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(54) **TOWER CRANE DEVICE AND MOUNTING METHOD AND CONTROL METHOD THEREOF**

(57) The disclosure relates to the technical field of tower cranes, and particularly to a tower crane device and a mounting method and a control method thereof. The tower crane device comprises a machine platform (1), a tower column (2) and an arm frame hoisting apparatus, the tower column (2) is rotatably connected to the machine platform (1) and the tower column (2) rotates around a center of the tower column relative to the

machine platform (1), the arm frame hoisting apparatus comprises a tail frame structure (3), a sleeving frame structure (4) and an jib structure (5), the tail frame structure (3) and the jib structure (5) are both connected with the sleeving frame structure (4), the sleeving frame structure (4) is connected with the tower column (2), and the sleeving frame structure (4) ascends and descends in a height direction of the tower column (2).

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of tower cranes, and particularly to a tower crane device and a mounting method and a control method thereof.

BACKGROUND

[0002] A tower crane plays a role of hoisting and feeding in the field of building construction, the tower crane comprises a tower column and an arm frame connected along the tower column, a hoisting hook is arranged on the arm frame, the other end of the arm frame is a counterweight for balancing a weight of the arm frame, and the arm frame cannot slidably ascend and descend along the tower column, that is, an operation height cannot be adjusted.

[0003] Because a circumferential operation orientation needs to be adjusted during operation of the existing tower crane, the rotation of the arm frame relative to the tower column is generally used to adjust a circumferential position of hoisting operation currently. However, according to this solution, when the arm frame rotates relative to the tower column, a pump pipe cannot be arranged along the tower crane, because when the pump pipe is arranged on the tower crane, the pump pipe will be twisted and deformed at a joint between a vertical section (a part arranged along the tower column) and a horizontal section (a part arranged along the arm frame) of the tower crane, resulting in concrete transportation blockage to affect a pouring operation, so that the tower crane generally can only realize a hoisting operation, but cannot realize multi-functional operations such as pumping.

SUMMARY

[0004] Therefore, the technical problem to be solved by the present disclosure is to overcome the defect that a pump pipe is easily twisted and deformed to affect a pouring operation during rotation of a tower crane in the prior art, thus providing a tower crane device which does not affect the use of the pump pipe during rotation, and a mounting method and a control method thereof.

[0005] In order to solve the above problem, the present disclosure provides a tower crane device, which comprises a machine platform; a tower column rotatably connected to the machine platform, wherein the tower column rotates around a center of the tower column relative to the machine platform; and an arm frame hoisting apparatus comprising a tail frame structure, a sleeving frame structure and an jib structure, wherein the tail frame structure and the jib structure are both connected with the sleeving frame structure, the sleeving frame structure is connected with the tower column, and the sleeving frame structure ascends and descends in a

height direction of the tower column.

[0006] Optionally, the tower crane device further comprises a concrete pumping device, wherein the concrete pumping device comprises a pump arranged on the tower column; a vertical telescoping pump pipe arranged in the height direction of the tower column, wherein the vertical telescoping pump pipe is connected with the pump; and a horizontally telescoping pump pipe connected with the vertical telescoping pump pipe, wherein the horizontally telescoping pump pipe is arranged in a length direction of the jib structure.

[0007] Optionally, the concrete pumping device further comprises a feed pipe arranged on the tower column, wherein the feed pipe is connected with the vertical telescoping pump pipe through the pump, and a feeding hopper is arranged on the feed pipe.

[0008] Optionally, a plurality of feed pipes are provided and arranged at intervals in a circumferential direction of the tower column.

[0009] Optionally, the tower crane device further comprises a lifting drive mechanism, wherein the lifting drive mechanism is in transmission connection with the sleeving frame structure to drive the sleeving frame structure to ascend and descend in the height direction of the tower column.

[0010] Optionally, the lifting drive mechanism comprises: a lifting motor arranged on the sleeving frame structure; a lifting gear rotatably arranged on the sleeving frame structure, wherein the lifting gear is in transmission connection with the lifting motor; and a lifting rack arranged on the tower column in the height direction of the tower column, wherein the lifting gear is meshed with the lifting rack.

[0011] Optionally, the tower crane device further comprises a lifting locking mechanism, wherein the lifting locking mechanism is suitable for locking the sleeving frame structure and the tower column.

[0012] Optionally, the lifting locking mechanism comprises: a lifting locking cylinder arranged on the sleeving frame structure; a lifting locking pin connected with the lifting locking cylinder; and a plurality of positioning holes arranged in the height direction of the tower column, wherein the lifting locking cylinder drives the lifting locking pin to be clamped in one of the positioning holes.

[0013] Optionally, the tower column comprises a plurality of tower sections, and the plurality of tower sections are sequentially connected in the height direction to form the tower column.

[0014] Optionally, the tower crane device further comprises a jacket jacking device sleeved on the tower column, wherein the jacket jacking device is used for increasing or reducing the tower sections to adjust a height of the tower column.

[0015] Optionally, the jacket jacking device comprises: an upper jacking platform sleeved on a periphery of the tower column, wherein a first jacking gear is arranged on the upper jacking platform, and the first jacking gear is meshed with the lifting rack; and a lower jacking platform

connected with the upper jacking platform, wherein a lifting space is formed between the lower jacking platform and the upper jacking platform, a second jacking gear is arranged on the lower jacking platform, the second jacking gear is meshed with the lifting rack, and the first jacking gear drives the tower section matched with the first jacking gear to be far away from the lower jacking platform and jacked up.

[0016] Optionally, the jacket jacking device further comprises an upper locking assembly, wherein the upper locking assembly comprises: an upper locking cylinder arranged on the upper jacking platform; and an upper locking pin connected with the upper locking cylinder, wherein the upper locking cylinder drives the upper locking pin to be clamped in one of the positioning holes.

[0017] Optionally, the jacket jacking device further comprises a lower locking assembly, wherein the lower locking assembly comprises: a lower locking cylinder arranged on the lower jacking platform; and a lower locking pin connected with the lower locking cylinder, wherein the lower locking cylinder drives the lower locking pin to be clamped in one of the positioning holes.

[0018] Optionally, the jacket jacking device further comprises a tower section gantry crane, wherein the tower section gantry crane is connected with the upper jacking platform through a tower section rail.

[0019] Optionally, the tower crane device further comprises a rotation drive mechanism, wherein the rotation drive mechanism is in transmission connection with the tower column to drive the tower column to rotate.

[0020] Optionally, the rotation drive mechanism comprises: a rotation motor; a rotation gear in transmission connection with the rotation motor; and a gear plate, wherein one of the gear plate and the rotation gear is arranged on the machine platform, and the other is arranged on the tower column, and a gear ring of the gear plate is meshed with the rotation gear.

[0021] Optionally, the rotation drive mechanism further comprises a rotation support, and the rotation support comprises: an upper revolving frame sleeved on the periphery of the tower column, wherein the tower column is connected with the upper revolving frame in a sliding or rolling way; a lower revolving frame fixedly arranged on the machine platform and sleeved on a periphery of the gear plate; and a support rod connected with both the upper revolving frame and the lower revolving frame.

[0022] Optionally, the rotation drive mechanism further comprises a rotation connection, the rotation connection is fixedly connected with the tower column, and the rotation gear is rotatably arranged on the rotation connection.

[0023] Optionally, a first revolving bearing is also arranged on the rotation connection, and the first revolving bearing is matched with a surface of the gear plate in a rolling way.

[0024] Optionally, the rotation drive mechanism further comprises a guiding connection, a guiding slot is arranged in the guiding connection, and the upper revolving

frame is slidably clamped in the guiding slot.

[0025] Optionally, an inner wall of the guiding slot is provided with a second revolving bearing, and the second revolving bearing is matched with the upper revolving frame in a rolling way.

[0026] Optionally, the tower crane device further comprises a bottom section gantry crane, and the bottom section gantry crane is connected with the upper revolving frame through a bottom overhead rail.

[0027] Optionally, the tower crane device further comprises a pump pipe auxiliary crane, wherein the pump pipe auxiliary crane is arranged on the jib structure.

[0028] The present disclosure further provides a mounting method of the tower crane device, which comprises the following steps of: rotatably connecting the tower column to the machine platform; slidably connecting the sleeving frame structure to the tower column; and respectively hoisting the tail frame structure and the jib structure to two sides of the sleeving frame structure to be connected and fixed.

[0029] Optionally, the rotatably connecting the tower column to the machine platform, comprises: hoisting and mounting the plurality of tower sections part by part from bottom to top, mounting the tower section at the bottom and the tower section to be jacked first, mounting the jacket jacking device on an outer side of the tower section to be jacked after mounting, synchronously mounting the pump, an in-situ control box, a storage battery, and related apparatuses into the tower section at the bottom, and mounting the tower sections upwardly step by step by using the jacket jacking device to make the tower column reach a use height.

[0030] The present disclosure further provides a control method of the tower crane device, which comprises the following steps of: allowing the tower column to rotate relative to the machine platform to drive the sleeving frame structure to rotate synchronously, thus driving both the tail frame structure and the jib structure to rotate to realize the operation of the tower crane device in different orientations along a circumferential direction; and allowing the sleeving frame structure to ascend and descend in the height direction of the tower column to drive both the tail frame structure and the jib structure to ascend and descend in the height direction of the tower column to realize the operation of the tower crane device at different heights.

[0031] Optionally, the control method further comprises: using the jacket jacking device for increasing a number of the tower sections to increase an operation height of the tower column.

[0032] Optionally, the using the jacket jacking device for increasing the number of the tower sections to increase the operation height of the tower column, comprises: when an entry orientation of a new tower section is the same as an orientation of the jib structure, allowing the arm frame hoisting apparatus to descend to a lowest position first, separating a top portion of the vertical telescoping pump pipe from the jib structure to be placed

at the bottom, allowing a telescoping ladder to fall to the lowest position accordingly, and then hoisting the new tower section to the tower section at the top for splicing; and when the entry orientation of the new tower section is different from the orientation of the jib structure, directly hoisting the new tower section to the tower section at the top for splicing.

[0033] The present disclosure has the following advantages.

1. According to the tower crane device of the present disclosure, the machine platform supports the whole tower column, and the tail frame structure, the sleeving frame structure and the jib structure which are connected to the tower column, so as to ensure the use stability of the device; when the sleeving frame structure ascends and descends in the height direction of the tower column, the tail frame structure and the jib structure are driven to ascend and descend integrally, thus adjusting the operation height of the tower crane; when the tower column rotates around the center of the tower column relative to the machine platform, the tail frame structure, the sleeving frame structure and the jib structure on the tower column are driven to rotate together, thus adjusting the circumferential operation position of the tower crane, and improving the operation flexibility of the tower crane; meanwhile, according to the present disclosure, the circumferential orientation is adjusted through the rotation of the tower column relative to the machine platform, and there is no relative rotation between the jib structure and the tower column; and compared with an existing method of driving the jib structure to rotate through the rotary connection between the sleeving frame structure and the tower column, the present disclosure is more convenient for arranging the pump pipe along the tower column and the jib structure due to non-existence of relative rotation between the jib structure and the tower column, and the pump pipe will not be deformed and blocked due to rotation, and can meet the use requirements of material pumping.

2. The tower crane device of the present disclosure further comprises the concrete pumping device, wherein the concrete pumping device comprises the pump, the vertical telescoping pump pipe and the horizontally telescoping pump pipe, the pump is arranged on the tower column, the pump is connected with the vertical telescoping pump pipe, the vertical telescoping pump pipe is arranged in the height direction of the tower column, the horizontally telescoping pump pipe is connected with the vertical telescoping pump pipe, and the horizontally telescoping pump pipe is arranged in the length direction of the jib structure. In this arrangement, the pump pumps concrete to the vertical telescoping pump pipe at a high pressure, and pumps the concrete to the horizontally telescoping pump pipe through the

vertical telescoping pump pipe, thus realizing the high-altitude pouring operation; when the jib structure ascends and descends along the tower column, the vertical telescoping pump pipe can be extended or retracted adaptively to change a length of the vertical telescoping pump pipe to adapt to the ascending and descending of the jib structure, while the horizontally telescoping pump pipe can be extended or retracted to change a transverse length of the horizontally telescoping pump pipe to adjust a discharging position, so as to meet different pouring requirements; and when the tower column rotates relative to the machine platform, the pump, the horizontally telescoping pump pipe and the vertical telescoping pump pipe can be driven to rotate together, so that the horizontally telescoping pump pipe and the vertical telescoping pump pipe are always reliably connected, thus realizing the smooth transportation of the concrete.

3. According to the tower crane device of the present disclosure, the concrete pumping device further comprises the feed pipe arranged on the tower column, wherein the feed pipe is connected with the vertical telescoping pump pipe through the pump, and the feeding hopper is arranged on the feed pipe. The concrete subjected to qualified stirring is added into the feed pipe through the feeding hopper, and then the concrete in the feed pipe is pumped into the vertical telescoping pump pipe by the pump, then pumped into the horizontally telescoping pump pipe, and finally output through a vertical discharge pipe, so as to realize the pouring operation of the concrete, and the feed pipe may rotate with the tower column, so that the feed pipe and the pump are always reliably connected.

