop blocks 4121 are located above the hoisting pulley 62. That is, the hoisting pulleys 62 of the semicircular wheels can only rotate within a small angle range due to the two stop blocks 4121. When either side of the hoisting pulleys 62 exceeds a predetermined rotation angle, the stop blocks the hoisting pulleys 62, thereby serving as a leveling function.

In some embodiments, the end mounting plate 412 is provided with a detection member for detecting whether the rope 64 is broken. If abnormal breaking takes place, and the power will be off and an alarm will be given. Specifically, the detection member may be a pass sensor.

Optionally, as shown in FIG. 8, the hoisting pulley 62 includes a pulley body 621 and a rotary shaft 622. The rotary shaft 622 is mounted on an end mounting plate 412, and the pulley body 621 is mounted on the rotary shaft 622 by means of a bearing 624 so as to rotate the pulley body 621 relative to the end mounting plate 412.

Optionally, as shown in FIG. 8, the pulley body 621 is provided with mounting grooves 6211 in correspondence with the pressing blocks 625. The mounting grooves 6211 communicate with the rope groove on the pulley body 621, and the pressing blocks 625 are configured to mate with the mounting grooves 6211 and can be locked by a fastening member. In this manner, the rope 64 is pressed in the rope groove of the pulley body 621.

A plastering apparatus according to an embodiment of the present application includes a chassis 10, a lifting device 100, and a plastering mechanism (not shown). The lifting device 100 is the lifting device 100 described above, and the first lifting frame 21 is disposed on the chassis 10. The plastering mechanism is disposed on the mounting base 42 of the lifting device.

According to the plastering apparatus according to an embodiment of the present application, the plastering mechanism is disposed on the lifting device 100. Since the lifting device 100 can achieve multi-stage lifting, the plastering mechanism has a large coverage when operating on interior walls. The plastering mechanism can move from the bottom to the top of the apparatus, realizing full coverage during the plastering operation. Thus, the plastering operation is facilitated, and the operation efficiency is high.

In some embodiments, as shown in FIG. 1, the chassis 10 is a rolling chassis with an independent drive. For example, the rolling chassis is an automatically navigable sports car, which may have the ability to adjust the level, or adding other mechanism for adjusting plumbs to the multi-stage lifting device 100, thereby ensuring that the lifting action of the multi-stage lifting device 100 is parallel to the working surface and improving adaptability.

An embodiment of the plastering apparatus of the present application is described below in conjunction with FIG. 1 to FIG. 11.

As shown in FIG. 1, the plastering apparatus includes a chassis 10, a lifting device 100, and a plastering mechanism. The lifting device 100 includes a first-stage lifting mechanism 20, a first guide member 30, a second-stage lifting mechanism 40, a first mating member 50, a drive mechanism 60, and a support mechanism 70.

As shown in FIG. 3, the first-stage lifting mechanism 20 includes two lifting frames 21 constituting two sections of lifting structures. The second lifting frame 21 is connected to the first lifting frame 21. The first lifting frame 21 is configured to independently drive the second lifting frame 21 to ascend or descend. On a side of each lifting frame 21, a first guide member 30 is disposed. The first-stage lifting mechanism 20 also includes a first independent drive on the first lifting frame 21. The first independent drive includes a first drive motor 213, a first synchronous belt mechanism 214, and a first lead screw 215. The first lead screw 215 is pivotally disposed on the first lifting frame 21. The second lifting frame 21 is mounted on the first lead screw 215. One pulley of the first synchronous belt mechanism 214 is connected to the first lead screw 215, and another pulley of the first synchronous belt mechanism 214 is connected to the first drive motor 213. As shown in FIG. 3, the first lifting frame 21 is provided with a second guide member 211, and the second lifting frame 21 is provided with a second mating member 212. The second guide member 211 is a slide rail and the second mating member 212 is a slide block. The stable lifting of the first lifting frame 21 on the second lifting frame 21 is achieved by making the slide rail mate with the slide block, thereby increasing the reliability of the lifting action.