4. According to the tower crane device of the present disclosure, the plurality of feed pipes are provided and arranged at intervals in the circumferential direction of the tower column. The plurality of feed pipes are arranged in the circumferential direction of the tower column, so that when the tower column rotates to different orientations, a stirrer can also be conveniently fed by a corresponding feed pipe in an original position, and the position of the stirrer does not need to be frequently adjusted along with the change of the orientation of the feed pipe, thus improving construction convenience and efficiency.

5. The tower crane device of the present disclosure further comprises the lifting drive mechanism, wherein the lifting drive mechanism comprises the lifting motor, the lifting gear and the lifting rack, the lifting motor is arranged on the sleeving frame structure, the lifting gear is rotatably arranged on the sleeving frame structure, the lifting gear is in transmission connection with the lifting motor, the lifting rack is arranged on the tower column in the height direction of the tower column, and the lifting gear is meshed with the lifting rack. In this arrangement,

when the sleeving frame structure needs to ascend and descend, the lifting motor drives the lifting gear to rotate, and because the lifting gear is meshed with the lifting rack, the lifting gear is driven to rotate along the lifting rack, so that the sleeving frame structure is driven to ascend and descend in the height direction of the tower column, thus realizing the adjustment at different heights.

6. The tower crane device of the present disclosure further comprises the lifting locking mechanism, and the lifting locking mechanism is suitable for locking the sleeving frame structure and the tower column, so as to ensure that the sleeving frame structure is reliably fixed after ascending and descending in place, enhance the stability of the sleeving frame structure when in use, reduce the risk of relative movement between the sleeving frame structure and the tower column during use, and reduce a stress on the lifting gear at the same time.

7. The tower crane device of the present disclosure further comprises the jacket jacking device sleeved on the tower column, wherein the jacket jacking device is used for increasing or reducing the tower sections to adjust the height of the tower column or dismantle the tower column. The tower sections are increased to increase the height of the tower column through the jacket jacking device, or the tower sections are reduced to reduce the height of the tower column or dismantle the tower column through the jacket jacking device, so as to meet the use requirements at different heights and facilitate disassembly and assembly.

8. According to the tower crane device of the present disclosure, the jacket jacking device comprises the upper jacking platform and the lower jacking platform, wherein the upper jacking platform is sleeved on the periphery of the tower column, the first jacking gear is arranged on the upper jacking platform, the first jacking gear is meshed with the lifting rack, the lower jacking platform is connected with the upper jacking platform, the lifting space is formed between the lower jacking platform and the upper jacking platform, the second jacking gear is arranged on the lower jacking platform, the second jacking gear is meshed with the lifting rack, and the first jacking gear drives the tower section matched with the first jacking gear to be far away from the lower jacking platform and jacked up. In the above arrangement, when the tower sections need to be increased, a connection point of adjacent tower sections in the lifting space is loosened, the first jacking gear drives the tower section matched with the first jacking gear to be far away from the lower jacking platform and jacked up, so that the adjacent tower sections are separated up and down, and the new tower section is placed in a separation space, and connected and fixed with the upper and lower adjacent tower sections to increase the overall height of the tower

column, thus meeting higher operation requirements; when the tower sections need to be reduced, the connection point of adjacent tower sections in the lifting space is loosened, the first jacking gear drives the tower section matched with the first jacking gear to be far away from the lower jacking platform and jacked up, so that the adjacent tower sections are separated up and down, the tower section in the lifting space is dismantled, and the first jacking gear drives the tower section matched with the first jacking gear to be close to the lower jacking platform and move down, so as to be reconnected with the tower section below to reduce the overall height of the tower column, thus meeting operation requirements of a small space, and reducing a weight of the device and improving operation stability by reducing the tower sections.

9. According to the tower crane device of the present disclosure, the jacket jacking device further comprises the upper locking assembly, wherein the upper locking assembly comprises the upper locking cylinder and the upper locking pin, the upper locking cylinder is arranged on the upper jacking platform, the upper locking pin is connected with the upper locking cylinder, and the upper locking cylinder drives the upper locking pin to be clamped in one of the positioning holes. When the first jacking gear drives the tower section matched with the first jacking gear to be jacked in place, the upper locking cylinder drives the upper locking pin to be clamped in one of the positioning holes, so that the upper jacking platform and an upper half part of the tower column can be locked, thus avoiding relative sliding between the upper jacking platform and the tower column, and ensuring the safety of personnel working in the lifting space, and meanwhile, the upper locking pin can further disperse a stress on the first jacking gear, which reduces the risk of damaging the first jacking gear by an excessive stress.

10. According to the tower crane device of the present disclosure, the jacket jacking device further comprises the lower locking assembly, wherein the lower locking assembly comprises the lower locking cylinder and the lower locking pin, the lower locking cylinder is arranged on the lower jacking platform, the lower locking pin is connected with the lower locking cylinder, and the lower locking cylinder drives the lower locking pin to be clamped in one of the positioning holes. Before the movement of the first jacking gear, the lower locking cylinder drives the lower locking pin to be clamped in one of the positioning holes, so that the lower jacking platform and a lower half part of the tower column can be locked, thus avoiding relative sliding between the lower jacking platform and the tower column, and ensuring that the first jacking gear drives the upper half part of the tower column to be jacked up, and the lower locking pin can further disperse a stress on the second

jacking gear, which reduces the risk of damaging the second jacking gear by an excessive stress.

11. The tower crane device of the present disclosure further comprises the rotation drive mechanism, wherein the rotation drive mechanism comprises the rotation motor, the rotation gear and the gear plate, the rotation gear is in transmission connection with the rotation motor, one of the gear plate and the rotation gear is arranged on the machine platform, and the other is arranged on the tower column, and the gear ring of the gear plate is meshed with the rotation gear. In this arrangement, when the tower column needs to rotate, the rotation motor drives the rotation gear to rotate, and because the rotation gear is meshed with the gear ring of the gear plate, the rotation gear is driven to rotate along the gear ring, and then the tower column connected with the rotation gear or the gear plate is driven to rotate along the gear ring, thus adjusting the circumferential orientation of the device.

12. According to the tower crane device of the present disclosure, the rotation drive mechanism further comprises the rotation support, wherein the rotation support comprises the upper revolving frame, the lower revolving frame and the support rod, the upper revolving frame is sleeved on the periphery of the tower column, the tower column is connected with the upper revolving frame in a sliding or rolling way, the lower revolving frame is fixedly arranged on the machine platform and sleeved on the periphery of the gear plate, and the support rod is connected with both the upper revolving frame and the lower revolving frame. In this arrangement, the upper revolving frame provides sliding support to the tower column during rotation to improve sliding stability, the lower revolving frame connects and fixes the gear plate to enhance connection strength of the gear plate, the support rod connects the upper revolving frame and the lower revolving frame into a whole to enhance structural strength, and meanwhile, the rotation support is sleeved on the periphery of the tower column through the upper revolving frame and the lower revolving frame, which can enhance the reliability of the tower column during rotation, thus avoiding the tower column from falling off and tilting at the joint with the machine platform.

13. According to the tower crane device of the present disclosure, the rotation drive mechanism further comprises the rotation connection, the rotation connection is fixedly connected with the tower column, the rotation gear is rotatably arranged on the rotation connection, the first revolving bearing is also arranged on the rotation connection, and the first revolving bearing is matched with the surface of the gear plate in a rolling way. When the rotation gear rotates to drive the rotation connection to rotate, the first revolving bearing rolls along the surface of the gear plate, and then the first revolving bearing further

provides sliding support to the tower column during rotation, so that the rotation stability is improved, and meanwhile, the rolling matching between the first revolving bearing and the gear plate can reduce a friction force and rotation resistance.

14. According to the tower crane device of the present disclosure, the rotation drive mechanism further comprises the guiding connection, the guiding slot is arranged in the guiding connection, and the upper revolving frame is slidably clamped in the guiding slot. When the tower column rotates, the guiding connection is driven to rotate together, so as to make the upper revolving frame slide relatively in the guiding slot, so that the sliding matching between the guiding connection and the upper revolving frame further realizes rotating support to the tower column, and the guiding slot also plays a role in limiting, thus ensuring the accuracy of rotation path of the tower column.

15. According to the tower crane device of the present disclosure, the inner wall of the guiding slot is provided with the second revolving bearing, and the second revolving bearing is matched with the upper revolving frame in a rolling way. When the tower column rotates to drive the guiding connection to rotate, the second revolving bearing rolls along the surface of the upper revolving frame under the friction force, and then the second revolving bearing provides rolling support to the tower column during rotation, thus improving the rotation stability; and meanwhile, the rolling matching between the second revolving bearing and the upper revolving frame changes sliding friction between the guiding connection and the upper revolving frame into rolling friction, which can reduce the friction force and the rotation resistance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] In order to illustrate the technical solutions in the specific embodiments of the present disclosure or the prior art more clearly, the drawings which need to be used in describing the specific embodiments or the prior art will be briefly introduced hereinafter. Apparently, the drawings described hereinafter are only some embodiments of the present disclosure, and those of ordinary skills in the art may further obtain other drawings according to these drawings without going through any creative work.

FIG. 1 is a schematic diagram of an overall structure of a tower crane device according to an embodiment of the present disclosure;

FIG. 2 is a schematic structural diagram of matching between an arm frame hoisting apparatus and a tower column according to the embodiment of the present disclosure;

FIG. 3 is a schematic structural diagram of matching between a sleeving frame structure and the tower

column according to the embodiment of the present disclosure;

FIG. 4 is a front view of a jacket jacking device according to the embodiment of the present disclosure;

FIG. 5 is a schematic diagram of a stereoscopic structure of the jacket jacking device according to the embodiment of the present disclosure;

FIG. 6 is a schematic structural diagram of matching between a rotation drive mechanism and the tower column according to the embodiment of the present disclosure;

FIG. 7 is a schematic diagram of an enlarged structure of a part A in FIG. 6; and

FIG. 8 is a schematic diagram of an enlarged structure of a part B in FIG. 6.

[0035] Description of reference numerals:

1 - machine platform; 2 - tower column; 21 - positioning hole; 22 - tower section; 3 - tail frame structure; 31 - counterweight; 4 - sleeving frame structure; 5 - jib structure; 51 - hoisting hook; 52 - hook tractor; 6 - concrete pumping device; 61 - pump; 62 - vertical telescoping pump pipe; 63 - horizontally telescoping pump pipe; 64 - feed pipe; 641 - feeding hopper; 65 - telescoping ladder; 7 - lifting drive mechanism; 71 - lifting gear; 72 - lifting rack; 73 - synchronous gear axle; 8 - jacket jacking device; 81 - upper jacking platform; 811 - first jacking gear; 82 - lower jacking platform; 821 - second jacking gear; 83 - lifting space; 84 - tower section gantry crane; 85 - tower section rail; 86 - connecting ladder; 9 - rotation drive mechanism; 91 - rotation motor; 92 - rotation gear; 93 - gear plate; 931 - gear ring; 94 - rotation support; 941 - upper revolving frame; 942 - lower revolving frame; 943 - support rod; 95 - rotation connection; 951 - first revolving bearing; 96 - guiding connection; 961 - guiding slot; 962 - second revolving bearing; 97 - bottom section gantry crane; 10 - pump pipe auxiliary crane; 20 - operator cab; and 40 - external power supply.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0036] The technical solutions of the present disclosure are clearly and completely described hereinafter with reference to the drawings. Apparently, the described embodiments are merely some but not all of the embodiments of the present disclosure. Based on the embodiments of the present disclosure, all other embodiments obtained by those of ordinary skills in the art without going through any creative work should fall within the scope of protection of the present disclosure.

[0037] In the description of the present disclosure, it should be noted that if the orientation or position relationship indicated by the terms "center", "upper", "lower", "left", "right", "vertical", "horizontal", "inner", "outer", and the like is based on the orientation or position relationship shown in the drawings, it is only for the convenience of description of the present disclosure and simplification of

the description, and it is not to indicate or imply that the indicated device or element must have a specific orientation, and be constructed and operated in a specific orientation. Therefore, the terms should not be understood as limiting the present disclosure. Moreover, the terms "first", "second" and "third" are used for descriptive purposes only and cannot be understood as indicating or implying relative importance.

[0038] In the description of the present disclosure, it should be noted that the terms "mounting", "connected" and "connection" should be understood in a broad sense unless otherwise clearly specified and defined. For example, they may be fixed connection, removable connection or integrated connection; may be mechanical connection or electrical connection; and may be direct connection, or indirect connection through an intermediate medium, and connection inside two elements. The specific meanings of the above terms in the present disclosure may be understood in a specific case by those of ordinary skills in the art.

[0039] In addition, the technical features involved in different embodiments of the present disclosure described hereinafter may be combined with each other as long as they do not conflict with each other.

[0040] As shown in FIG. 1, the embodiment discloses a tower crane device, which comprises a machine platform 1, a tower column 2 and an arm frame hoisting apparatus, wherein the tower column 2 is rotatably connected to the machine platform 1 and the tower column 2 rotates around a center of the tower column relative to the machine platform 1, the arm frame hoisting apparatus comprises a tail frame structure 3, a sleeving frame structure 4 and a jib structure 5, the tail frame structure 3 and the jib structure 5 are both connected with the sleeving frame structure 4, the sleeving frame structure 4 is connected with the tower column 2, and the sleeving frame structure 4 ascends and descends in a height direction of the tower column 2.

[0041] According to the tower crane device of the embodiment, the machine platform 1 supports the whole tower column 2, and the tail frame structure 3, the sleeving frame structure 4 and the jib structure 5 which are connected to the tower column, so as to ensure the use stability of the device. When the sleeving frame structure 4 ascends and descends in the height direction of the tower column 2, the tail frame structure 3 and the jib structure 5 are driven to ascend and descend integrally, thus adjusting the operation height of the tower crane. When the tower column 2 rotates around the center of the tower column relative to the machine platform 1, the tail frame structure 3, the sleeving frame structure 4 and the jib structure 5 on the tower column 2 are driven to rotate together, thus adjusting the circumferential operation position of the tower crane, and improving the operation flexibility of the tower crane. Meanwhile, according to the embodiment, the circumferential orientation is adjusted through the rotation of the tower column 2 relative to the machine platform 1, and there is no relative rotation

between the jib structure 5 and the tower column 2. Compared with an existing method of driving the jib structure 5 to rotate through the rotary connection between the sleeving frame structure 4 and the tower column 2, the embodiment is more convenient for arranging the pump pipe along the tower column 2 and the jib structure 5 due to non-existence of relative rotation between the jib structure 5 and the tower column 2, and the pump pipe will not be deformed and blocked, broken or loosened due to rotation, and can meet the use requirements of material pumping.

[0042] The tower crane device is described in detail hereinafter with the drawing.

[0043] As shown in FIG. 1 and FIG. 6, in the embodiment, the machine platform 1 is a rectangular supporting frame platform, and an overall lateral occupied area of the machine platform is larger than that of the tower column 2, so as to improve the supporting stability to a bottom portion of the tower column 2.

[0044] In the embodiment, the tower column 2 is a truss or tower drum structure, the tower column 2 is a rectangular column, the tower column 2 comprises a plurality of tower sections 22, and the plurality of tower sections 22 are sequentially connected in the height direction to form the tower column 2, so that a modular design of the tower column 2 is convenient for production, transportation and assembly.

[0045] Illustratively, after butt joint between adjacent tower sections 22, a bolt, a screw and other fasteners may be used for connection and fixation, which is convenient for disassembly and assembly, and replacement, and the tower section 22 at the bottom may be rotatably connected with the machine platform 1 through a rotating shaft or a bearing.

[0046] It should be noted herein that, when the tower column 2 rotates relative to the machine platform 1, the jib structure 5 is driven to rotate synchronously, so that there is no relative rotation between the tower column 2 and the jib structure 5. Therefore, when a pouring operation is needed, the pump pipe may be arranged along the tower column 2 and the jib structure 5, and no torsion deformation will occur due to the relative rotation between the tower column and the jib structure, resulting in poor transportation.

[0047] As shown in FIG. 1 and FIG. 2, the tail frame structure 3 is used for mounting a counterweight 31 to balance a weight of the jib structure 5 during working, thus improving the operation stability of the whole device. Specifically, the counterweight 31 may be a concrete slab, and actually, a corresponding number of counterweights 31 may be provided according to a working weight of the jib structure 5. Further, the tail frame structure 3 and the sleeving frame structure 4 may be fixed by pin connection, screw connection or direct welding, a pulling rod may be further arranged between the tail frame structure 3 and the sleeving frame structure 4, and the pulling rod further supports the tail frame structure 3.

[0048] The sleeving frame structure 4, as a connecting section between the jib structure 5 and the tail frame structure 3, may be a box-shaped or ring-shaped structure or other suitable structural forms. In the embodiment, the sleeving frame structure 4 is matched with the tower column 2 in shape, and because the tower column 2 is the rectangular column, the sleeving frame structure 4 in the embodiment is a rectangular frame structure, an interior of the sleeving frame structure 4 is hollow, and the sleeving frame structure 4 is sleeved on a periphery of the tower column 2 through the hollow structure.

[0049] The jib structure 5 maybe a truss, a tower drum or other suitable structural forms, a hook tractor 52 is arranged on the jib structure 5, a hoisting hook 51 is arranged on the hook tractor 52, and the hook tractor 52 may drive the hoisting hook 51 to slide along the jib structure 5 for a hoisting operation. Specifically, slide rails are arranged on two sides of a bottom portion of the jib structure 5, and the hook tractor 52 is slidably arranged on the slide rails, so that the hoisting hook 51 may move along an arm frame to realize the hoisting operation.

[0050] The hoisting hook 51 may be provided with a winding mechanism, and the winding mechanism is used as a lifting rope driving mechanism of the hoisting hook 51 to realize the ascending and descending of the hoisting hook 51. Preferably, the winding mechanism is arranged on the tail frame structure 3, so that a weight of the winding mechanism may be used to balance a part of weight of the jib structure 5, thus reducing the counterweights 31 on the tail frame structure 3 and reducing a cost.

[0051] The tower crane device further comprises an operator cab 20, and the operator cab 20 is connected with the sleeving frame structure 4. The operator cab 20 is a control room, which is convenient for an operator to access a control device to operate, and the operator cab 20 can ascend and descend along with the ascending and descending of the sleeving frame structure 4, so as to operate at different heights.

[0052] As shown in FIG. 1, FIG. 2 and FIG. 6, preferably, the tower crane device of the embodiment further comprises a concrete pumping device 6, wherein the concrete pumping device 6 comprises a pump 61, a vertical telescoping pump pipe 62 and a horizontally telescoping pump pipe 63. The pump 61 is arranged on the tower column 2, the pump 61 is connected with the vertical telescoping pump pipe 62, the vertical telescoping pump pipe 62 is arranged in the height direction of the tower column 2, the horizontally telescoping pump pipe 63 is connected with the vertical telescoping pump pipe 62, and the horizontally telescoping pump pipe 63 is arranged in a length direction of the jib structure 5. In this arrangement, the pump 61 pumps concrete to the vertical telescoping pump pipe 62 at a high pressure, and pumps the concrete to the horizontally telescoping pump pipe 63 through the vertical telescoping pump pipe 62, thus realizing the high-altitude pouring operation. When the jib

structure 5 ascends and descends along the tower column 2, the vertical telescoping pump pipe 62 can be extended or retracted adaptively to change a length of the vertical telescoping pump pipe to adapt to the ascending and descending of the jib structure 5, while the horizontally telescoping pump pipe 63 can be extended or retracted to change a transverse length of the horizontally telescoping pump pipe to adjust a discharging position, so as to meet different pouring requirements. When the tower column 2 rotates relative to the machine platform 1, the pump 61, the horizontally telescoping pump pipe 63 and the vertical telescoping pump pipe 62 can be driven to rotate together, so that the horizontally telescoping pump pipe 63 and the vertical telescoping pump pipe 62 are always reliably connected, thus realizing the smooth transportation of the concrete.

[0053] Specifically, the pump 61 is fixedly connected to the tower section 22 at the bottom of the tower column 2, and the vertical telescoping pump pipe 62 and the horizontally telescoping pump pipe 63 are flexible pipes, and are specifically corrugated pipes for adaptive extension and retraction. In addition, the vertical telescoping pump pipe 62 is slidably connected with the tower column 2 through a vertical supporting frame, and the horizontally telescoping pump pipe 63 is slidably connected with the jib structure 5 through a transverse supporting frame, so that the vertical telescoping pump pipe 62 and the horizontally telescoping pump pipe 63 are slidably supported through the vertical supporting frame and the transverse supporting frame respectively, thus improving the sliding stability.

[0054] In addition, a vertical discharge pipe (not shown in the drawings) is connected to a tail end of the horizontally telescoping pump pipe 63, a discharge port of the vertical discharge pipe is downward, and the concrete is transported into the vertical discharge pipe from the horizontally telescoping pump pipe 63, and then output vertically downwards through the vertical discharge pipe to realize the pouring operation, so that the vertical discharge pipe can further change a material output direction, thus improving the accuracy of the pouring operation.

[0055] The concrete pumping device 6 further comprises a feed pipe 64 arranged on the tower column 2, wherein the feed pipe 64 is connected with the vertical telescoping pump pipe 62 through the pump 61, and a feeding hopper 641 is arranged on the feed pipe 64. The concrete subjected to qualified stirring is added into the feed pipe 64 through the feeding hopper 641, and then the concrete in the feed pipe 64 is pumped into the vertical telescoping pump pipe 62 by the pump 61, then pumped into the horizontally telescoping pump pipe 63, and finally output through the vertical discharge pipe, so as to realize the pouring operation of the concrete, and the feed pipe 64 may rotate with the tower column 2, so that the feed pipe 64 and the pump 61 are always reliably connected.

[0056] Specifically, the feeding hopper 641 is docked with an external transport vehicle, and after the concrete

is transported in place by the transport vehicle, the concrete is added into the feeding hopper 641 to realize the material pumping. The feed pipe 64 is arranged on the tower section 22 at the bottom, and the feeding hopper 641 is a conical hopper, wherein a small end of the conical hopper is connected with the feed pipe 64, and a big end of the conical hopper is used as a feed port, so as to increase a receiving area.

[0057] In the embodiment, a plurality of feed pipes 64 are provided and arranged at intervals in the circumferential direction of the tower column 2. The plurality of feed pipes 64 are arranged in the circumferential direction of the tower column 2, so that when the tower column 2 rotates to different orientations, a stirrer can also be conveniently fed by a corresponding feed pipe 64 in an original position, and the position of the stirrer does not need to be frequently adjusted along with the change of the orientation of the feed pipe 64, thus improving construction convenience and efficiency.

[0058] In addition, the embodiment further comprises a telescoping ladder 65, a bottom portion of the telescoping ladder 65 is connected with the tower column 2, and a top portion of the telescoping ladder 65 is connected with the jib structure 5. When the jib structure 5 ascends and descends along with the sleeving frame structure 4, the telescoping ladder 65 is driven to be extended and retracted adaptively to adjust a length of the telescoping ladder, so as to adapt to the jib structure 5 at different heights.

[0059] As shown in FIG. 1 and FIG. 3, it can be understood that, in order to realize the automatic ascending and descending of the sleeving frame structure 4 along the tower column 2, the embodiment further comprises a lifting drive mechanism 7, wherein the lifting drive mechanism 7 is in transmission connection with the sleeving frame structure 4 to drive the sleeving frame structure 4 to ascend and descend in the height direction of the tower column 2.

[0060] The lifting drive mechanism 7 comprises a lifting motor, a lifting gear 71 and a lifting rack 72, wherein the lifting motor is arranged on the sleeving frame structure 4, the lifting gear 71 is rotatably arranged on the sleeving frame structure 4, the lifting gear 71 is in transmission connection with the lifting motor, the lifting rack 72 is arranged on the tower column 2 in the height direction of the tower column 2, and the lifting gear 71 is meshed with the lifting rack 72. In this arrangement, when the sleeving frame structure 4 needs to ascend and descend, the lifting motor drives the lifting gear 71 to rotate, and because the lifting gear 71 is meshed with the lifting rack 72, the lifting gear 71 is driven to rotate along the lifting rack 72, so that the sleeving frame structure 4 is driven to ascend and descend in the height direction of the tower column 2, thus realizing the adjustment at different heights.

[0061] In the embodiment, the lifting motor is a forward-reverse motor, when the forward-reverse motor rotates clockwise, the sleeving frame structure 4 is driven to

ascend in the height direction of the tower column 2, and when the forward-reverse motor rotates counterclockwise, the sleeving frame structure 4 is driven to descend in the height direction of the tower column 2.

[0062] Four lifting racks 72 are arranged along four corners of the tower column 2, two lifting gears 71 are respectively arranged on two opposite sides of the sleeving frame structure 4, and two lifting gears 71 on the same side are connected through a synchronous gear axle 73, so that the two lifting gears 71 on the same side rotate synchronously. The arrangement of the lifting gears 71 on two sides of the sleeving frame structure 4 can improve the stability of ascending and descending of the sleeving frame structure 4, and plays a good role in balancing and supporting the two sides at the same time.

[0063] Further, the lifting drive mechanism 7 may further comprise a reduction gearbox, the reduction gearbox is connected with both the lifting motor and the lifting gear 71, and output kinetic energy of the lifting motor is decelerated to a suitable rotation speed through the reduction gearbox.

[0064] Then, the lifting gear 71 is driven to rotate at an appropriate speed to ensure the stability of ascending and descending of a sleeve frame apparatus.

[0065] In the embodiment, the tower crane device further comprises a lifting locking mechanism, and the lifting locking mechanism is suitable for locking the sleeving frame structure 4 and the tower column 2, so as to ensure that the sleeving frame structure 4 is reliably fixed after ascending and descending in place, enhance the stability of the sleeving frame structure 4 when in use, reduce the risk of relative movement between the sleeving frame structure 4 and the tower column 2 during use, and reduce a stress on the lifting gear 71 at the same time.