As shown in FIG. 5, the second-stage lifting mechanism includes a bracket 41 and a mounting base 42 liftably disposed on the bracket 41, and the mounting base 42 is configured to connect an actuator. Two first mating members 50 are disposed on a side of the bracket 41. The second-stage lifting mechanism 40 also includes a second independent drive on the mounting base 42. The second independent drive includes a second drive motor 43, a second synchronous

belt mechanism 44, a second lead screw 45. The second lead screw 45 is pivotally disposed on a bracket 41, and the mounting base 42 is mounted on the second lead screw 45. One pulley of the second synchronous belt mechanism 44 is connected to the second lead screw 45, and another pulley of the second synchronous belt mechanism 44 is connected to the second drive motor 43.

As shown in FIG. 5, the bracket 41 is provided with a third guide member 411, and the mounting base 42 is provided with a third mating member 421. The third guide member 411 is a slide rail, and the third mating member 421 is a slide block. The mounting base 42 is configured to mate with the slide rail by the slide block in a slidable manner, so that the mounting base 42 is stably lifted on the bracket 41. As shown in FIG. 1, the first mating member 50 is connected to the bracket 41, and the bracket 41 is provided with the first mating member 50 on both sides perpendicular to the lifting direction. The first mating member 50 is provided in one-to-one correspondence with the first guide member 30. Each of the first mating members 50 is configured to mate with a corresponding first guide member 30 in a slidable manner. The first guide member 30 is a double-shaft linear guide rail, and the first mating member 50 is a V-shaped groove roller.

The drive mechanism 60 is configured to drive the bracket 41 to ascend or descend along two lifting frames 21 in sequence. First guide members 30 on two lifting frames 21 mate with two first mating members 50 in sequence in the process in which the bracket 41 is ascending or descending. As shown in FIG. 1, FIG. 2 and FIG. 4, the tail lifting frame 21 is provided with a top seat 216, and the support mechanism 70 also includes a support member 71 and a third-stage lifting mechanism 72 for driving the support member 71 to ascend or descend. The third-stage lifting mechanism 72 is configured to, when a contact surface 200 is disposed above the lifting device 100, drive the support member 71 to abut against the contact surface 200.

As shown in FIG. 4, the third-stage lifting mechanism 72 includes two racks 721, two gears 722, and a third drive motor 723. Two racks 721 pass through the top seat 216 and are vertically slidably connected to the top seat 216. The support member 71 is connected to the two racks 721. The two gears 722 are meshed with the two racks 721 in a one-to-one manner. The third drive motor 723 is disposed on the top seat 216, and is drivingly connected to the two gears 722 to drive the two gears 722 to rotate.

As shown in FIG. 4, the racks 721 are circular racks. The third drive motor 723 is connected to a speed reducer with double output shafts 724 to form a motor with the double output shafts. The two output shafts of the motor with the double output shafts are mounted on the top seat

216 through the bearing seat 725. The two output shafts of the motor with the double output shafts are connected to the two gears 722 in a one-to-one manner, so as to drive the two racks 721 to lift.

As shown in FIG. 4, the two racks 721 are connected to the same connecting seat 73, the support member 71 is vertically slidably disposed on the connecting seat 73, and a first elastic member 74 is disposed between the support member 71 and the connecting seat 73. Two support members 71 are spaced apart on the connecting seat 73, and a first elastic member 74 is disposed between each of the support members 71 and the connecting seats 73. The first elastic member 74 is a spring.

As shown in FIG. 4, the third-stage lifting mechanism 72 also includes third guide bars 75 and sliding sleeves 77. Two third guide bars 75 are provided and four sliding sleeves 77 are provided. The sliding sleeves 77 are disposed on the top seat 216. The two third guide bars 75 are configured to vertically slidably mate with the corresponding sliding sleeves 77. The two third guide bars 75 are connected to the connecting seat 73. The two circular racks are configured to vertically slidably mate with the corresponding sliding sleeves 77, and the sliding sleeves 77 are linear bearings. A connecting plate 751 is disposed at the bottom of the third guide bar 75, and the other end of the connecting plate 751 is connected to a rack 721.

As shown in FIG. 4, the connecting seat 73 is formed as an arcuate plate recessed downwardly in the middle, whereby the structural strength of the connecting seat 73 can be improved. The middle of the arcuate plate is provided with a guide sleeve 76 with which the support member 71 is configured to mate.