[0066] The lifting locking mechanism comprises a lifting locking cylinder, a lifting locking pin and a positioning hole 21. The lifting locking cylinder is arranged on the sleeving frame structure 4, the lifting locking pin is connected with the lifting locking cylinder, and a plurality of positioning holes 21 are arranged in the height direction of the tower column 2, wherein the lifting locking cylinder drives the lifting locking pin to be clamped in one of the positioning holes 21. In this arrangement, when the sleeving frame structure 4 ascends and descends in place along the tower column 2, the lifting locking cylinder drives the lifting locking pin to be clamped in one of the positioning holes 21, so that the sleeving frame structure 4 and the tower column 2 can be locked, and the lifting locking pin can further realize stress support to disperse a stress on the lifting gear 71, thus reducing the risk of damaging the lifting gear 71 due to an excessive stress.

[0067] Specifically, the lifting locking cylinder is a telescopic oil cylinder, and the lifting locking pin is in transmission connection with the telescopic oil cylinder, so that the lifting locking pin is driven by the telescopic oil cylinder to be extended to be inserted into the positioning hole 21 or retracted to be separated from the positioning hole 21,

thus locking or releasing the sleeving frame structure 4.

[0068] The positioning holes 21 are consecutively arranged in the height direction of the tower column 2, so that the sleeving frame structure 4 can be clamped in the corresponding positioning hole 21 by the lifting locking pin when ascending and descending to any position of the tower column 2 to realize the locking. In the embodiment, four columns of positioning holes 21 are arranged along four corners of the tower column 2, four lifting locking pins are arranged along four corners of the sleeving frame structure 4, and the four lifting locking pins are clamped in the corresponding four columns of positioning holes 21 to synchronously lock the four corners of the sleeving frame structure 4, so as to improve the locking reliability, realize stress support to the four corners of the sleeving frame structure 4, and effectively reduce stresses on the lifting gears 71 on two sides, thus improving the use stability.

[0069] As shown in FIG. 1, FIG. 4 and FIG. 5, the embodiment further comprises a jacket jacking device 8 sleeved on the tower column 2, wherein the jacket jacking device 8 is used for increasing or reducing the tower sections 22 to adjust the height of the tower column 2 or dismantle the tower column 2. The tower sections 22 are increased to increase the height of the tower column 2 through the jacket jacking device 8, or the tower sections 22 are reduced to reduce the height of the tower column 2 or dismantle the tower column 2 through the jacket jacking device 8, so as to meet the use requirements at different heights and facilitate disassembly and assembly.

[0070] In the embodiment, the jacket jacking device 8 comprises an upper jacking platform 81 and a lower jacking platform 82. The upper jacking platform 81 is sleeved on the periphery of the tower column 2, a first jacking gear 811 is arranged on the upper jacking platform 81, the first jacking gear 811 is meshed with the lifting rack 72, the lower jacking platform 82 is connected with the upper jacking platform 81, a lifting space 83 is formed between the lower jacking platform 82 and the upper jacking platform 81, a second jacking gear 821 is arranged on the lower jacking platform 82, the second jacking gear 821 is meshed with the lifting rack 72, and the first jacking gear 811 drives the tower section 22 matched with the first jacking gear to be far away from the lower jacking platform 82 and jacked up.

[0071] In the above arrangement, when the tower sections 22 need to be increased, a connection point of adjacent tower sections 22 in the lifting space 83 is loosened, the first jacking gear 811 drives the tower section 22 matched with the first jacking gear to be far away from the lower jacking platform 82 and jacked up, so that the adjacent tower sections 22 are separated up and down, and the new tower section 22 is placed in a separation space, and connected and fixed with the upper and lower adjacent tower sections 22 to increase the overall height of the tower column 2, thus meeting higher operation requirements; and when the tower sec-

tions 22 need to be reduced, the connection point of adjacent tower sections 22 in the lifting space 83 is loosened, the first jacking gear 811 drives the tower section 22 matched with the first jacking gear to be far away from the lower jacking platform 82 and jacked up, so that the adjacent tower sections 22 are separated up and down, the tower section 22 in the lifting space 83 is dismantled, and the first jacking gear 811 drives the tower section 22 matched with the first jacking gear to be close to the lower jacking platform 82 and move down, so as to be reconnected with the tower section 22 below to reduce the overall height of the tower column 2, thus meeting operation requirements of small height, and reducing a weight of the device and improving operation stability by reducing an arrangement number of the tower sections 22.

[0072] It can be understood that, in the embodiment, during the normal use of the device, the jacket jacking device 8 may ascend and descend in the height direction of the tower column 2 by the rotation of the first jacking gear 811 and the second jacking gear 821 along the lifting rack 72, so as to adjust a position of the jacket jacking device 8, thus avoiding the jacket jacking device 8 from affecting the ascending and descending of the sleeving frame structure 4, and meanwhile, the tower sections 22 can also be increased and reduced in different positions of the tower column 2 according to requirements.

[0073] Therefore, in the embodiment, the jacket jacking device 8 is driven by the matching of the first jacking gear 811 and the second jacking gear 821 with the lifting rack 72, which is namely an integrated matching scheme of the jacket jacking device 8 and the lifting drive mechanism 7. Compared with an existing method of driving the jacket jacking device 8 by separately arranging a driving oil cylinder, the embodiment can reduce the weight of the device and simplify the structure.

[0074] Specifically, the upper jacking platform 81 and the lower jacking platform 82 are both a rectangular platform, one end of the upper jacking platform 81 far away from the lower jacking platform 82 and one end of the lower jacking platform 82 far away from the upper jacking platform 81 are both provided with a jacking sleeve portion, the jacking sleeve portions are sleeved on the periphery of the tower column 2, and the first jacking gear 811 and the second jacking gear 821 are both rotatably arranged on the jacking sleeve portions.

[0075] Two first jacking gears 811 are arranged on two opposite sides of the jacking sleeve portion of the upper jacking platform 81, and two first jacking gears 811 on the same side are connected through a synchronous shaft, so that the two first jacking gears 811 on the same side rotate synchronously. The arrangement of the first jacking gears 811 on two sides of the jacking sleeve portion can improve the stability of ascending and descending of the upper jacking platform 81, and plays a good role in balancing and supporting the two sides.

[0076] Similarly, the arrangement of the second jacking gears 821 on two sides of the jacking sleeve portion of

the lower jacking platform 82 is the same as that of the first jacking gears 811, which will not be repeated in the embodiment.

[0077] The upper jacking platform 81 and the lower jacking platform 82 are connected and fixed by rectangular frame beams, one side of the lower jacking platform 82 is provided with an opening, and the opening is communicated with the lifting space 83, so as to facilitate the tower section 22 to enter and withdraw the lifting space 83 through the opening during hoisting.

[0078] In addition, a connecting ladder 86 is also arranged between the upper jacking platform 81 and the lower jacking platform 82, so as to facilitate personnel to operate between the upper jacking platform 81 and the lower jacking platform 82 through the connecting ladder 86.

[0079] Preferably, the jacket jacking device 8 further comprises an upper locking assembly, wherein the upper locking assembly comprises an upper locking cylinder and an upper locking pin. The upper locking cylinder is arranged on the upper jacking platform 81, the upper locking pin is connected with the upper locking cylinder, and the upper locking cylinder drives the upper locking pin to be clamped in one of the positioning holes 21. When the first jacking gear 811 drives the tower section 22 matched with the first jacking gear to be jacked in place, the upper locking cylinder drives the upper locking pin to be clamped in one of the positioning holes 21, so that the upper jacking platform 81 and an upper half part of the tower column 2 can be locked, thus avoiding relative sliding between the upper jacking platform and the tower column, and ensuring the safety of personnel working in the lifting space 83, and meanwhile, the upper locking pin can further disperse a stress on the first jacking gear 811, which reduces the risk of damaging the first jacking gear 811 by an excessive stress.

[0080] Accordingly, the jacket jacking device 8 further comprises a lower locking assembly, wherein the lower locking assembly comprises a lower locking cylinder and a lower locking pin. The lower locking cylinder is arranged on the lower jacking platform 82, the lower locking pin is connected with the lower locking cylinder, and the lower locking cylinder drives the lower locking pin to be clamped in one of the positioning holes 21. Before the movement of the first jacking gear 811, the lower locking cylinder drives the lower locking pin to be clamped in one of the positioning holes 21, so that the lower jacking platform 82 and a lower half part of the tower column 2 can be locked, thus avoiding relative sliding between the lower jacking platform and the tower column, and ensuring that the first jacking gear 811 drives the upper half part of the tower column 2 to be jacked up, and the lower locking pin can further disperse a stress on the second jacking gear 821, which reduces the risk of damaging the second jacking gear 821 by an excessive stress.

[0081] It can be understood that the upper locking assembly and the lower locking assembly can also lock the jacket jacking device 8 and the tower column 2

through the matching of the upper locking assembly and the lower locking assembly with the positioning holes 21 after the jacket jacking device 8 ascends and descends in place in the height direction of the tower column 2, so as to position the jacket jacking device 8 to a corresponding position of the tower column 2.

[0082] Specifically, the upper locking cylinder and the lower locking cylinder are both a linear oil cylinder, and the upper locking pin or the lower locking pin is driven by the linear oil cylinder to be extended to be clamped in the positioning hole 21 or retracted to be separated from the positioning hole 21, so as to lock or release the upper jacking platform 81 and the lower jacking platform 82.

[0083] Therefore, in the embodiment, the upper locking assembly and the lower locking assembly are positioned by using the positioning holes 21 in the tower column 2, that is, the upper locking assembly and the lower locking assembly are both integrated and matched with the lifting drive mechanism 7, so that the whole structure has good compactness and a small volume.

[0084] In the embodiment, the jacket jacking device 8 further comprises a tower section gantry crane 84, wherein the tower section gantry crane 84 is connected with the upper jacking platform 81 through a tower section rail 85. The tower section gantry crane 84 can move along the tower section rail 85, and the tower section gantry crane 84 can hoist the tower section 22 increased or dismantled, so as to facilitate mounting or dismantling the tower section 22.

[0085] It can be understood that, when the tower section gantry crane 84 and the jib structure 5 are located on the same side, the tower section 22 increased or dismantled may be hoisted in place by relay cooperation between the hoisting hook 51 on the jib structure 5 and the tower section gantry crane 84; and when the tower section gantry crane 84 and the jib structure 5 are located on different sides, the tower section gantry crane 84 independently hoists the tower section 22 increased or the tower section 22 dismantled in place.

[0086] As shown in FIG. 1, FIG. 6, FIG. 7 and FIG. 8, in order to realize the automatic rotation of the tower column 2 relative to the machine platform 1, the embodiment further comprises a rotation drive mechanism 9, wherein the rotation drive mechanism 9 is in transmission connection with the tower column 2 to drive the tower column 2 to rotate.

[0087] Illustratively, the rotation drive mechanism 9 comprises a rotation motor 91, a rotation gear 92 and a gear plate 93. The rotation gear 92 is in transmission connection with the rotation motor 91, one of the gear plate 93 and the rotation gear 92 is arranged on the machine platform 1, and the other is arranged on the tower column 2, and the gear ring 931 of the gear plate 93 is meshed with the rotation gear 92.

[0088] In this arrangement, when the tower column 2 needs to rotate, the rotation motor 91 drives the rotation gear 92 to rotate, and because the rotation gear 92 is meshed with the gear ring 931 of the gear plate 93, the

rotation gear 92 is driven to rotate along the gear ring 931, and then the tower column 2 connected with the rotation gear 92 or the gear plate 93 is driven to rotate along the gear ring 931, thus adjusting the circumferential orientation of the device.

[0089] In the embodiment, the rotation gear 92 is rotatably arranged on the tower column 2, the gear plate 93 is fixedly arranged on the machine platform 1, and the gear ring 931 is arranged along an inner ring of the gear plate 93.

[0090] The rotation motor 91 is set as a forward-reverse motor, when the rotation motor 91 rotates forwards, the tower column 2 and the jib structure 5 are driven to rotate clockwise together, so as to adjust the orientation clockwise, and when the rotation motor 91 rotates reversely, the tower column 2 and the jib structure 5 are driven to rotate counterclockwise together, so as to adjust the orientation counterclockwise,

[0091] The rotation gear 92 is rotatably connected to the tower section 22 at the bottom of the tower column 2, and an axis of the rotation gear 92 is perpendicular to the gear plate 93, so that tooth marks of the rotation gear 92 are meshed with the gear ring 931.

[0092] The gear plate 93 is annular, and a surface of the inner ring of the gear plate 93 is integrally provided with the gear ring 931.

[0093] Further, the rotation drive mechanism 9 further comprises a rotation support 94, wherein the rotation support 94 comprises an upper revolving frame 941, a lower revolving frame 942 and a support rod 943. The upper revolving frame 941 is sleeved on the periphery of the tower column 2, the tower column 2 is slidably connected with the upper revolving frame 941, the lower revolving frame 942 is fixedly arranged on the machine platform 1 and sleeved on a periphery of the gear plate 93, and the support rod 943 is connected with both the upper revolving frame 941 and the lower revolving frame 942. In this arrangement, the upper revolving frame 941 provides sliding support to the tower column 2 during rotation to improve sliding stability, the lower revolving frame 942 connects and fixes the gear plate 93 to enhance connection strength of the gear plate 93, the support rod 943 connects the upper revolving frame 941 and the lower revolving frame 942 into a whole to enhance structural strength, and meanwhile, the rotation support 94 is sleeved on the periphery of the tower column 2 through the upper revolving frame 941 and the lower revolving frame 942, which can enhance the reliability of the tower column 2 during rotation, thus avoiding the tower column 2 from falling off and tilting at the joint with the machine platform 1.