As shown in FIG. 2, FIG. 6 and FIG. 7, the tail lifting frame 21 is provided with a top seat 216. The drive mechanism 60 includes two guide pulley sets 61, a hoisting pulley 62, two spool sets 63 and a rope 64. The two guide pulley sets 61 are spaced apart below the top seat 216. The hoisting pulley 62 is pivotally disposed on the bracket 41. The two spool sets 63 are connected and rotatably disposed on the chassis 10. The middle of the rope 64 is in contact with and configured to mate with the hoisting pulley 62, and two ends of the rope 64 are in contact with and configured to mate with the two guide pulley sets 61 and are wound around the two spool sets 63 in a one-to-one manner.

As shown in FIG. 6 and FIG. 7, the drive mechanism 60 also includes a mounting support 68 and a fourth drive motor 66. The two spool sets 63 are pivotally disposed on the mounting

support 68, and the fourth drive motor 66 is disposed on the mounting support 68 and drivingly connected to the spool sets 63 via a gear set 67 to drive rotation of the spool sets 63.

As shown in FIG. 7, an elastic rope pressing mechanism 65 is provided below each of the two spool sets 63. The elastic rope pressing mechanism 65 includes a base 651, a supporting base 652, a rope pressing roller 653 and a second elastic member 654. The base 651 is disposed on the chassis 10. The supporting base 652 is disposed on the base 651 in a vertically movable manner. The rope pressing roller 653 is pivotally disposed on the supporting base 652. The second elastic member 654 is disposed between the supporting base 652 and the base 651, and the second elastic member 654 is configured to make the rope pressing roller 653 press the rope 64 against the spool sets 63.

As shown in FIG. 7, the base 651 is provided with two lug seats spaced apart. The two lug seats are each provided with a chute. Two ends of the rope pressing roller 653 are pivotally connected to the supporting base 652. The two supporting bases 652 are configured to mate with the two chutes in a one-to-one manner, and two ends of the second elastic member 654 abut against the supporting base 652 and the base 651 respectively.

As shown in FIG. 6, the hoisting pulley 62 is provided with a protective mechanism to lock the rope 64. The protective mechanism includes three pressing blocks 625 spaced apart along the circumference of the hoisting pulley 62 to press the rope 64 into the rope groove of the hoisting pulley 62.

As shown in FIG. 8, the bracket 41 is provided with an end mounting plate 412 on which two stop blocks 4121 are spaced apart. The hoisting pulley 62 is semicircular, and the two stop blocks 4121 are located above the hoisting pulley 62.

As shown in FIG. 8, the hoisting pulley 62 includes a pulley body 621 and a rotary shaft 622. The rotary shaft 622 is mounted on the end mounting plate 412. The pulley body 621 is mounted on the rotary shaft 622 through a bearing 624.

As shown in FIG. 8, the pulley body 621 is provided with mounting grooves 6211 in correspondence with the pressing blocks 625. The mounting grooves 6211 communicate with the rope groove on the pulley body 621, and the pressing blocks 625 are configured to mate with the mounting grooves 6211 and can be locked by a fastening member.

As shown in FIG. 1, the chassis 10 is a rolling chassis with an independent drive. For example, the rolling chassis is an automatically navigable sports car, which may have the ability to adjust the level, thereby ensuring that the lifting action of the lifting device 100 is parallel to the working surface.

As shown in FIG. 9, FIG. 10, and FIG. 11, when the lifting device 100 is in operation, the chassis 10 is positioned, the level is adjusted, and the lifting frame 21 of the first-stage lifting mechanism 20 is raised. In this manner, the support member 71 of the support mechanism 70 abuts upwardly against the contact surface 200, and the double rope hoisting mechanism of the drive mechanism 60 drives the second-stage lifting mechanism 40 to ascend on the first-stage lifting mechanism 20. As the second-stage lifting mechanism 40 has an independent lifting stroke, the end actuator can perform a corresponding operation.

In conclusion, through the support mechanism 70 that can independently ascend or descend, the lifting device 100 can adaptively cover a floor height range of 2850–3150 mm. Moreover, through a rise brought by the lead screw of the second-stage lifting mechanism 40 and a rise brought by a hoisting system constituted by the drive mechanism 60, the end actuator can completely cover a facade (wall) from the bottom to the top (30–3120 mm from the ground), greatly extending the processing range of the facade (wall). If the end actuator is adapted appropriately in size, full coverage of the entire wall area (0–3150 mm) can be achieved. The end of the mechanism can be connected to different types of actuators to achieve different operation functions and can be widely applied to automatic operations such as polishing, spray painting (by using, for example, paint, putty, or mortar), and plastering of the inner wall.