[0094] The upper revolving frame 941 and the lower revolving frame 942 are both an annular frame, and an annular size of the lower revolving frame 942 is larger than that of the upper revolving frame 941, so that the upper revolving frame 941 and the lower revolving frame 942 are matched to form a conical support structure with a small top and a large bottom, thus improving the sup-

port stability.

[0095] A plurality of support rods 943 are arranged at intervals in a circumferential direction of the upper revolving frame 941 and the lower revolving frame 942 to enhance connection strength between the upper revolving frame 941 and the lower revolving frame 942.

[0096] In the embodiment, the rotation drive mechanism 9 further comprises a rotation connection 95, the rotation connection 95 is fixedly connected with the tower column 2, and the rotation gear 92 is rotatably arranged on the rotation connection 95. When the rotation gear 92 rotates, the rotation connection 95 is driven to rotate, and then the tower column 2 is driven to rotate together.

[0097] A first revolving bearing 951 is also arranged on the rotation connection 95, and the first revolving bearing 951 is matched with a surface of the gear plate 93 in a rolling way. When the rotation gear 92 rotates to drive the rotation connection 95 to rotate, the first revolving bearing 951 rolls along the surface of the gear plate 93, and then the first revolving bearing 951 further provides sliding support to the tower column 2 during rotation, so that the rotation stability is improved, and meanwhile, the rolling matching between the first revolving bearing 951 and the gear plate 93 can reduce a friction force and rotation resistance.

[0098] Specifically, the rotation connection 95 is a connecting block, the connecting block extends above the gear plate 93, the rotation gear 92 and the first revolving bearing 951 are both rotatably connected below the connecting block through a rotating shaft, the rotation gear 92 is located on an inner side of the gear plate 93 to be meshed with the gear ring 931 of the inner ring, and the first revolving bearing 951 is located on an upper surface of the gear plate 93.

[0099] As far as an arrangement number, in the embodiment, each rotation connection 95 is correspondingly provided with one rotation gear 92 and two first revolving bearings 951, a plurality of rotation connections 95 are arranged in the circumferential direction of the tower column 2, so as to drive the tower column 2 to rotate through the synchronous rotation of the plurality of first revolving bearings 951, so as to improve rotation efficiency, and meanwhile, the plurality of rotation connections 95 can also support the tower column 2 at multiple points in the circumferential direction, so that the stress is more balanced.

[0100] In addition, the rotation drive mechanism 9 further comprises a guiding connection 96, a guiding slot 961 is arranged in the guiding connection 96, and the upper revolving frame 941 is slidably clamped in the guiding slot 961. When the tower column 2 rotates, the guiding connection 96 is driven to rotate together, so as to make the upper revolving frame 941 slide relatively in the guiding slot 961, so that the sliding matching between the guiding connection 96 and the upper revolving frame 941 further realizes rotating support to the tower column 2, and the guiding slot 961 also plays a role in limiting, thus ensuring the accuracy of rotation path of the tower col-

umn 2.

[0101] An inner wall of the guiding slot 961 is provided with a second revolving bearing 962, and the second revolving bearing 962 is matched with the upper revolving frame 941 in a rolling way. When the tower column 2 rotates to drive the guiding connection 96 to rotate, the second revolving bearing 962 rolls along the surface of the upper revolving frame 941 under the friction force, and then the second revolving bearing 962 provides rolling support to the tower column 2 during rotation, thus improving the rotation stability; and meanwhile, the rolling matching between the second revolving bearing 962 and the upper revolving frame 941 changes sliding friction between the guiding connection 96 and the upper revolving frame 941 into rolling friction, which can reduce the friction force and the rotation resistance.

[0102] As far as specific arrangement, the guiding connection 96 may be set as a strip block, the guiding slot 961 is a U-shaped groove, the U-shaped groove is arranged at one end of the strip block oriented to the upper revolving frame 941, the upper revolving frame 941 is clamped inside the U-shaped groove, and the second revolving bearing 962 is arranged on at least one side wall of the U-shaped groove, so that sliding contact between the inner wall of the U-shaped groove and the upper revolving frame 941 may be changed into rolling contact, thus greatly reducing friction resistance.

[0103] As far as an arrangement number, two second revolving bearings 962 are arranged in each guiding slot 961, and a plurality of guiding connections 96 are arranged at intervals in the circumferential direction of the tower column 2 to support and limit various parts of the tower column 2.

[0104] As far as a specific structure, the first revolving bearing 951 and the second revolving bearing 962 may be universal balls or rollers.

[0105] Further, the rotation drive mechanism 9 may further comprise a reducer, the reducer is connected with both the rotation motor 91 and the rotation gear 92, output kinetic energy of the rotation motor 91 is decelerated to a suitable rotation speed through the reducer, and then the rotation gear 92 is driven to rotate at the suitable rotation speed, thus ensuring the rotation stability of the tower column 2.

[0106] Therefore, the slewing of the tower column 2 means that the tower column 2 rotates together with the jib structure 5, the sleeving frame structure 4, the tail frame structure 3, the lifting drive mechanism 7, the jacket jacking device 8, the vertical telescoping pump pipe 62, the horizontally telescoping pump pipe 63, the telescoping ladder 65 and other structures attached to the tower column, but the rotation support 94 and the machine platform 1 do not participate in the rotation.

[0107] Optionally, the tower crane device further comprises a bottom section gantry crane 97, wherein the bottom section gantry crane 97 is connected with the upper revolving frame 941 through a bottom overhead rail. The bottom section gantry crane 97 can slide along

the bottom overhead rail to facilitate the transportation and maintenance of the pump 61 or its accessories.

[0108] It can be understood that, when the bottom section gantry crane 97 and the tower section gantry crane 84 are located on the same side, the bottom section gantry crane 97 can be optimized and omitted, and an action and a function of the bottom section gantry crane 97 can be realized only by using the tower section gantry crane 84.

[0109] The embodiment further comprises a pump pipe auxiliary crane 10, wherein the pump pipe auxiliary crane 10 is arranged on the jib structure 5. The pump pipe auxiliary crane 10 is mainly used for mounting, adjusting and maintaining the vertical telescopic pump tube 62 and the transverse telescopic pump tube 63, and maintenance works required by other structures in corresponding positions, and the pump pipe auxiliary crane 10 is arranged on the jib structure 5, and may ascend and descend along with the jib structure 5 to meet mounting at different heights.

[0110] An external track is also arranged below the machine platform 1, and the external track is convenient for the machine platform 1 to travel along the external track through a traveling apparatus, so as to realize position adjustment of the whole tower crane device. At least two external tracks are arranged in parallel to improve the traveling stability of the machine platform 1.

[0111] In addition, an external power supply 40 is also arranged below the machine platform 1, and the external power supply 40 may supply power to an electrical device on the tower crane device when powered on, so as to meet normal use requirements. Specifically, the external power supply 40 may be a plug or a socket.

[0112] A lightning rod is also arranged on a top portion of the tower column 2 to reduce lightning strikes on the tower crane device, so as to improve the overall safety.

[0113] Further, in the embodiment, an in-situ electric control box may be arranged in the tower section 22 at the bottom of the tower column 2 for in-situ control of the tower crane, the pump 61 and the auxiliary mechanisms in another way. A power supply frequency conversion and control apparatus, a signal receiving and transmitting apparatus, a program signal control apparatus, and the like are arranged in the in-situ control box.

[0114] The embodiment is further provided with a storage battery, wherein the storage battery is used as an emergency standby power supply, and can supply power to the electrical device in the device after the external power supply 40 is powered off, so as to ensure the normal operation of the device in case of external power-off.

[0115] A central collector ring is also arranged on the machine platform 1, and the central collector ring is used for making a cable for external power supply penetrate through rotating parts to supply power to the rotating tower column 2 and corresponding electrical mechanisms.

[0116] In addition, the embodiment is further provided

with a remote control apparatus, wherein the remote control apparatus is in signal connection with both the rotation drive mechanism 9 and the lifting drive mechanism 7 to wirelessly control the rotation drive mechanism 9 and the lifting drive mechanism 7 to act and wirelessly control the rotation of the tower column 2 and the ascending and descending of the sleeving frame structure 4; and a long-range control apparatus used for long-range control in a wireless or wired mode, wherein hardware configuration of the long-range control apparatus comprises a power supply frequency conversion and control apparatus, a signal receiving and transmitting apparatus, a program signal control apparatus, an on-site video monitoring apparatus, and the like for assisting long-range control of the device.

[0117] In order to facilitate understanding the tower crane device of the embodiment, mounting and use situations of the tower crane device will be described as follows with reference to FIG. 1 to FIG. 8.

[0118] During mounting, the tower sections 22 are hoisted and mounted part by part from bottom to top, only the most basic number of tower sections 22 capable of meeting the mounting of the jacket jacking device 8 are mounted during initial mounting, and the jacket jacking device 8 is mounted around the periphery of the tower section 22 after the tower section 22 is mounted. It is also necessary to synchronously mount the pump 61, the in-situ control box and the storage battery arranged in the tower section 22 at the bottom of the tower column 2. In order to avoid subsequent devices from being damaged by falling objects during mounting, the pump 61, the in-situ control box, the storage battery, and other apparatuses may be mounted in a filling way after the jacket jacking device 8 is mounted, a detachable cross bracing on the tower section 22 is reassembled after mounting, and the jib structure 5, the sleeving frame structure 4 and the tail frame structure 3 may be hoisted and connected into a whole on the tower section 22 in a lower position of the tower column 2 (that is, only a partial number of tower sections 22 are mounted to make the height of the tower column 2 low).

[0119] After all tower sections 22 in lower positions are mounted and debugged as a whole, the tower section 22 is added by using the jacket jacking device 8 until the tower column 2 reaches a suitable use height.

[0120] Working conditions of hoisting: when the tower column 2 needs to slew, the rotation motor 91 drives the rotation gear 92 to rotate, and then the tower column 2 (all tower sections 22), and the sleeving frame structure 4, the jib structure 5, the tail frame structure 3, and other apparatuses on the tower column are driven to rotate under the support and constraint of the rotation support 94, the first revolving bearing 951 and the second revolving bearing 962, so as to adjust the circumferential position.

[0121] Working conditions of pumping and pouring: the pump 61 is started up, the pump 61 pumps the concrete from the feed pipe 64 into the vertical telescoping pump

pipe 62, and then the concrete is transported to the horizontally telescoping pump pipe 63 from the vertical telescoping pump pipe 62, and finally output from the vertical discharge pipe, so as to realize concrete transportation and pouring. When a difference between a pipe orifice height of the vertical discharge pipe and a height of a pouring and blanking part is too large, it is easy to cause the quality problem of the concrete, so that it is necessary to adjust a height of the jib structure 5 according to different pouring heights during pouring, so as to adjust the pouring height of the vertical discharge pipe, and in combination with the slewing of the jib structure 5, all-round continuous pouring and feeding can be realized on the premise of ensuring the pouring quality of the concrete.

[0122] Jacking up of tower section 22 during operation: with the continuous lifting of the pouring part, the tower sections 22 of the tower column 2 must be increased to increase the overall height of the tower column to adapt to the continuous lifting of the pouring part, thus avoiding the vertical discharge pipe from interfering and colliding with the pouring part due to insufficient height.

[0123] Specifically, when the jacket jacking device 8 starts to jack up, the lower locking cylinder drives the lower locking pin to be clamped in the positioning hole 21 in the tower column 2 to lock the lower jacking platform 82, the upper locking cylinder drives the upper locking pin to be retracted from the positioning hole 21 to unlock the upper jacking platform 81, the connection point of adjacent tower sections 22 in the lifting space 83 is loosened, the first jacking gear 811 is driven to rotate, and then a corresponding upper half part of tower sections 22, and the jib structure 5, the tail frame structure 3, the sleeving frame structure 4, and other apparatuses on the upper half part of tower sections are driven to be jacked up together (to move away from the lower jacking platform 82). After an empty position of one tower section 22 is jacked up, the new tower section 22 is sent to the empty position jacked up in the lifting space 83 by the matching of the tower section gantry crane 84 with the hoisting hook 51 on the jib structure 5, and connected and fixed with a lower half part of tower sections 22 after adjustment, and so on, until the tower column 2 is increased to the suitable operation height.

[0124] When the tower sections 22 of the tower column 2 need to be reduced or the device needs to be dismantled, the lower locking cylinder drives the lower locking pin to be clamped in the positioning hole 21 in the tower column 2 to lock the lower jacking platform 82, the upper locking cylinder drives the upper locking pin to be retracted from the positioning hole 21 to unlock the upper jacking platform 81, connection points between upper and lower connection surfaces of the tower section 22 in the lifting space 83 and other tower sections 22 are loosened, the first jacking gear 811 is driven to rotate, and then the corresponding upper half part of tower sections 22, and the jib structure 5, the tail frame structure 3, the sleeving frame structure 4, and other apparatuses

on the upper half part of tower sections are driven to be jacked up together (to move away from the lower jacking platform 82). After an empty position capable of dismantling one tower section 22 is jacked up, the tower section 22 with the upper and lower connection surfaces loosened is dismantled, then the dismantled tower section 22 is hoisted away by the matching of the tower section gantry crane 84 with the hoisting hook 51 on the jib structure 5, and so on, until the tower column 2 is adjusted to the suitable height or the tower column 2 is dismantled.

[0125] To sum up, the advantages of the embodiment are that: existing hoisting and concrete pouring are two major working procedures of engineering construction, and generally completed by different devices, the two functions are effectively combined in a very clever way in the present disclosure, which can not only realize the hoisting and carrying operations, but also carry out the concrete pouring operation, so as to achieve multiple purposes in one machine, and form a multi-purpose tower crane device integrating hoisting, carrying and pouring operations, thus having very strong universality.

[0126] It can be understood that the tower crane device of the embodiment may be widely used in various construction fields, such as buildings, and water and electricity, has a very wide range of applications, and has very strong applicability and rich application scenarios.

[0127] The embodiment further provides a mounting method of the tower crane device, which comprises the following steps of rotatably connecting the tower column 2 to the machine platform 1; slidably connecting the sleeving frame structure 4 to the tower column 2; and respectively hoisting the tail frame structure 3 and the jib structure 5 to two sides of the sleeving frame structure 4 to be connected and fixed. The mounting method of the tower crane device of the embodiment has the same technical effect as the tower crane device of the embodiment, which will not be repeated herein.

[0128] Optionally, the rotatably connecting the tower column 2 to the machine platform 1, comprises: hoisting and mounting the plurality of tower sections 22 part by part from bottom to top, mounting the tower section 22 at the bottom and the tower section 22 to be jacked first, mounting the jacket jacking device 8 on an outer side of the tower section 22 to be jacked after mounting, synchronously mounting the pump 61, the in-situ control box, the storage battery, and related apparatuses into the tower section 22 at the bottom, and mounting the tower sections 22 upwardly step by step by using the jacket jacking device 8 to make the tower column 2 reach a use height. The plurality of tower sections 22 are hoisted and mounted part by part from bottom to top, and the tower sections 22 are mounted upwardly step by step by using the jacket jacking device 8 to make the tower column 2 reach the use height, so that the mounting is labor-saving and efficient.

[0129] In addition, the pump 61, the in-situ control box, the storage battery, and other apparatuses may also be mounted in a filling way after the tower section 22 is

mounted, and the detachable cross bracing on the tower section 22 is reassembled after mounting. The jib structure 5, the sleeving frame structure 4 and the tail frame structure 3 are preferably hoisted and connected into a whole on the tower section 22 at a lower part.

[0130] The embodiment further provides a control method of the tower crane device, which comprises the following steps of: allowing the tower column 2 to rotate relative to the machine platform 1 to drive the sleeving frame structure 4 to rotate synchronously, thus driving both the tail frame structure 3 and the jib structure 5 to rotate, so as to realize the operation of the tower crane device in different orientations along a circumferential direction; and allowing the sleeving frame structure 4 to ascend and descend in the height direction of the tower column 2 to drive both the tail frame structure 3 and the jib structure 5 to ascend and descend in the height direction of the tower column 2, so as to realize the operation of the tower crane device at different heights.

[0131] The control method of the tower crane device of the embodiment has the same technical effect as the tower crane device of the embodiment, which will not be repeated herein.

[0132] The control method further comprises: using the jacket jacking device 8 for increasing a number of the tower sections 22 to increase an operation height of the tower column 2; and using the jacket jacking device 8 for increasing a number of the tower sections 22 according to an operation height requirement of the tower column 2 to increase an operation height of the tower column 2, thus meeting an operation requirement of a higher distance.

[0133] Optionally, the using the jacket jacking device 8 for increasing the number of the tower sections 22 to increase the operation height of the tower column 2, comprises: when an entry orientation of a new tower section 22 is the same as an orientation of the jib structure 5, allowing the arm frame hoisting apparatus to descend to a lowest position first, separating a top portion of the vertical telescoping pump pipe 62 from the jib structure 5 to be placed at the bottom, allowing a telescoping ladder 65 to fall to the lowest position accordingly, and then hoisting the new tower section 22 to the tower section 22 at the top for splicing; and when the entry orientation of the new tower section 22 is different from the orientation of the jib structure 5, directly hoisting the new tower section 22 to the tower section 22 at the top for splicing.

[0134] Specifically, in the process of separating the top portion of the vertical telescoping pump pipe 62 from the jib structure 5, a top hoisting point of the vertical telescoping pump pipe 62 may be hoisted by the pump pipe auxiliary crane 10 to slowly place the vertical telescoping pump pipe on the bottom, and after the vertical telescoping pump pipe 62 falls in place, the telescoping ladder 65 may fall to the lowest position through hoisting by the pump pipe auxiliary crane 10, which aims to avoid the vertical telescoping pump pipe 62 and the telescoping ladder 65 from affecting the arrival of the newly mounted tower section 22.

[0135] Certainly, the above descriptions are all the optimal technical solutions of the embodiment. In addition:

[0136] in some embodiments, the gear plate 93 may also be fixedly arranged on the upper revolving frame 941, and the rotation gear 92 is meshed with the gear ring 931 on the gear plate 93 on the upper revolving frame 941, while the lower revolving frame 942 is slidably connected with the tower column 2, so that the tower column 2 may also be rotatably driven.

[0137] In some embodiments, the winding mechanism may also be arranged on the jib structure 5 or the sleeving frame structure 4 according to requirements, and can also realize a lifting function of the hoisting hook 51.

[0138] In some embodiments, the operator cab 20 may also be arranged on the jib structure 5 or the tail frame structure 3 according to requirements, and can also realize the same function as the embodiment.

[0139] Obviously, the above embodiments are only examples for clearly illustrating the present disclosure, but are not intended to limit the implementations of the present disclosure. For those of ordinary skills in the art, other different forms of changes or variations may be made on the basis of the above description. It is not necessary or possible to exhaust all the implementations herein. Moreover, the obvious changes or variations derived from this are still included in the scope of protection of the present disclosure.

Claims

1. A tower crane device, **characterized in that**, comprising:

a machine platform (1);
a tower column (2) rotatably connected to the machine platform (1), wherein the tower column (2) rotates around a center of the tower column relative to the machine platform (1); and
an arm frame hoisting apparatus comprising a tail frame structure (3), a sleeving frame structure (4) and an jib structure (5), wherein the tail frame structure (3) and the jib structure (5) are both connected with the sleeving frame structure (4), the sleeving frame structure (4) is connected with the tower column (2), and the sleeving frame structure (4) ascends and descends in a height direction of the tower column (2).

2. The tower crane device according to claim 1, **characterized in that**, further comprising a concrete pumping device (6), wherein the concrete pumping device (6) comprises:

a pump (61) arranged on the tower column (2);
a vertical telescoping pump pipe (62) arranged in the height direction of the tower column (2),

- wherein the vertical telescoping pump pipe (62) is connected with the pump (61); and a horizontally telescoping pump pipe (63) connected with the vertical telescoping pump pipe (62), wherein the horizontally telescoping pump pipe (63) is arranged in a length direction of the jib structure (5); and/or the concrete pumping device (6) further comprises a feed pipe (64) arranged on the tower column (2), wherein the feed pipe (64) is connected with the vertical telescoping pump pipe (62) through the pump (61), a feeding hopper (641) is arranged on the feed pipe (64), and the feed pipes (64) are arranged at intervals in a circumferential direction of the tower column (2).
3. The tower crane device according to any one of claims 1 to 2, **characterized in that**, further comprising a lifting drive mechanism (7), wherein the lifting drive mechanism (7) is in transmission connection with the sleeving frame structure (4) to drive the sleeving frame structure (4) to ascend and descend in the height direction of the tower column (2).
4. The tower crane device according to claim 3, **characterized in that**, the lifting drive mechanism (7) comprises:
- a lifting motor arranged on the sleeving frame structure (4);
 - a lifting gear (71) rotatably arranged on the sleeving frame structure (4), wherein the lifting gear (71) is in transmission connection with the lifting motor;
 - a lifting rack (72) arranged on the tower column (2) in the height direction of the tower column (2), wherein the lifting gear (71) is meshed with the lifting rack (72); and
 - a lifting locking mechanism, wherein the lifting locking mechanism is used for locking the sleeving frame structure (4) and the tower column (2).
5. The tower crane device according to claim 4, **characterized in that**, the lifting locking mechanism comprises:
- a lifting locking cylinder arranged on the sleeving frame structure (4);
 - a lifting locking pin connected with the lifting locking cylinder; and
 - a plurality of positioning holes (21) arranged in the height direction of the tower column (2), wherein the lifting locking cylinder drives the lifting locking pin to be clamped in one of the positioning holes (21).
6. The tower crane device according to claim 5, **characterized in that**, the tower column (2) comprises a

plurality of tower sections (22), and the plurality of tower sections (22) are sequentially connected in the height direction to form the tower column (2).

7. The tower crane device according to claim 6, **characterized in that**, further comprising a jacket jacking device (8) sleeved on the tower column (2), wherein the jacket jacking device (8) is used for increasing or reducing the tower sections (22) to adjust a height of the tower column (2).
8. The tower crane device according to claim 7, **characterized in that**, the jacket jacking device (8) comprises:

an upper jacking platform (81) sleeved on a periphery of the tower column (2), wherein a first jacking gear (811) is arranged on the upper jacking platform (81), and the first jacking gear (811) is meshed with the lifting rack (72); and a lower jacking platform (82) connected with the upper jacking platform (81), wherein a lifting space (83) is formed between the lower jacking platform (82) and the upper jacking platform (81), a second jacking gear (821) is arranged on the lower jacking platform (82), the second jacking gear (821) is meshed with the lifting rack (72), and the first jacking gear (811) drives the tower section (22) matched with the first jacking gear to be far away from the lower jacking platform (82) and jacked up; and/or the jacket jacking device (8) further comprises an upper locking assembly, wherein the upper locking assembly comprises:

an upper locking cylinder arranged on the upper jacking platform (81); and an upper locking pin connected with the upper locking cylinder, wherein the upper locking cylinder drives the upper locking pin to be clamped in one of the positioning holes (21); and/or the jacket jacking device (8) further comprises a lower locking assembly, wherein the lower locking assembly comprises:

a lower locking cylinder arranged on the lower jacking platform (82); and a lower locking pin connected with the lower locking cylinder, wherein the lower locking cylinder drives the lower locking pin to be clamped in one of the positioning holes (21); and/or the jacket jacking device (8) further comprises a tower section gantry crane (84), wherein the tower section gantry crane (84) is connected with the upper jacking platform (81) through a tower

section rail (85).

9. The tower crane device according to any one of claims 1 to 2, **characterized in that**, further comprising a rotation drive mechanism (9), wherein the rotation drive mechanism (9) is in transmission connection with the tower column (2) to drive the tower column (2) to rotate.

10. The tower crane device according to claim 9, **characterized in that**, the rotation drive mechanism (9) comprises:

a rotation motor (91);
a rotation gear (92) in transmission connection with the rotation motor (91); and
a gear plate (93), wherein one of the gear plate (93) and the rotation gear (92) is arranged on the machine platform (1), and the other is arranged on the tower column (2), and a gear ring (931) of the gear plate (93) is meshed with the rotation gear (92).

11. The tower crane device according to claim 10, **characterized in that**, the rotation drive mechanism (9) further comprises a rotation support (94), and the rotation support (94) comprises:

an upper revolving frame (941) sleeved on the periphery of the tower column (2), wherein the tower column (2) is connected with the upper revolving frame (941) in a sliding or rolling way;
a lower revolving frame (942) fixedly arranged on the machine platform (1) and sleeved on a periphery of the gear plate (93); and
a support rod (943) connected with both the upper revolving frame (941) and the lower revolving frame (942); and/or
the rotation drive mechanism (9) further comprises a rotation connection (95), the rotation connection (95) is fixedly connected with the tower column (2), the rotation gear (92) is rotatably arranged on the rotation connection (95), a first revolving bearing (951) is also arranged on the rotation connection (95), and the first revolving bearing (951) is matched with a surface of the gear plate (93) in a rolling way.

12. The tower crane device according to claim 11, **characterized in that**, the rotation drive mechanism (9) further comprises a guiding connection (96), a guiding slot (961) is arranged in the guiding connection (96), the upper revolving frame (941) is slidably clamped in the guiding slot (961), an inner wall of the guiding slot (961) is provided with a second revolving bearing (962), and the second revolving bearing (962) is matched with the upper revolving frame (941) in a rolling way; and/or

the rotation drive mechanism (9) further comprises a bottom section gantry crane (97), and the bottom section gantry crane (97) is connected with the upper revolving frame (941) through a bottom overhead rail.