Other configurations and operations of the lifting device 100 according to an embodiment of the present application are known to those skilled in the art, and will not be described in detail herein.

In a description of this specification, the description of reference terms "an embodiment" and "example" is intended to be included in at least one of embodiments or examples of the present application in connection with specific characteristics, structures, materials or features described in this embodiment or example. In the specification, the illustrative description of the preceding terms does not necessarily refer to the same embodiment or example. Moreover, the described specific characteristics, structures, materials or features may be combined properly in one or more embodiments or examples.

While embodiments of the present application have been shown and described, it will be understood by those of ordinary skill in the art that various changes, modifications, substitutions and variations may be made to these embodiments without departing from the principles and spirit of the present application, the scope of which is defined by the claims and their equivalents.

Claims

1. A lifting device, comprising:

a first-stage lifting mechanism comprising at least two lifting frames, wherein a second lifting frame of two adjacent ones of the at least two lifting frames is connected to a first lifting frame of the two adjacent ones of the at least two lifting frames, and the first lifting frame is configured to independently drive the second lifting frame to ascend or descend, wherein the second lifting frame is a next-section lifting frame after the first lifting frame; and on one side of each of the at least two lifting frames, a first guide member is disposed;

a second-stage lifting mechanism comprising a bracket and a mounting base liftably disposed on the bracket, wherein the mounting base is configured to connect an actuator, at least two first mating members are disposed on one side of the bracket; and

a drive mechanism configured to drive the bracket to ascend or descend along the at least two lifting frames in sequence, wherein in a process in which the bracket is ascending or descending, the first guide member on the one side of the each of the at least two lifting frames sequentially mates with the at least two first mating members disposed on the one side of the bracket.

2. The lifting device according to claim 1, wherein the first guide member is a guide bar mounted on the one side of the each of the at least two lifting frames, each of the at least two first mating members is a guide seat mounted on the one side of the bracket, and each guide seat is provided with a guide hole configured to mate with the guide bar.

3. The lifting device according to claim 1, wherein the first guide member is a guide rail mounted on the one side of the each of the at least two lifting frames, the guide rail has a guide groove, each of the at least two first mating members is a rolling member mounted on the one side of the bracket, and the rolling member is configured to mate with the guide groove.

4. The lifting device according to claim 1, wherein the first lifting frame is provided with a second guide member, the second lifting frame is provided with a second mating member configured to mate with the second guide member, and the second mating member is slidable along the second guide member.

5. The lifting device according to claim 1, wherein the first-stage lifting mechanism further comprises a first independent drive on the first lifting frame, wherein the first independent drive comprises a first drive motor, a first synchronous belt mechanism, and a first lead screw; the first lead screw is pivotally disposed on the first lifting frame; the second lifting frame is mounted on the first lead screw; and one pulley of the first synchronous belt mechanism is

connected to the first lead screw, another pulley of the first synchronous belt mechanism is connected to the first drive motor, and the first drive motor is configured to, when activated, drive the second lifting frame to ascend or descend.

6. The lifting device according to claim 1, wherein the bracket is provided with a third guide member, the mounting base is provided with a third mating member, and the third mating member is slidable along the third guide member.

7. The lifting device according to claim 1, wherein the second-stage lifting mechanism further comprises a second independent drive on the mounting base, wherein the second independent drive comprises a second drive motor, a second synchronous belt mechanism, and a second lead screw; the second lead screw is pivotally disposed on the bracket; the mounting base is mounted on the second lead screw; and one pulley of the second synchronous belt mechanism is drivingly connected to the second lead screw, and another pulley of the second synchronous belt mechanism is drivingly connected to an output end of the second drive motor.

8. The lifting device according to claim 1, wherein a tail lifting frame of the at least two lifting frames is provided with a top seat, the lifting device further comprises a support mechanism disposed on the top seat, the support mechanism comprises a support member and a third-stage lifting mechanism for driving the support member to ascend or descend, and the third-stage lifting mechanism is configured to, when a contact surface is disposed above the lifting device, drive the support member to abut against the contact surface.