13. The tower crane device according to any one of claims 1 to 2, **characterized in that**, further comprising a pump pipe auxiliary crane (10), wherein the pump pipe auxiliary crane (10) is arranged on the jib structure (5).

14. A mounting method of the tower crane device according to any one of claims 1 to 13, **characterized in that**, comprising the following steps of:

rotatably connecting the tower column (2) to the machine platform (1);
slidably connecting the sleeving frame structure (4) to the tower column (2); and
respectively hoisting the tail frame structure (3) and the jib structure (5) to two sides of the sleeving frame structure (4) to be connected and fixed; wherein,
the tower column (2) rotates relative to the machine platform (1) to drive the sleeving frame structure (4) to rotate synchronously, thus driving both the tail frame structure (3) and the jib structure (5) to rotate to realize the operation of the tower crane device in different orientations along a circumferential direction; and
the sleeving frame structure (4) ascends and descends in the height direction of the tower column (2) to drive both the tail frame structure (3) and the jib structure (5) to ascend and descend in the height direction of the tower column (2) to realize the operation of the tower crane device at different heights.

15. The mounting method according to claim 14, **characterized in that**, the rotatably connecting the tower column (2) to the machine platform (1), comprises: hoisting and mounting the plurality of tower sections (22) part by part from bottom to top, mounting the tower section (22) at the bottom and the tower section (22) to be jacked first, mounting the jacket jacking device (8) on an outer side of the tower section (22) to be jacked after mounting, and synchronously mounting the pump (61), an in-situ control box and a storage battery into the tower section (22) at the bottom, wherein the jacket jacking device (8) is used for increasing a number of the tower sections (22) to increase an operation height of the tower column (2); and
mounting the tower sections (22) upwardly step by step by using the jacket jacking device (8) to make the tower column (2) reach a use height, wherein, when an entry orientation of a new tower section (22)

is the same as an orientation of the jib structure (5),
the arm frame hoisting apparatus descends to a
lowest position first, a top portion of the vertical
telescoping pump pipe (62) is separated from the
jib structure (5) to be placed at the bottom, a tele- 5
scoping ladder (65) falls to the lowest position ac-
cordingly, and then the new tower section (22) is
hoisted to the tower section (22) at the top for spli-
cing; and when the entry orientation of the new tower
section (22) is different from the orientation of the jib 10
structure (5), the new tower section (22) is directly
hoisted to the tower section (22) at the top for spli-
cing.

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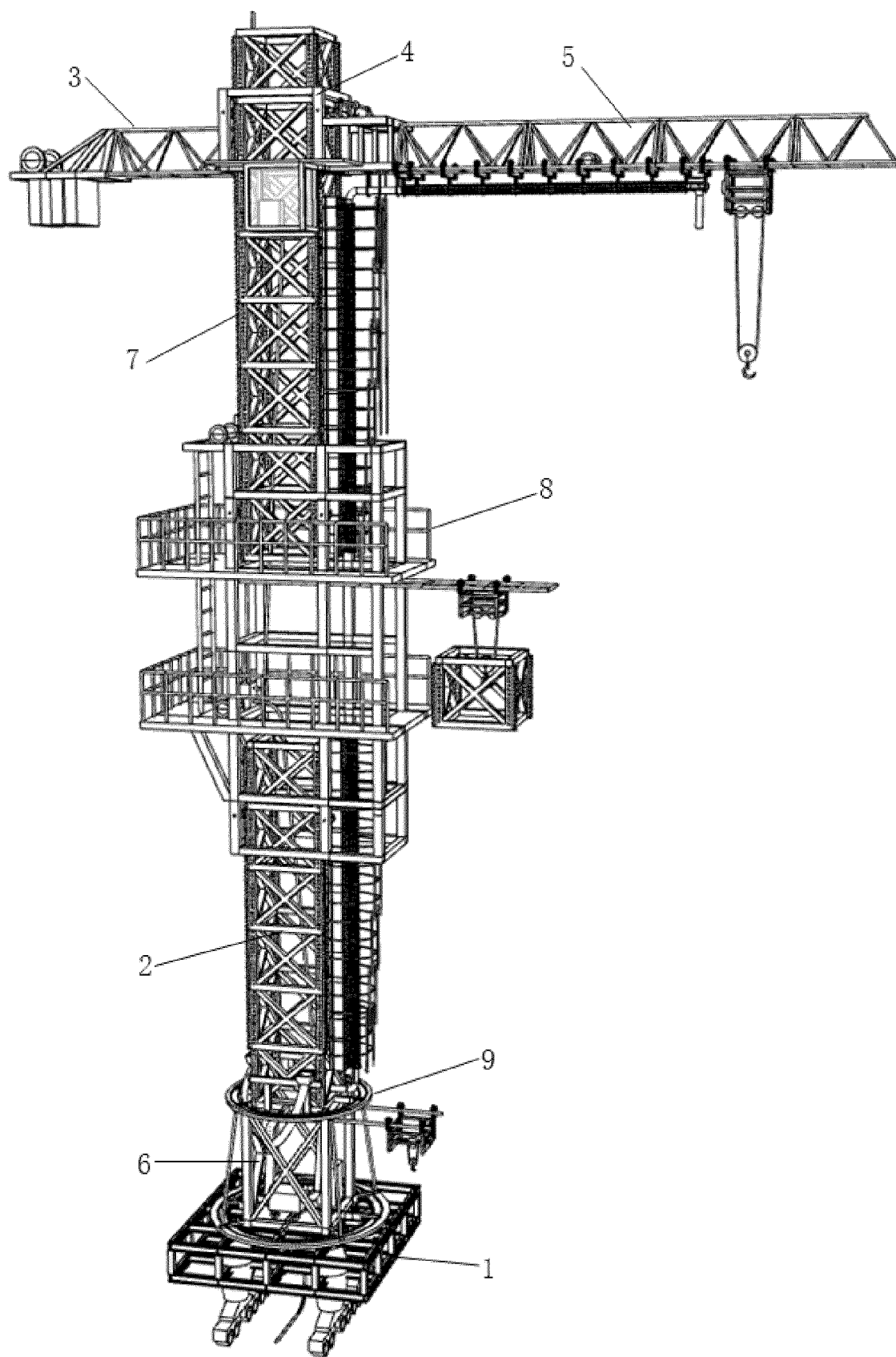


FIG. 1

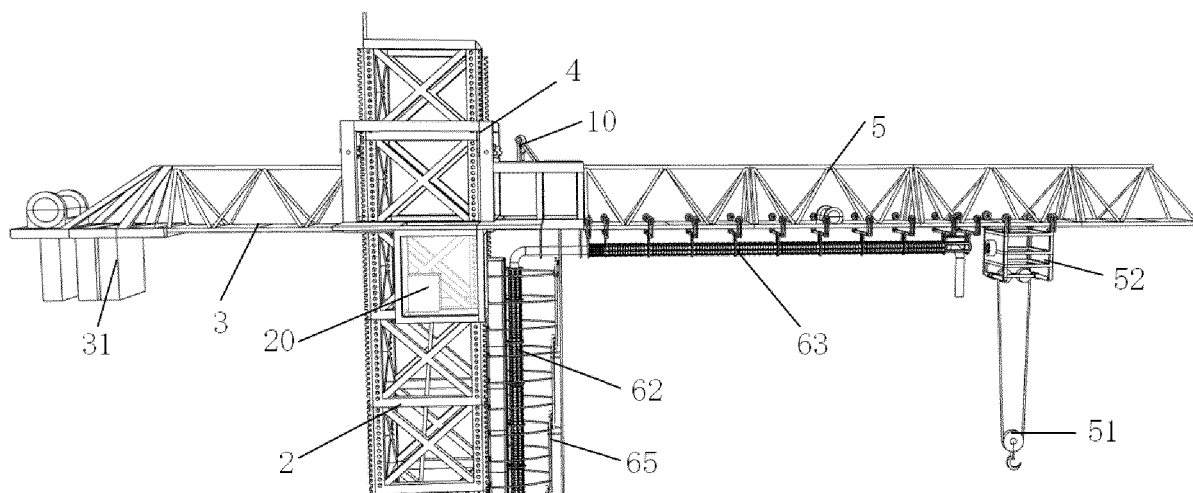


FIG. 2

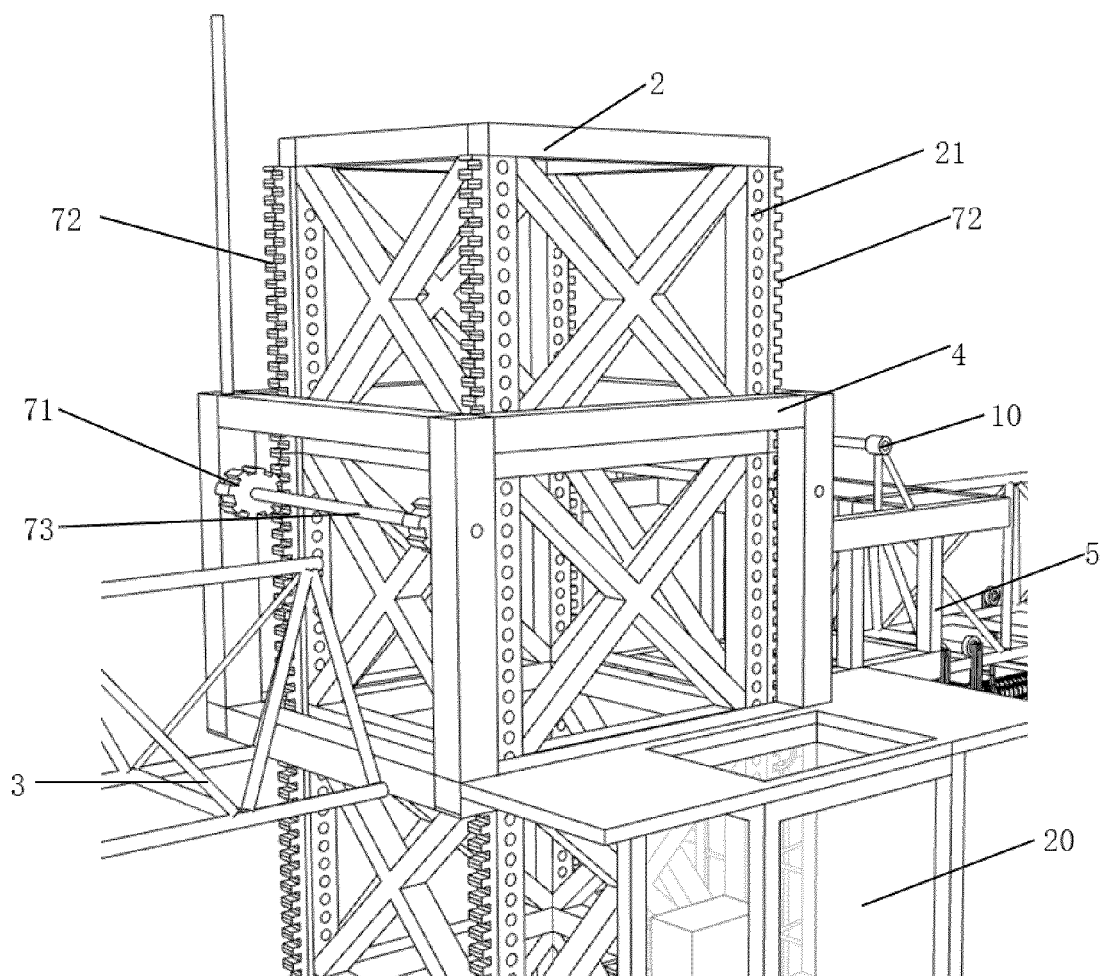


FIG. 3

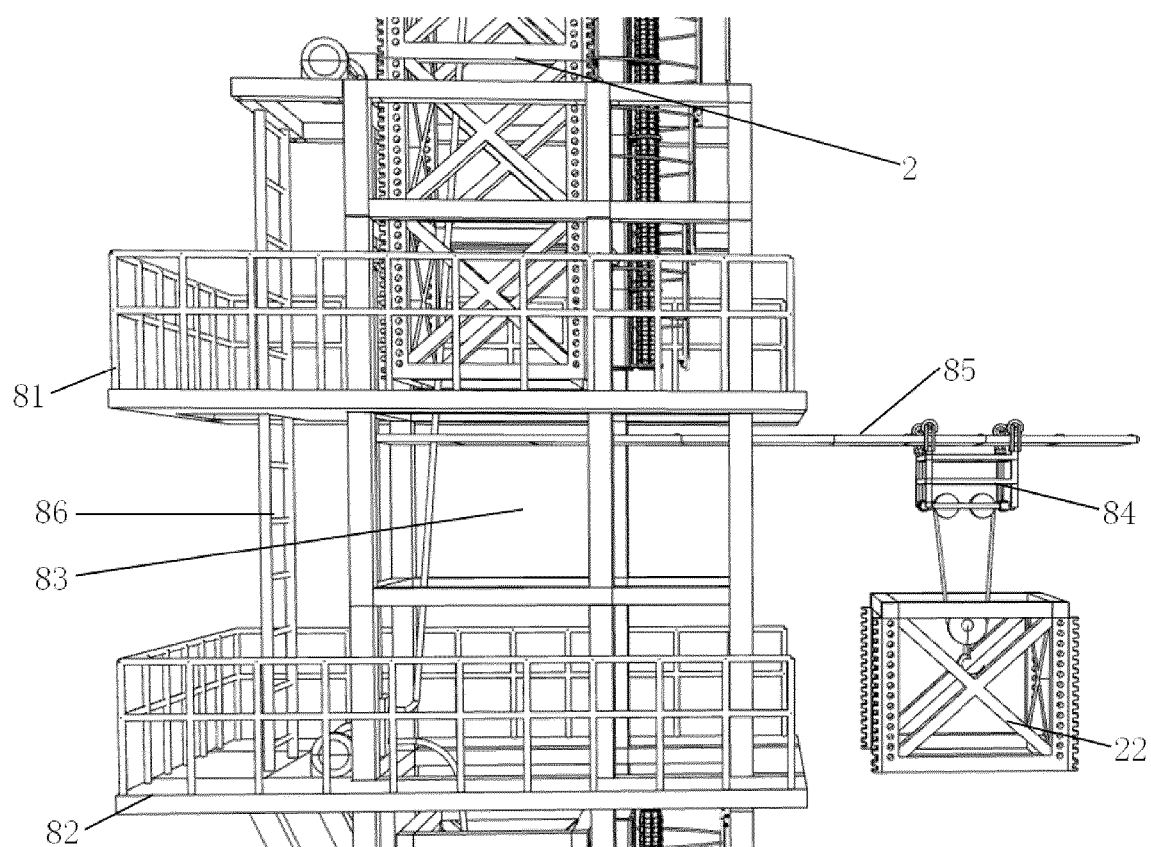


FIG. 4

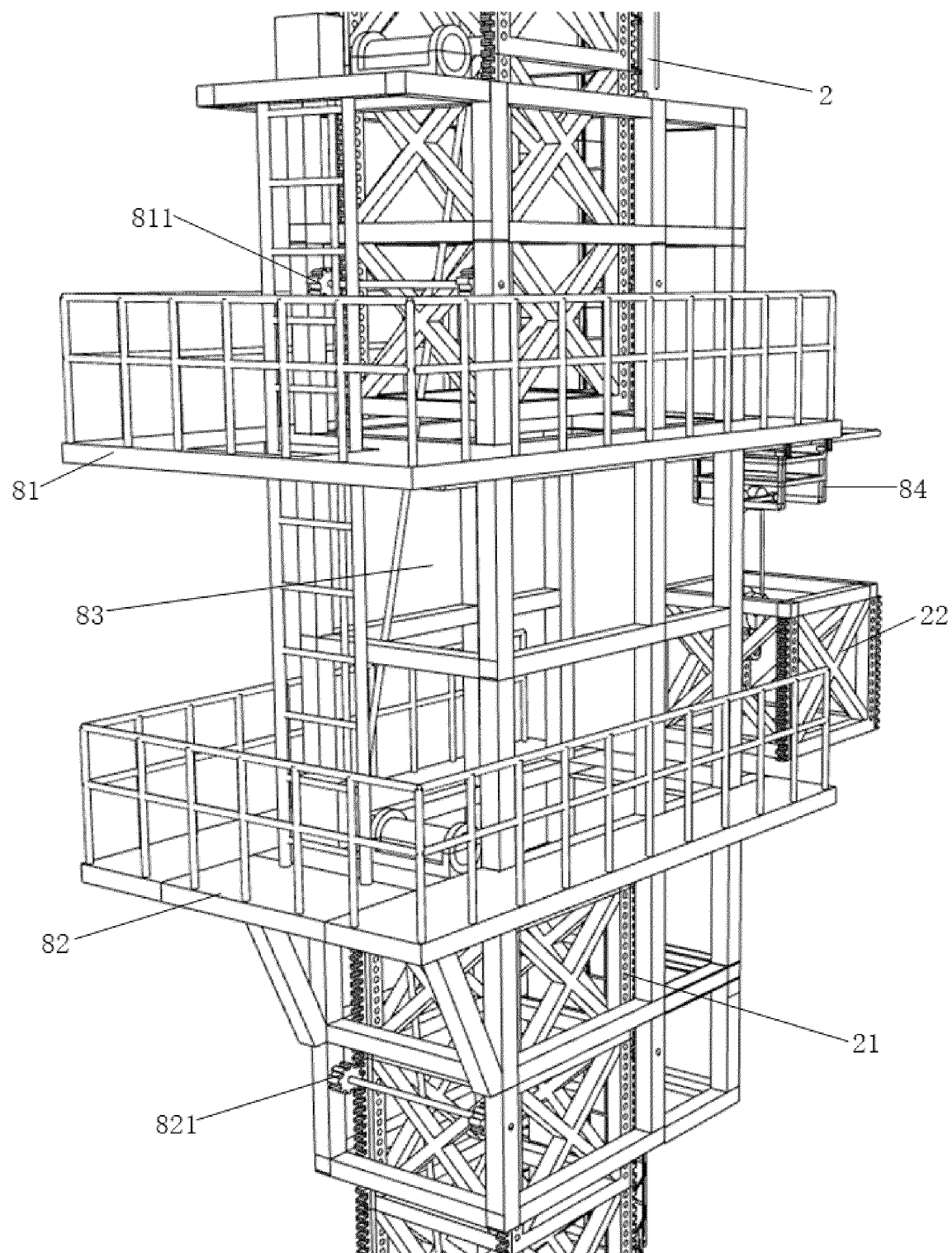


FIG 5

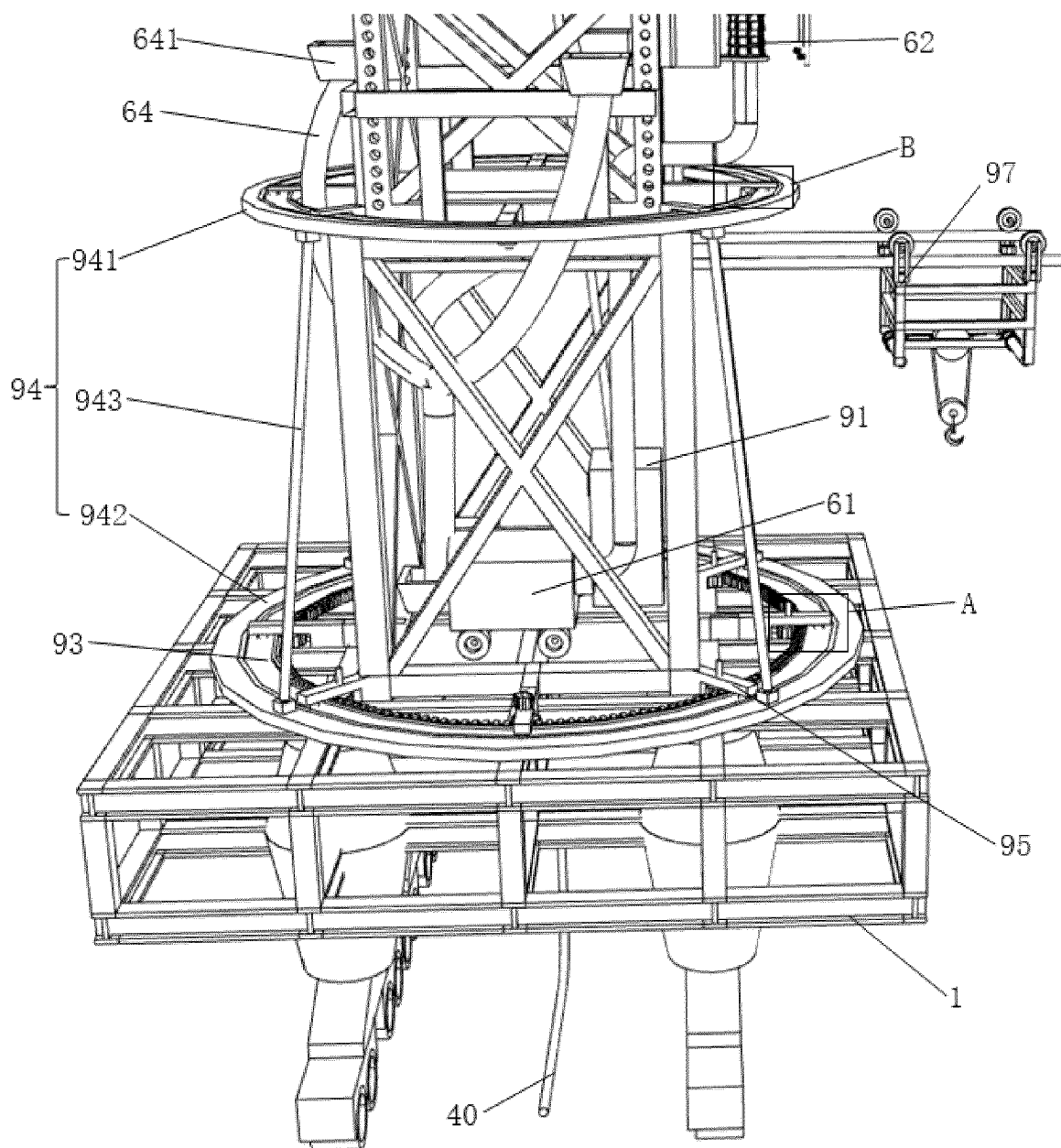


FIG. 6

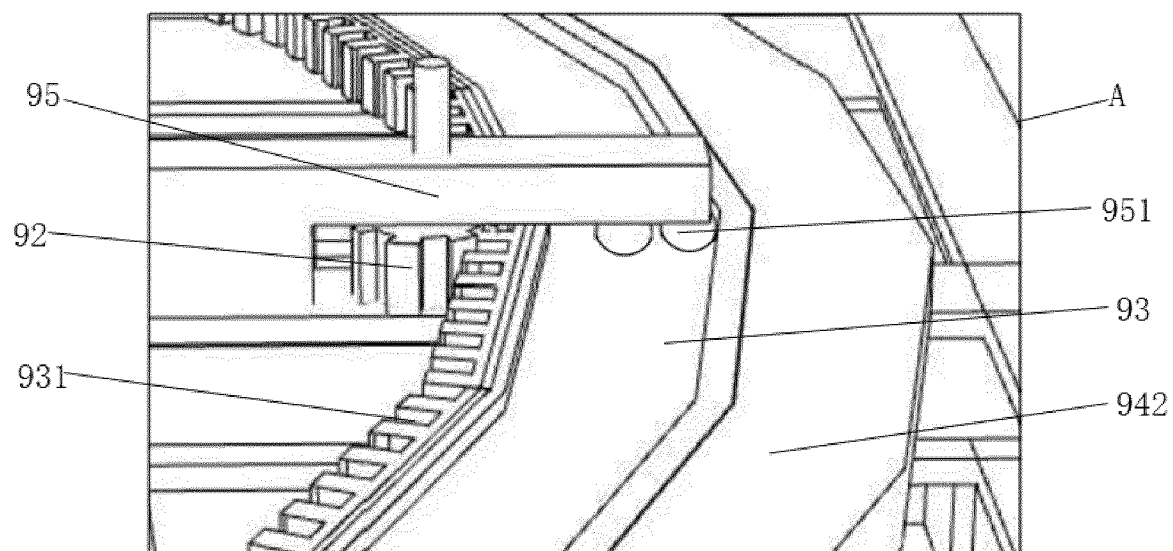


FIG 7

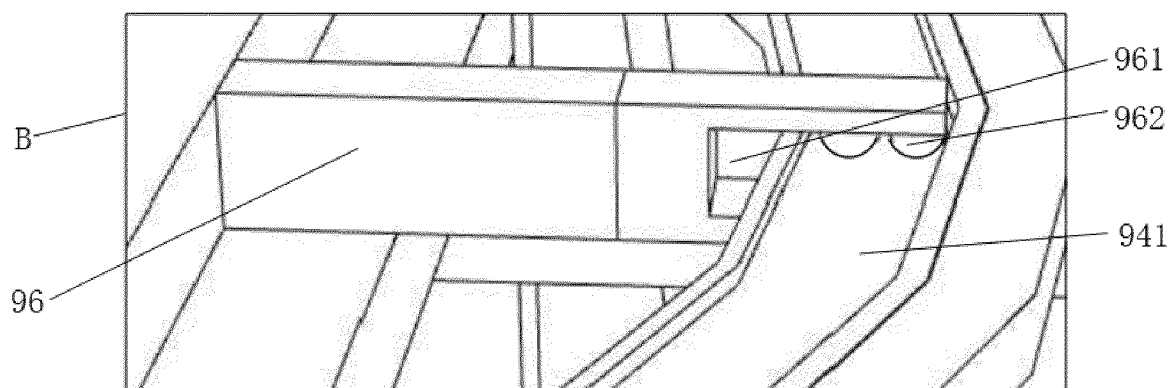


FIG 8



EUROPEAN SEARCH REPORT

Application Number

EP 24 17 5183

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* paragraph [0005]; figures 1-4 * * paragraph [0040] - paragraph [0056] *	2,8, 10-13	B66C23/28 E04G21/04
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			E04G B66F B66C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		30 October 2024	Manera, Marco
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EP 24 17 5183

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82