9. The lifting device according to claim 8, wherein the third-stage lifting mechanism comprises:

a plurality of racks passing through the top seat, vertically slidably connected to the top seat, and connected to the support member;

a plurality of gears meshed with the plurality of racks in a one-to-one manner; and

a third drive motor disposed on the top seat and drivingly connected to the plurality of gears.

10. The lifting device according to claim 9, wherein the plurality of racks are connected to a same connecting seat, the support member is vertically slidably disposed on the connecting seat, and a first elastic member is disposed between the support member and the connecting seat.

11. The lifting device according to claim 1, wherein a tail lifting frame of the at least two lifting frames is provided with a top seat, and the drive mechanism comprises:

two guide pulley sets spaced apart below the top seat;

a hoisting pulley pivotally disposed on the bracket;

two rotatable spool sets connected to each other; and

a rope, wherein a middle of the rope is in contact with and configured to mate with the hoisting pulley, and two ends of the rope are in contact with and configured to mate with the two guide pulley sets and are wound around the two spool sets in a one-to-one manner.

12. The lifting device according to claim 11, wherein below each of the two spool sets, an elastic rope pressing mechanism is disposed, wherein the elastic rope pressing mechanism comprises:

a base;

a supporting base disposed on the base in a vertically movable manner;

a rope pressing roller pivotally disposed on the supporting base; and

a second elastic member disposed between the supporting base and the base and configured to make the rope pressing roller press the rope against the spool sets.

13. The lifting device according to claim 11, wherein the hoisting pulley is provided with a rope groove for accommodating the rope, the hoisting pulley is provided with a protection mechanism for locking the rope, the protection mechanism comprises a plurality of pressing blocks, and the plurality of pressing blocks are spaced apart along a circumferential direction of the hoisting pulley to press the rope into the rope groove.

14. The lifting device according to claim 13, wherein the bracket is provided with an end mounting plate provided with two stop blocks spaced apart, the hoisting pulley is semicircular, and the two stop blocks are located above the hoisting pulley.

15. The lifting device according to claim 14, wherein the hoisting pulley comprises a pulley body and a rotary shaft, the rotary shaft is mounted on the end mounting plate, the pulley body is mounted on the rotary shaft, the rope groove is formed on the pulley body, the pulley body is provided with mounting grooves formed in correspondence with the plurality of pressing blocks, the mounting grooves communicate with the rope groove, and the plurality of pressing blocks are in locking engagement with the mounting grooves.

16. The lifting device according to claim 11, wherein the drive mechanism further comprises a mounting support and a fourth drive motor, the two spool sets are pivotally disposed on the

mounting support, and the fourth drive motor is disposed on the mounting support and is drivingly connected to the spool sets.

17. A plastering apparatus, comprising:

a chassis;

the lifting device according to any one of claims 1 to 16, wherein a head lifting frame of the at least two lifting frames is mounted on the chassis; and

a plastering mechanism mounted on the mounting base of the lifting device.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/098884

A. CLASSIFICATION OF SUBJECT MATTER

E04F 21/08(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)

E04F

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)

VEN, CNTXT, CNKI, CNABS, 万方: 升降, 抹灰, 驱动, 丝杆, lift+ , fall+ , plaster+, driv+, screw

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 1752380 A (PU, Guomin et al.) 29 March 2006 (2006-03-29) description paragraphs 2-32 and figure 1	1-17
X	CN 2905953 Y (PU, Guomin et al.) 30 May 2007 (2007-05-30) description paragraphs 2-32 and figure 1	1-17
A	CN 1100171 A (LU, Xingqiao) 15 March 1995 (1995-03-15) entire document	1-17
A	CN 109881871 A (CENTRAL SOUTH UNIVERSITY) 14 June 2019 (2019-06-14) entire document	1-17
A	US 2019249446 A1 (MARS-N MARSHALLTOWN C) 15 August 2019 (2019-08-15) entire document	1-17
A	FR 2867497 A1 (CSCO-N CONSTR COTE D'EMERAUDE S) 16 September 2005 (2005-09-16) entire document	1-17

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

* Special categories of cited documents:
"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
"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)
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Date of the actual completion of the international search	Date of mailing of the international search report
09 August 2021	**26 August 2021**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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Information on patent family members

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